

A-18 Thematic Poster - Athletic Skills Post ACL Reconstruction

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-2009

68 Chair: Susan M. Sigward. *University of Southern California, Los Angeles, CA.*
(No relevant relationships reported)

69 Board #1 May 27 9:30 AM - 11:30 AM Kinetic Asymmetry During Squatting And Landing Are Associated In Anterior Cruciate Ligament Reconstructed Patients

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Reported Relationships: **R. Queen:** Industry contracted research; DJO Global.

High kinetic asymmetry during landing is associated with an increased risk for sustaining a second anterior cruciate ligament (ACL) injury in athletes returning to sport following ACL reconstruction (ACL-R). While previous literature has found that ACL-R patients have more kinetic asymmetry than healthy controls during both landing and bilateral squatting, it is currently unknown if landing asymmetry and squatting asymmetry are related in ACL-R patients. **PURPOSE:** Determine the relationship between landing kinetic asymmetry and squatting kinetic asymmetry in ACL-R patients. **METHODS:** 34 ACL-R patients (19 male; 73 ± 16 kg; 174 ± 10 cm; 6.0 ± 1.5 months post-operative) signed informed consent and participated in the study. All participants completed one set of 15 bilateral squats and then ten bilateral stop jump trials, while 3D lower extremity kinematics and kinetics were recorded at 240 Hz and 1920 Hz, respectively. Peak knee extension moment (KEM) and vertical ground reaction force impulse (GRFI) were computed during the descending phase of both tasks. The descending phase was defined between squat initiation and the minimum position of the pelvis during each squat and between initial contact and the minimum position of the pelvis for each stop jump. A limb symmetry index (LSI) was computed for peak KEM and GRFI as the difference between the surgical and non-surgical leg divided by their average during each squat and each stop jump, and then the LSI was averaged across trials. Peak KEM LSI and GRFI LSI were then compared between the stop jump and squat trials using Pearson's correlations. **RESULTS:** There was a significant relationship between both stop jump kinetic asymmetry outcomes and both squat kinetic asymmetry outcomes (Table 1). **CONCLUSION:** Kinetic asymmetry during squatting and bilateral landing are associated in ACL-R patients, which indicates that biofeedback retraining during bilateral squatting could result in improvements in bilateral landing symmetry.

Squat	Stop Jump	
	Peak KEM LSI 45.8% ± 24.6%	GRFI LSI 42.8% ± 26.0%
Peak KEM LSI 34.8% ± 25.4%	r = 0.693 p < 0.001	r = 0.555 p = 0.001
GRFI LSI 14.5% ± 10.5%	r = 0.428 p = 0.012	r = 0.479 p = 0.004

Table 1: Mean ± standard deviation for both outcomes on the squat and stop jump trials, and the relationship between kinetic asymmetry during squatting and stop jump landing

71 Board #2 May 27 9:30 AM - 11:30 AM Individualized Training Improves Inter-limb Joint Kinetic Symmetry During Jump Landing After ACL Reconstruction

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(No relevant relationships reported)

Most athletes with unilateral ACL reconstruction present with reduced knee and hip flexion and asymmetrical vertical ground reaction force (VGRF) and internal knee extension moment during two-legged jump landings. This landing movement pattern is associated with low scores on self-reported outcome surveys and may contribute to the increased risk of re-injury in athletes with ACL reconstruction. The capacity for correction of inter-limb asymmetries during landing remains understudied. **PURPOSE:** To determine whether jump training can correct asymmetrical limb loading and whether corrections are retained over time. **METHODS:** An 8-camera motion analysis system with dual force plates collected kinematic and kinetic data in a 30cm drop vertical jump to screen 48 potential participants with unilateral ACL reconstruction. Twenty-three athletes (14 women, 23 ± 5 years old, 20 ± 15 months post-surgical, Tegner score: 7 ± 2) presented with below-average knee loading symmetry in landing and poor clinical outcomes, and participated in 8 weeks of twice-weekly high-repetition progressive jump landing training. Subjects re-tested at 4 and 8 weeks. Retention testing was performed after 8 weeks post-training. Changes in hip and knee kinematics and kinetics including limb symmetry indices (percent of the uninvolved limb) over time were assessed with paired t-tests. **RESULTS:** Peak hip and knee flexion angles in the involved limb increased significantly in the drop vertical jump after 4 weeks of training (hip: 78±22 to 92±20, p<0.0001; knee: 86±11 to 96±16, p=0.0001). Symmetry in peak VGRF between limbs during landing increased after the full 8-week training period (83%±18% to 91%±16%, p=0.005). Changes in joint flexion and VGRF were retained for at least 8 weeks after the final training session. Symmetry in knee moment between limbs did not reach a statistical improvement until final retention tests (Pre: 80%±17%, Post: 86%±12%, p=0.47; Retention: 94%±21%, p=0.004). **CONCLUSIONS:** Individualized jump training results in normalization of limb loading symmetry during jump landings. Visible kinematic changes occur early in training, but symmetry in loading of the limb and knee specific kinetic measures take more time to achieve as they integrate into an athlete's movement pattern.

72 Board #3 May 27 9:30 AM - 11:30 AM Quadriceps Strength And Rate Of Torque Development Are Associated With Countermovement Jump Knee Kinetics Post-aclr

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Quadriceps neuromuscular dysfunction is ubiquitous after anterior cruciate ligament reconstruction (ACLR) and can impair knee function during athletic activities. While peak quadriceps strength is often measured, time-dependent metrics such as rate of torque development may be important to sports performance. **PURPOSE:** To determine the relationships between quadriceps strength, rate of torque development, time since surgery, and knee joint kinetics during jumping in collegiate athletes up to 2 years post-ACLR. **METHODS:** 31 Division I athletes (age 20.3±1.3, BMI 26.1±3.9 kg/m², 17 female) performed countermovement jumps (CMJ) on force plates while whole body kinematics were recorded and completed maximal and rapid voluntary isometric knee extension (KE) contractions. Sagittal plane KE impulses were computed for concentric (CON) and landing (LAND) CMJ phases; KE peak torque (PT) and rate of torque development from 20-80% of peak torque (RTD) were extracted from isometric KE efforts. Limb symmetry indices (LSI) were computed and clinically relevant cutoffs of 90% LSI were investigated. A mixed effects model accounted for repeated measurements and assessed the relationships of PT, RTD, and time from surgery with CON and LAND. All possible pairwise interactions were tested. **RESULTS:** Among 31 athletes, 81 tests were completed 4-24 months post-surgery. PT and RTD were significantly correlated with CON (PT: p=.001, RTD: p=.044) and LAND (PT: p=.009, RTD: p=.008). No significant pairwise interactions between PT, RTD, and time from surgery were detected. Among 24 instances of PT LSI ≥ 90%, mean CON and LAND LSI were 87.3% and 94.2%, respectively. In comparison, among 15 occurrences of RTD LSI ≥ 90%, mean CON and LAND LSI were 93.0% and 102.2%. Among the 22 assessments completed ≥ 1 year post-surgery, mean CON and LAND LSI were 82.4%, and 83.3%, respectively. However, when CON and LAND LSI were ≥ 90%, mean PT was 94.5-94.7% and mean RTD was 85.1-85.3%. **CONCLUSIONS:** Both peak and rapid knee extensor torque development are strongly associated with symmetrical sagittal plane CMJ knee mechanics. CMJ knee

kinetic asymmetries did not resolve over time, independent from quadriceps function. Restoring maximal and rapid quadriceps torque capacity appears to be an important step in recovering symmetrical CMJ mechanics post-ACLR.

73 Board #4 May 27 9:30 AM - 11:30 AM
Biomechanical Determinants Of Return To Sport Following Anterior Cruciate Ligament Reconstruction

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(No relevant relationships reported)

The ability to return to sport (RTS) after an anterior cruciate ligament reconstruction (ACLR) return to sport is due to many factors. To date, few studies have considered the role of poor biomechanics to predict RTS status. Potentially, higher ground reaction forces (GRF) and better frontal plane knee alignment at a 6 month follow up, may indicate an athlete who is able to return to sport at their pre-injury level. However, this has never been formally tested.

Purpose: To determine the biomechanical factors at six months that predict return to sport at pre-injury level following ACLR.

Methods: 21 subjects, (13 F, 20.1 ± 5.9 years, 22.3 ± 2.1 BMI, Pre-injury Tegner 8.1 ± 2.1) six months (190.6 ± 15.3 days) following ACLR, ran on an instrumented treadmill during three-dimensional assessment. Visual 3D was used to analyze peak GRF, impact peak, and frontal plane knee angle. Subjects were contacted at 4.5 ± 2.1 years post-surgery to answer a questionnaire regarding RTS. Logistic regression model selection was performed using the Feasible Solutions Algorithm with AIC as a criterion. p-values presented here are based on the main effect significance tests from the selected model.

Results: Of the 21 subjects, 62% returned to sport at their pre-injury level. Subjects who returned to sport had significantly higher peak GRF (RTS 2.1 ± 0.24 BW, No RTS 1.98 ± 0.18 BW, p=0.03), impact peak (RTS 1.6 ± 0.3 BW, No RTS 1.4 ± 0.16 BW, p=0.04), and maximum frontal plane knee angle (RTS 5.2 ± 3.0°, No RTS 3.3 ± 3.3°, p=0.04).

Conclusion: This data indicates that athletes who run with greater axial loading and whose knee is in a more adducted position are more likely to RTS at pre-injury level. We speculate that athletes who land with greater impact forces are more confident in their knee function and, thus, are more likely to return to sport. In addition, positioning the knee in more adduction may help the athlete feel more secure in their knee and, consequently, return to playing sport. Rehabilitation efforts should focus greater impact loading and improved frontal plane alignment of the knee during running to increase the likelihood of RTS at pre-injury level.

74 Board #5 May 27 9:30 AM - 11:30 AM
Relationship Between Dynamic Limb Symmetry And Subjective Limb Confidence Post ACL Reconstruction In Youth Athletes

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(No relevant relationships reported)

Limb symmetry index (LSI) of dynamic movement is used as return to sport criteria for athletes who have undergone an anterior cruciate ligament reconstruction (ACLR). However the relationship between an individual's perception of confidence and dynamic performance is poorly understood. **PURPOSE:** To discern a relationship between dynamic limb symmetry during a drop landing (DL) and single leg hop (SLHOP) task with subjective limb confidence in athletes who have had an ACLR. **METHODS:** 23 subjects (13 female, 10 male; 16±1.4 years) underwent a biomechanical assessment, including a DL and SLHOP task, at around 7±1 months post op ACLR. Subjects were outfitted with a custom marker set and recorded with a 3D camera system while performing tasks on 2 force platforms. To examine dynamic limb symmetry, kinematic variables of peak hip flexion, knee flexion, and ankle dorsiflexion, with kinetic variables of peak hip extension moment, knee extension moment, ankle plantar flexion moment, and vertical ground reaction force (GRFz) were collected and analyzed as an index between the involved and non-involved limb. Subjects completed questionnaires for limb confidence; International Knee Documentation Committee (IKDC)/Pedi-IKDC and Tampa Scale of Kinesiophobia (TSK). The relationship between LSI during DL and SLHOP with the IKDC and TSK scores were tested using a multilinear regression analysis. **RESULTS:** A significant strong relationship was found between LSI of DL mechanics and IKDC (86±12, r= 0.84, p<0.05). Among predictor variables, peak GRFz (LSI 79±21, p<0.05) was significant in its explanation of IKDC scores. Independent regressions showed significant moderate correlations between IKDC and LSI for peak hip extension moments (LSI 107±24, r= 0.56, p<0.01), knee extension moments (LSI 80±23, r=0.51, p<0.05), and GRFz (r= 0.62, p<0.01). No significant relationships were found for SLHOP and IKDC scores, or with TSK for either dynamic test. **CONCLUSIONS:**

Subjective limb confidence demonstrated a strong relationship with limb symmetry of sagittal plane mechanics with a 1% difference in LSI of GRFz corresponding to a 0.4% difference in IKDC scores during a DL and not SLHOP task. Symmetry in mechanics during a bilateral task may be more reflective of patient confidence in utilizing the affected limb prior to return to sport after ACLR.

75 Board #6 May 27 9:30 AM - 11:30 AM
Quantifying The Relationship Between Quadriceps Strength And Aerobic Fitness Following ACL Reconstruction

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(No relevant relationships reported)

PURPOSE: Investigate the relationship between performance measures and quadriceps strength in individuals with ACL reconstruction (ACLR) and healthy controls.

METHODS: Thirty-three individuals with ACLR (22F/11M, 19.9±2.2 years, 68.3±10.9 kg, 170.4±8.4 cm, 22.7±23.3 months post-surgery) and 29 healthy individuals (18F/11M, 20.1±1.5 years, 70.0±9.9 kg, 172.7±8.7 cm) completed isokinetic quadriceps strength testing using a Biodex dynamometer at 180 degrees/sec on both legs then completed vertical jump (VJ) testing with and without countermovement (NCMJ) on a jump mat. All participants completed an incremental treadmill test to determine maximal oxygen consumption testing (VO2max). Initial running velocity was self-selected and increased 0.5mph every 2 minutes until volitional fatigue. Knee extensor torques and VO2max were normalized by mass. Bivariate Pearson's correlations were calculated between strength and performance variables. Significant correlations were retained for a regression analysis.

RESULTS: In ACLR, peak torque was correlated with VJ (r = 0.43, P = .012), NCMJ (r = 0.44, P = .011), and VO2max (r = 0.52, P = .002). The only variable retained in the regression model was VO2max, which explained 26.7% of the variance in strength. In healthy individuals, peak torque was correlated with VJ (r = 0.72, P < .001), NCMJ (r = 0.62, P < .001), and VO2max (r = 0.55, P = .002). Two variables were retained in the regression model, including VJ (R² = 52.2%) and VO2max (R² = 6.8%) which together explained 59.0% of the variance in strength.

CONCLUSIONS: Quadriceps strength was associated with a VJ, a powerful quadriceps movement, in healthy individuals, while strength in individuals with ACLR was associated with aerobic fitness. Although VO₂max was a significant predictor of strength after ACLR, it explained a small amount of variance which suggests other factors contribute to strength after ACLR.

76 Board #7 May 27 9:30 AM - 11:30 AM
Effects Of A 4-week Vibration-induced Hamstrings Fatigue Intervention On Quadriceps Weakness After ACL Reconstruction

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Arthrogenic muscle inhibition (AMI) results from an inability to voluntarily activate all motor units in the quadriceps due to ongoing neuronal inhibition. This may be due to changes in small diameter afferent activity that increase the excitability of the flexor withdrawal pathway, causing over-excitation of the hamstrings and reciprocal inhibition of the quadriceps. Reciprocal inhibition of the quadriceps from Ia afferents of the hamstrings may be reduced with prolonged muscle vibration of the hamstrings via fatigue of the intrafusal muscle fibers.

PURPOSE: To determine the effects of vibration-induced hamstring fatigue on AMI after ACL reconstruction (ACLR).

METHODS: Seven adults (28.7 ± 8.2 yrs) with unilateral ACLr (time since surgery: 19.4 ± 9.7 months) were recruited. Participants received a 4-week long (3x/week) training program. Vibration-induced fatigue of the hamstrings consisted of 20 minutes of prolonged vibration applied directly to the hamstrings. Then, a cuff was placed on the proximal thigh and inflated to 150 mmHg to trap the metabolites in the muscle, and maintain hamstrings fatigue; during which participants performed 4 sets of 15 reps at 30% 1-repetition maximum (RM) unilateral knee extension (KE). Quadriceps strength and quadriceps inhibition were assessed before and after the intervention using KE 1-RM normalized to body weight, and the central activation ratio (CAR) measured by a superimposed burst. The co-activation of the hamstrings was assessed using hamstring EMG during KE. Paired t-tests were used to examine the effect of prolonged vibration on KE strength, quadriceps CAR, and hamstrings co-activation before and after the intervention.

RESULTS: KE strength increased significantly by 38.5% (from 0.45 ± 0.1 to 0.62 ± 0.2 %BW, $P=0.004$); quadriceps CAR also increased significantly by 5.8% (from $93 \pm 0.1\%$ to $98 \pm 0.8\%$, $P=0.02$). Finally, co-activation decreased by 34% (from $12 \pm 1.3\%$ to $8 \pm 0.9\%$, $P=0.03$).

CONCLUSIONS: These results suggest that quadriceps weakness may be due to over excitation of the hamstrings which results in reciprocal inhibition of the quadriceps. Vibration-induced hamstrings fatigue can be used as a rehabilitation strategy to restore normal quadriceps function following ACLr by reducing the hamstrings over-excitability and restoring full quadriceps activation.

A-19 Thematic Poster - Caffeine

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-2007

77 **Chair:** Eric E. Hall, FACSM. *Elon University, Elon, NC.*
(No relevant relationships reported)

78 **Board #1** **May 27 9:30 AM - 11:30 AM**
Effects Of Caffeine On Physiological Responses To Exercise And Time-trial Performance: Influence Of CYP1A2 Genotype.

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PURPOSE: The aim of this study was to investigate the influence of CYP1A2 genotype (which influences the rate of caffeine metabolism) on the effects of caffeine on physiological responses to submaximal exercise and cycling time-trial performance. **METHODS:** Eighty six cyclists were screened for their CYP1A2 genotype before being separated into two groups (AA [wildtype] versus AC or CC variant). Seventeen participants from each group (age: 45 ± 9 yrs; height: 1.81 ± 0.07 m; body mass: 76.4 ± 9.9 kg; $\dot{V}O_{2max}$: 4.02 ± 0.46 L \cdot min $^{-1}$) were then matched for self-reported endurance ability before taking part in a randomised, double-blind, placebo controlled study. In Trial 1, participants completed incremental cycling tests to establish the $\dot{V}O_2$ -power output relationship and $\dot{V}O_{2max}$. In trials 2 and 3 participants ingested a capsule containing 5 mg \cdot kg $^{-1}$ of caffeine or placebo one hour before completing a submaximal incremental cycling test (4-min stages) at 40, 55, 70, and 85% of $\dot{V}O_{2max}$, followed by a time trial (~30 mins). 95% confidence limits (CL_{95}) were calculated for all estimates. **RESULTS:** Relative to placebo, caffeine led to a significant reduction in time to complete the time trial (caffeine: 29.21 ± 1.60 mins; placebo: 30.30 ± 1.96 mins); but there was no effect of genotype. During submaximal exercise, caffeine resulted in significant reductions in heart rate (mean difference: 2.4 b \cdot min $^{-1}$; CL_{95} : $1.1 - 3.8$ b \cdot min $^{-1}$), with effects dissipating as exercise intensity increased. Caffeine also led to submaximal exercise reductions in ratings of perceived exertion (mean difference: 0.5 ; CL_{95} : $0.2 - 0.8$) and significant increases in respiratory exchange ratio (mean difference: 0.013 ; CL_{95} : $0.002 - 0.025$), minute ventilation (mean difference: 3.4 L \cdot min $^{-1}$; CL_{95} : $0.4 - 6.4$ L \cdot min $^{-1}$), and blood lactate concentration (mean difference: 0.24 mmol \cdot L $^{-1}$; CL_{95} : $0.11 - 0.37$ mmol \cdot L $^{-1}$). However, the responses were not affected by genotype. **CONCLUSION:** Caffeine influences physiological responses to submaximal exercise and improves time-trial performance. However, those effects are not influenced by CYP1A2 genotype.

79 **Board #2** **May 27 9:30 AM - 11:30 AM**
Caffeine Ingestion Increases The Specific Upper-body Performance Of Combat Sports Athletes

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PURPOSE: To investigate the acute effect of caffeine ingestion on upper-body intermittent endurance and maximal isometric strength performance of combat sports athletes. **METHODS:** Ten experienced judo and jiu-jitsu athletes completed two experimental sessions separated by at least 48 hours. Athletes consumed capsules containing either caffeine (5 mg \cdot kg $^{-1}$) or placebo 60 min before performing four bouts of an intermittent judogi's dynamic strength endurance test, interspersed by 3-min recovery, in a double-blind and placebo-controlled crossover design. The performance was determined by the total number of repetitions completed during each of 4 exercise bouts. Furthermore, the sum of all repetition throughout the test was also calculated in

order to analyze the overall performance. Heart rate (HR), rating of perceived exertion (RPE) and maximal isometric handgrip strength (MIHS) were evaluated prior to test and immediately after each exercise bout, while the blood lactate concentration [La] was measured just before and three minutes after the test. **RESULTS:** When compared to placebo condition (41 ± 8 reps and 45.6 ± 2.7 kg), caffeine ingestion increased the total number of repetitions (45 ± 10 reps, +7%, $P < 0.05$) and the MIHS (47.5 ± 2.8 kg, +5%, $P < 0.05$). However, there were no significant differences in RPE (CAF: 11.7 ± 1.1 a.u., PLA: 11.8 ± 0.9 a.u.), HR (CAF: 137 ± 3 bpm, PLA: 133 ± 3 bpm) and [La] (CAF: 6.6 ± 0.4 mmol \cdot L $^{-1}$, PLA: 5.7 ± 0.4 mmol \cdot L $^{-1}$) conditions ($P > 0.05$ for all comparisons). **CONCLUSION:** Caffeine ingestion (5 mg \cdot kg $^{-1}$) improved the upper-body intermittent endurance and maximal isometric strength of combat sports athletes without altering psychophysiological responses.

80 **Board #3** **May 27 9:30 AM - 11:30 AM**
Perceptions Of Caffeine Use Among Kansas High Intensity Functional Training Participants

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Caffeine is a psychoactive drug that decreases perceived effort and improves exercise tolerance. Yet, high-doses of caffeine can result in negative symptoms, which may affect exercise performance. High caffeine users likely perceive positive effects with caffeine-use. While high intensity functional training (HIFT) has expanded rapidly, the perceived effects of caffeine-use during HIFT is unknown.

Purpose: To compare perceived and actual responses to caffeine during HIFT between low and high caffeine users.

Methods: Seventeen HIFT-experienced men were recruited (age = 26.9 ± 6.5 years, weight = 84.7 ± 10.1 kg). Participants were randomized in a double-blind, crossover design to consume 5 mg/kg body mass of caffeine pills or placebo 60-minutes prior to a HIFT workout. Perceptions of caffeine's effect, successful blinding, and actual positive- and negative-symptoms were determined with surveys. Three chi-square tests were conducted to determine differences between caffeine-users (low- vs. high-users) for perceptions of caffeine's effects (positive vs. negative), blinding to the treatment (successful vs. unsuccessful), and symptoms after caffeine supplementation (positive and negative).

Results: Nine participants were low-users (< 200 mg caffeine/day), and 8 high-users (> 200 mg caffeine/day). Chi-square tests were non-significant ($p > 0.05$). Descriptively, 2 low-users and 0 high-users perceived negative-effects, while 6 low-users and 7 high-users perceived positive-effects of caffeine use at baseline. One low-user perceived both positive- and negative-effects. Four participants from each group correctly identified the caffeine condition. After study caffeine consumption, 1 participant from each group reported negative-symptoms, while 2 low-users and 4 high-users reported positive-symptoms.

Conclusion: No significant differences in perceived and actual responses to caffeine supplementation were found between low and high caffeine-users. However, we found that caffeine supplementation may result in negative-symptoms, so individual effects should be considered. Future studies should investigate perceived and actual responses for popular caffeinated pre-workout supplements on; specifically for negative symptoms.

Funding: Kansas State University College of Human Ecology

81 **Board #4** **May 27 9:30 AM - 11:30 AM**
COFFEE VOLUME DOES NOT SUPPRESS APPETITE OR CHANGE PERCEIVED HUNGER IN HABITUAL CAFFEINE CONSUMERS

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(No relevant relationships reported)

Caffeine is a heavily consumed substance that has several benefits, including appetite suppression and increased energy metabolism. **PURPOSE:** To determine the effect of caffeine amount and coffee volume on appetite profile, affective response, cognitive function, blood glucose levels and subsequent energy intake in female habitual caffeine consumers. **METHODS:** 19 healthy female (age: 24 ± 8 , BF%: 24.9 ± 5.1) habitual caffeine consumers (255 ± 122 mg/day) ingested coffee of different volumes and caffeine amounts on four different occasions (C1: 237 ml/4 mg/kg; C2: 237 ml/6mg/kg; C3: 473 ml/4mg/kg; C4: 473 ml/6mg/kg) in a single blind, randomized, crossover design. Participants completed a visual analog scale (VAS) of appetite profile at pre, 0, 30 and 60 minutes. Affective response and cognitive function were assessed using the Activation-Deactivation Adjective Checklist (AD-ACL), Trail Making (TM) and Stroop tasks (ST) before and after the test drink. Blood glucose levels were measured at pre, 30 and 60 minutes. In addition, ad libitum breakfast was consumed at 60 minutes and 24-hour self-reported energy intake was recorded. A repeated measures

ANOVA was used for analysis with significance accepted at $p < 0.05$. **RESULTS:** A significant time ($p < 0.001$), but not condition effect was observed in hunger ($p = 0.31$), satiety ($p = 0.16$), fullness ($p = 0.11$), desire to eat ($p = 0.31$) and prospective food consumption ($p = 0.19$). No significant condition effect was observed in blood glucose levels ($p = 0.12$), energy intake at breakfast (C1: 440 ± 213 ; C2: 400 ± 158 ; C3: 440 ± 226 ; C4: 386 ± 138 calories, $p = 0.43$) or over 24-hours (C1: 16773 ± 532 ; C2: 1486 ± 434 ; C3: 1503 ± 321 ; C4: 1662 ± 505 calories, $p = 0.28$). However, a significant interaction effect was observed in tiredness, calmness, energy and tension ($p = 0.02$). In addition, a significant time ($p < 0.001$) but not condition effect ($p > 0.05$) was observed in TM, ST and state anxiety. Participants' time to complete cognitive tasks decreased and state anxiety increased over time. **CONCLUSIONS:** Coffee volume may not have an effect on appetite suppression and perceived hunger, however, may modulate affective responses.

82 Board #5 May 27 9:30 AM - 11:30 AM
Caffeine Increases Plantar Flexion Peak Torque In Young But Not In Older Men

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Ageing is associated with neurodegeneration and loss of muscle function, driving to adverse age-related health events and decreasing quality of life. Of the many contributors to the ageing process, decreased skeletal muscle function plays a large role, but physical, nutritional, and ergogenic interventions can have positive effects on muscle function. For example, evidence suggests that a low dose of caffeine may act on the central nervous system and may improve force-generating capacity. However, the majority of these studies have focused in young individuals, and no study has compared the effects of caffeine on strength between older and younger individuals. **PURPOSE:** To compare the effect of caffeine on force-generating capacity between older and young adults.

METHODS: 21 older (68 ± 6 years) and 22 young men (25 ± 5 years) were tested for peak torque (PT) and contractile impulse (CI; torque integrated to time) of the plantar flexors using a Biodex 4 dynamometer. Participants were familiarized with testing procedures on the first day, and the experimental protocol was applied on two other days (2-7 days apart), which consisted of four maximal isometric contractions before and 60-min after 3 mg/kg of caffeine or placebo (double-blinded). PT, CI 0-50 (CI_{0-50}), and 100-200 ms ($CI_{100-200}$) were analyzed. A three-way mixed ANOVA was used to investigate potential differences between conditions (pre vs post-supplement) and groups (older vs young). Cohen's effect size (ES) was used to show the magnitude of differences and the standardized mean differences for caffeine versus placebo in both groups.

RESULTS: Caffeine increased PT in young (3.2%; $p = 0.007$, $ES = 0.21$) but not in older individuals (2.7%; $p = 0.104$, $ES = 0.13$). No differences were seen in CI_{0-50} and $CI_{100-200}$ in young and older ($p > 0.05$). The standardized mean differences showed a small effect in favor of caffeine on PT in young ($ES = 0.47$), CI_{0-50} in young ($ES = 0.41$) and older ($ES = 0.40$), and $CI_{100-200}$ in older ($ES = 0.24$).

CONCLUSIONS: Caffeine increased isometric peak torque in young but not in older individuals. Caffeine did not increase rapid torque output (i.e. CI_{0-50} and $CI_{100-200}$) in either young or older individuals. However, a small effect was observed in favor of caffeine against placebo in both groups.

83 Board #6 May 27 9:30 AM - 11:30 AM
Effect Of Caffeine Ingestion On Performance During A Repeated-bout Agility Test In Handball Players

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 (No relevant relationships reported)

PURPOSE: To verify whether caffeine would alter the psychophysiological responses and agility performance during repeated bouts of an agility test in handball players.

METHODS: 10 recreationally handball players (20.6 ± 3.3 years, 81.5 ± 10.0 kg, 1.80 ± 0.1 m) performed 6 exercise bouts, interspersed by 1-min recovery intervals, of an agility test (Illinois Agility Run Test) 60 min after ingesting, in a double-blind manner, either caffeine (5 mg·kg⁻¹ of body mass) or placebo (cellulose). The total exercise-bout time (sum of all time during each of the 6 exercise bouts) was compared between conditions using a paired t test, while the rating of perceived effort (RPE), heart rate (HR) and blood lactate concentration ([La]) were compared between conditions using a two-way repeated-measures ANOVA (condition and bout factors). **RESULTS:** There was no significant difference between caffeine (114.3 ± 5.9 s) and placebo (114.4 ± 4.7 s) conditions for total exercise-bout time ($P > 0.05$). The RPE increased progressively throughout the test in all conditions ($P < 0.05$), but without significant differences

between caffeine (bout 1: 8.1 ± 1.6 ; bout 6: 15.6 ± 4.1) and placebo (bout 1: 7.9 ± 1.1 ; bout 6: 15.5 ± 4.0) conditions ($P > 0.05$). Similar responses were found for HR, revealing an exponential increase during the test in both conditions ($P < 0.05$), but with no differences when caffeine condition (rest: 74 ± 17 bpm; bout 6: 179 ± 14 bpm) was compared with placebo condition (bout 1: 83 ± 15 bpm; bout 6: 183 ± 14 bpm; $P > 0.05$). Furthermore, the [La] increased linearly over the test in both conditions ($P < 0.05$), but it was significantly higher in caffeine (16.2 ± 2.7 mmol·L⁻¹) compared with placebo (13.8 ± 2.9 mmol·L⁻¹) 3 min after the repeated-bout agility test ($P < 0.05$). **CONCLUSION:** Caffeine ingestion increases the glycolytic flux but does not alter the performance during a repeated-bout agility test in handball players.

84 Board #7 May 27 9:30 AM - 11:30 AM
Caffeine May Increase Sugar Intake, Alter Taste Perception And Appetite Profile

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 (No relevant relationships reported)

The effects of caffeine on athletic and cognitive performance have been previously studied, however, less research is available on taste perception and appetite suppression. **PURPOSE:** The purpose of this study was to evaluate the effects of caffeine on taste perception, perceived caffeine amount, affect, energy metabolism and appetite profile. **METHODS:** 18 college-aged females (age 21 ± 1 yrs; BMI 24.3 ± 4.0 kg/m²; BF%: 24.6 ± 8.8) who were habitual caffeine consumers were recruited for the study. Participants reported to the laboratory fasted on two separate occasions and were provided with (355 ml) caffeinated (C) or decaffeinated (D) coffee test drink. Appetite profile, The Stanford Sleepiness (SSS), Feeling (FS) and Felt Arousal (FAS) scales were administered at pre-, 0, 25 and 45 minutes post-coffee drink. In addition, palatability and perceived caffeine amount were assessed using questionnaires at pre- and post- sugar addition. Sugar addition to the coffee drink was recorded. An indirect calorimetry method using ventilated hood technique was used to measure oxygen consumption (VO₂) and respiratory quotient (RQ) at pre- and post-25 minutes. A repeated measures ANOVA and t-test were used for analysis with significance accepted at $p < 0.05$. **RESULTS:** A significant interaction effect was observed for fullness ($p = 0.04$) and amount ($p = 0.03$), but not for hunger ($p = 0.16$), satiety ($p = 0.29$) or desire to eat ($p = 0.11$). A significant interaction effect was observed for RQ (C: 0.83 ± 0.06 and 0.89 ± 0.07 ; D: 0.82 ± 0.05 and 0.84 ± 0.04 , $p = 0.006$) and significant condition effect was observed for VO₂ (C: 3.9 ± 0.5 ml/kg/min; D: 3.7 ± 0.5 ml/kg/min, $p = 0.01$). A significant interaction effect was observed for perceived caffeine amount (C: 3.2 ± 0.5 and 3.7 ± 0.5 ; D: 3.3 ± 0.8 and 3.2 ± 0.8 , $p = 0.007$) and bitterness ($p = 0.02$), but not aftertaste ($p = 0.23$), sweetness ($p = 0.21$) or pleasantness of taste ($p = 0.19$). A significant interaction effect was observed for FAS ($p = 0.04$) and condition effect for SSS ($p = 0.003$) and FS ($p = 0.03$). In addition, significantly ($p = 0.004$) more sugar was added to caffeinated drink (6.3 ± 3.6 g) compared to decaffeinated (3.0 ± 1.9 g). **CONCLUSIONS:** Although, palatability and pleasantness of taste was not significantly different, caffeinated coffee was perceived bitter leading to more sugar added to the drink.

85 Board #8 May 27 9:30 AM - 11:30 AM
Caffeine Intake Influences The Blood Pressure Response To Strenuous Physical Exertion Among Firefighters

Rachel S. Berkowsky¹, Beth A. Taylor, FACSM¹, Amanda L. Zaleski¹, Paul M. Parducci¹, Ming-Hui Chen¹, Kim M. Gans¹, Yin Wu¹, Paul D. Thompson, FACSM², Antonio B. Fernandez², Linda S. Pescatello, FACSM¹. ¹University of Connecticut, Storrs, CT. ²Hartford Hospital, Hartford, CT.
 (No relevant relationships reported)

Caffeine may diminish the immediate blood pressure (BP) reductions that occur after an exercise bout, termed *post-exercise hypotension* (PEH). Neither PEH nor the influence of caffeine on PEH have been studied in firefighters (FF), who have a disproportionate high risk of sudden cardiac death on the job, partially due to its strenuous nature and poor nutrition. **PURPOSE:** To examine the influence of caffeine intake (CAF) on PEH after a maximal graded exercise stress test (GEST) in FF. **METHODS:** FF ($n = 15$) completed a non-exercise control (CONTROL) and GEST in random order on separate non-work days. They left the laboratory attached to an ambulatory BP (ABP) monitor for 19hr. CAF was assessed with the National Health and Nutrition Examination Survey food-frequency questionnaire. Repeated measures ANCOVA in SAS tested if the ABP response after GEST vs CONTROL differed by CAF group divided by the median as high (806.8 ± 190.7 mg) and low (239.3 ± 202.9 mg) with baseline ABP as a covariate. **RESULTS:** FF were overweight (29.0 ± 3.9 kg/m²), middle-aged (40.2 ± 9.5 yr) men with elevated resting BP ($124.1 \pm 10.3/79.6 \pm 11.5$ mmHg). CAF tended to be positively correlated with resting SBP ($r = .50$, $p = .06$) and DBP ($r = .50$, $p = .06$). Among the total sample, the systolic ABP (ASBP) (18.0 ± 4.8 mmHg, $p < .01$) and diastolic ABP (ADBP) (9.1 ± 1.5 mmHg, $p < .01$) changes from baseline were greater after GEST vs CONTROL over 19hr, independent

of CAF ($P_s \geq 0.05$), but with significant interactions among ASBP, ADBP, and CAF over 19hr ($P_s < 0.05$). These interactions revealed ASBP was consistently greater after GEST vs CONTROL over 19hr in high CAF ($p < 0.01$ GEST vs CONTROL); whereas in low CAF the difference in ASBP after GEST vs CONTROL was variable over 19hr ($p = 0.03$ GEST vs CONTROL x Time). By contrast, the ADBP response after GEST vs CONTROL over 19hr tended to be greater in low (15.3 ± 4.5 mmHg, $p = .08$) than high CAF (4.4 ± 2.4 mmHg, $p = .05$). **DISCUSSION:** This small sample of FF exhibited post-exercise hypertension and CAF seemed to modulate this adverse response. Further study is needed in a larger sample of FF to confirm our findings and better establish the relationship of these associations.

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A-20 Thematic Poster - Cognition, Function, and Aging

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-2000

86 Chair: Heather E. Webb. *Texas A&M Corpus Christi, Corpus Christi, TX.*
(No relevant relationships reported)

87 Board #1 May 27 9:30 AM - 11:30 AM
Impact Of Neuromuscular Electrical Stimulation On Quality Of Life In Older Adults
Nigel C. Jiwan, Kyndall P. Ramirez, Monica A. Mendoza, Mitchell S. Kane, Lindsay E. Kipp, Joni A. Mettler. *Texas State University, San Marcos, TX.* (Sponsor: Tinker Murray, FACSMM)
(No relevant relationships reported)

Older adults often suffer from sarcopenia, the age-related loss of muscle mass and strength, which negatively impacts physical function and quality of life (QoL). Neuromuscular electrical stimulation (NMES) is frequently used in physical rehabilitation as a muscle strengthening modality; however, little research exists on QoL outcomes in response to NMES. **PURPOSE:** The aim of this study was to determine change in QoL and physical function in older adults after 4 weeks of NMES. **METHODS:** Eight older adults (68.9 ± 2.4 years) completed 12, 40-min NMES training sessions of the quadriceps muscles on each leg over 4 weeks with the stimulation frequency set at 60 Hz. During the treatment, subjects were seated on an isokinetic dynamometer with the leg positioned at a 60° angle. The subjects were given a pre and post survey assessing indicators of QoL: self-efficacy for physical function (0-100 scale), perceived competence in physical domains (e.g., strength, coordination, physical activity, 1-6 scale), physical self-concept (1-6 scale), and intention to be physically active (1-7 scale). Physical function of the lower body was assessed pre and post intervention with a timed up and go test (TUG). Paired sample *t*-tests were used to test for differences over time (pre, post) for TUG and QoL dimensions. Cohen's *d* was calculated for effect size. **RESULTS:** The following QoL dimensions showed a statistically non-significant increase with small to large effect sizes: self-efficacy (97.80 ± 0.84 vs 98.97 ± 0.17 , $p = 0.17$, $d = 0.83$), intention (5.91 ± 0.72 vs 6.59 ± 0.27 , $p = 0.38$, $d = 0.49$), coordination (5.10 ± 0.20 vs 5.30 ± 0.20 , $p = 0.12$, $d = 0.36$), and physical activity (3.84 ± 0.54 vs 4.22 ± 0.39 , $p = 0.20$, $d = 0.29$), pre vs post, respectively. Physical self-concept showed no effect (4.58 ± 0.44 vs 4.67 ± 0.36 , $p = 0.74$, $d = 0.07$), indicating this global dimension may take longer to change. There was a significant decrease in time to complete TUG (8.38 ± 0.60 s vs 7.40 ± 0.45 s, $p = 0.02$, $d = 0.62$). **CONCLUSION:** TUG times showed significant improvement and QoL dimensions trended toward improvement after 4 weeks of NMES. Enhanced physical function from NMES treatment may help improve overall QoL by increasing confidence and willingness to perform physical activities, potentially decreasing risk of sarcopenia.

88 Board #2 May 27 9:30 AM - 11:30 AM
Predictors Of Functional Performance Among Older Adults
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(No relevant relationships reported)

Age-associated reductions in muscle strength and power are associated with decrements in functional performance. It is unclear which neuromuscular factors that contribute to strength and power (e.g. muscle mass, contractile speed) and limb fatigability (activity-induced reduction in strength and power) are predictive of functional performance among old adults.

PURPOSE: The aim was to determine the contribution of lower limb fatigability and neuromuscular factors to decrements in functional performance tests among older adults.

METHODS: Eighty-one adults (39 females, 42 males: $61 - 93$ years, 73 ± 7.7 years, body mass index = 26.4 ± 4.1 kg/m², body fat = 34.7 ± 7.8 %) participated in sessions to assess; 1) Physical function including a 6-minute walk, chair-rise (x5), timed stair-climbing and balance (Berg balance); 2) Dual-energy X-ray absorptiometry to assess the body composition; and, 3) fatigability of the knee extensor muscles which involved 80 maximal velocity concentric contractions (1/3 s) with a load of 20% of the maximal voluntary isometric contraction. Voluntary activation and contractile properties of the knee extensors were assessed with transcranial magnetic stimulation and peripheral nerve stimulation before, and after the fatiguing task. Correlation analysis and regression analysis were performed to determine which variables were predictive of physical function.

RESULTS: Distance walked over 6 minutes was associated with younger age, greater power, more thigh lean tissue and lower knee extensor fatigability ($R^2 = 0.55$, $P < 0.001$). Faster chair-rise time (x5) was associated with younger age, less body fat, and lower fatigability ($R^2 = 0.44$, $P < 0.001$). Both a faster stair-climb ($R^2 = 0.3$, $P < 0.001$) and a higher Berg balance score ($R^2 = 0.43$, $P < 0.001$) were associated with younger age and less body fat. **CONCLUSIONS:** Our findings demonstrate that younger age, greater peak power and lower fatigability of a dynamic fatigue task were strong predictors of lower limb functional performance tasks that are common to daily activities among older adults. Our results also suggest that interventions to offset age-related declines in lean mass and increases in body fat will aid in maintenance of functional performance with advancing age.

89 Board #3 May 27 9:30 AM - 11:30 AM
Higher Fitness Levels Influence Association Between Cognition And Mobility In Older Adults With Hypertension And Dementia Risk
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(No relevant relationships reported)

Higher levels of fitness are associated with preserved cognitive function in older adults. Preserved cognition is linked to better mobility and reduced risk of falls. However, it remains to be explored whether cardiovascular fitness (CF) influences the link between cognition and mobility in individuals with cardiovascular disease burden and risk of dementia. **PURPOSE:** We explored whether CF influences the relationship between cognition and mobility in older adults with hypertension and subjective cognitive decline. These individuals are at higher risk of dementia due to cardiovascular disease burden and early signs of cognitive impairment. **METHODS:** Older adults ($n = 118$, age 70.1 (SD = 6.7) years, 62% males) underwent CF assessment (Bruce protocol treadmill stress test) and were grouped based on Bruce protocol stage completion into low (stage 1 [$n = 31$]), average (stage 2 [$n = 57$]), and high (stage ≥ 3 [$n = 30$]) CF groups. Cognition was measured via the Cambridge Brain Sciences cognitive battery; mobility (usual and dual-task gait [naming animals]) was measured using the GAITRite walkway system. We conducted hierarchical regression models adjusting for sex, age and years of education to determine whether CF modulated association between cognition and mobility. **RESULTS:** For usual gait, cognition was positively associated with gait velocity in high CF (Change statistics: $F(1,25) = 14.3$, $p = .001$, $R^2 = .35$), as well as step length in high CF ($F(1,25) = 10.8$, $p = .003$, $R^2 = .27$) and average CF ($F(1,50) = 4.4$, $p = .04$, $R^2 = .08$), and gait variability in average CF ($F(1,48) = 9.8$, $p = .003$, $R^2 = .17$). For dual-task gait, cognition was positively associated with gait velocity in both high CF ($F(1,25) = 9.15$, $p = .006$, $R^2 = .26$) and average CF ($F(1,49) = 5.8$, $p = .02$, $R^2 = .10$), as well as step length in both high CF group ($F(1,25) = 7.2$, $p = .01$, $R^2 = .21$) and average CF group ($F(1,49) = 7.2$, $p = .01$, $R^2 = .13$). **CONCLUSIONS:** Cognition was positively associated with mobility outcomes in individuals with average and high

CF, while no associations were seen in those with low CF. These findings suggest that the protective effects of cognition on mobility (e.g., reduced falls risk and prolonged independence) may be hindered by low CF in older adults with hypertension.

90 Board #4 May 27 9:30 AM - 11:30 AM
12-week Of Tai Chi Training Improves Cognitive Function In Older Adults With Mild Cognitive Impairment

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Manifestation of mild cognitive impairment (MCI) is an early sign indicative of accelerated decline in cognitive function during ageing that precedes the development of dementia. Its prevalence rate in older adults in China (≥ 60) ranges from 10% to 20%. To date, there is no documented pharmacological intervention for dementia. Preliminary studies, however, have shown that exercise can improve cognitive function.

PURPOSE: This study aims to examine the effectiveness of Tai Chi training in improving cognitive function in older adults with MCI.

METHODS: This randomized controlled trial was conducted between October, 2018 and May, 2019. In this two-arm, single-blinded randomized controlled trial, 20 Chinese adults aged ≥ 50 years with MCI [Score of Montreal Cognitive Assessment Hong Kong Version (MoCA-HK) below 7th percentile of the age and education-corrected normative data of Hong Kong] were randomly assigned to Control (CON, n=10, received no intervention) and Tai Chi (TC, n=10, received 12-week Tai Chi training) groups. Global cognitive function was the primary outcome which was assessed by MoCA-HK 12 weeks after post-randomization. Secondary outcomes including executive function, working memory, long term memory, and attention were assessed by trial making test A and B, digit span, 30-min delay recall test and attention network test respectively. Data were analyzed by generalized linear model with baseline as covariate.

RESULTS: TC provoked a robust improvement in MoCA-HK score compared with CON (TC: +24% vs CON: +9%, $P < 0.001$). TC participants also performed better in 30-min delay recall (TC: +52% vs CON: +8%, $P = 0.005$) and trial making test B/A ratio compared with CON (TC: -21% vs CON: -2%, $P = 0.028$). No statistical difference was observed in forward and back digit span. There was no statistical difference in reaction time, accuracy, alerting network and orienting network between the two groups. However the change in executive network was significantly different between TC and CON (TC: +19% vs CON: -24%, $P < 0.001$).

CONCLUSIONS: A 12-week Tai Chi training can improve global cognitive function in older adults with MCI. Tai Chi improves executive function and long-term memory and alters the attention network.

91 Board #5 May 27 9:30 AM - 11:30 AM
Effect Of Low Intensity Resistance Exercise Training On Cognitive Function In Middle-aged And Older Individuals

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 (No relevant relationships reported)

PURPOSE: Many studies have reported that aerobic exercise training improves cognitive function (CF), even with low-intensity (e.g. walking) (Kramer et al. 1999; Hillman et al. 2008). Alternatively, moderate (MRT) to high intensity RT (60-80% 1RM) improves CF (Chang et al. 2012). However, older individuals and patients with chronic disease often have difficulty with higher exercise loads due to declining cardiovascular and musculoskeletal systems. The purpose of this study was to examine the effect of low intensity resistance exercise training (LRT) on CF in middle-aged and older individuals. Given that an acute bout of even low intensity resistance exercise improves CF albeit less effective than higher intensity (Tsukamoto et al. 2017), we hypothesized that LRT would improve CF although its effect might be lower than higher intensity training. **METHODS:** 50 healthy middle-aged and older individuals (age: 50 to 77 years) were randomly classified into three groups (control (CON), LRT (40%1RM), and MRT (60%1RM)). Resistance exercise programs were leg extension, seated leg curl, leg press, and chest press. For each exercise, all participants performed 14 repetitions for three sets with 2 minutes interval. LRT and MRT participants completed all these exercise for three times per week and CON participants maintained their conventional lifestyle. CF (working memory (WM), short memory (SM), and

inhibitory control (IC)) were determined with reading span test, face-name matching task, and color-word Stroop task, respectively. Each task was performed at before the intervention (PRE), 12 weeks (12W), and 24 weeks (24W) of the intervention period. **RESULTS:** There was significant interaction for the IC score ($p = 0.021$). As compared with the PRE, the IC at the 12W did not change in the MRT ($p = 0.184$), while tended to improve for the LRT ($p = 0.065$), and significantly declined in the CON ($p = 0.020$). At the 24W, the IC score did not change significantly for all conditions as compared with the PRE. The score of WM and SM did not change significantly for all conditions throughout the intervention.

CONCLUSIONS: The finding suggests that even with a lower load, chronic RT may improve IC in middle-aged and older individuals. However, the exercise intensity, training period, and task specificity for the CF should be further elucidated.

92 Board #6 May 27 9:30 AM - 11:30 AM
Systolic Blood Pressure And Heart Rate Recovery Are Related To Cognition In Healthy Older Adults

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 (No relevant relationships reported)

SYNOPSIS: Attenuated heart rate recovery (HRR) and systolic blood pressure recovery (SBPR) after a maximal exercise test (VO_{2peak}) are linked to cardiovascular risk factors (CVRF). The relationship between the presence of CVRF and reduced cognition is well established in older adults. Yet the explicit relationship between HRR or SBPR and cognition has yet to be studied in older adults, here we found that reduced HRR and SBPR were directly related to worse cognition. **PURPOSE:** To determine if a relationship exists between cognition and HRR or SBPR measured during a VO_{2peak} test in older adults

METHODS: Prior to enrollment in an intervention, a total of 68 participants (70 \pm 6yrs; 45 women) completed neuropsychological tests and a VO_{2peak} incremental test on a cycle ergometer. After standard verifications at rest, heart rate and blood pressure were continuously monitored during the incremental test and a 3-minute recovery period. HRR was calculated as the first minute recovery heart rate subtracted from the maximal heart rate during the test, where lower numbers were interpreted as reduced recovery and increased likelihood of CVRF. SBPR was defined as the maximal reading during the test divided by the first- and third-minute recovery where a higher ratio indicates higher probability of CVRF. Correlations analyses were completed with sex, age and education as covariates.

RESULTS: VO_{2peak} was inversely related to Stroop inhibition reaction time ($r = -0.275$, $p = 0.048$). HRR approached significance with total digit span score ($r = 0.230$; $p = 0.090$). SBPR was negatively associated with Stroop inhibition reaction time ($r = -0.327$; $p = 0.042$) and Stroop switching reaction time ($r = -0.379$; $p = 0.017$)

CONCLUSIONS: For the first time, we identified that there is a direct relationship between SBPR and cognitive outcomes. HRR and SBPR are early indicators of cardiovascular and endothelial dysfunction, thus, it could be that the relationship between cognition and CVRF are mediated by early vascular dysfunction that could be affecting upstream cerebral vascular health. This hypothesis could be confirmed in future work including larger samples of individuals as well as neuroimaging techniques.

93 Board #7 May 27 9:30 AM - 11:30 AM
Association Of Cognitive Function With BMI And Physical Function In Older Adults: The CogEx Study

Audrey M. Collins, Renee J. Rogers, FACSM, Fabrisia Ambrosio, Kirk Erickson, Marissa L. Marcin, Andrea C. Kozai, Katherine A. Collins, Nalingna Yuan, John M. Jakicic, FACSM. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: John M. Jakicic, FACSM)
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Aging negatively impacts cognitive function and physical function in older adults. Physical activity may protect or improve the brain and physical functions that are crucial for multiple health outcomes in older adults, whereas obesity may negatively impact these outcomes.

PURPOSE: To examine the association between cognitive function with BMI and physical function in underactive older adults.

METHODS: Baseline data were examined from sedentary older adults (N=31; age=70.3 \pm 3.7 years; BMI=28.8 \pm 4.6 kg/m²) prior to engaging in a 12-month physical activity intervention. Assessments included height, weight, physical function, and cognitive function. Cognitive function was assessed using the Modified Mini-

Mental State (3MS) examination and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Physical function performance was assessed using the time to complete the 400-Meter Walk Test (minutes).

RESULTS: Average time to complete the 400-meter walk was 6.3 ± 1.0 minutes, which was modestly associated with BMI ($r=0.312$, $p=0.088$). The 3MS Total Score (94.7 ± 3.7) was not significantly correlated with BMI ($r=-.158$; $p=.397$) or 400-Meter Walk Test performance ($r=-.152$; $p=.415$). Similarly, the RBANS Sum of Index Score (209.0 ± 21.1) was not significantly correlated with BMI ($r=-.297$; $p=.105$) or 400-Meter Walk Test performance ($r=-.164$; $p=.378$). When examining this relationship by cognitive domain, a higher BMI was associated with a poorer RBANS Immediate Memory Index Score ($r=-.412$; $p=.021$). We also observed that worse performance on the 400-Meter Walk Test was associated with poorer RBANS Immediate Memory Index Score ($r=-.314$; $p=.08$). Neither BMI nor 400-Meter Walk performance were significantly associated with RBANS Visuospatial/Constructional Index, Language Index, Attention Index, or Delayed Memory Index scores.

CONCLUSION: Findings reveal that RBANS Immediate Memory Index score was inversely associated with both BMI and physical function in sedentary older adults. This may suggest that both obesity and poor physical function negatively impact immediate memory performance in older adults. Future studies to investigate whether and how physical therapeutics may enhance short-term memory function in older adults are warranted.

Supported by UPMC Enterprises

94 Board #8 May 27 9:30 AM - 11:30 AM

The Effect Of Acute Yoga And Circuit Training On Cognitive Function Of Sedentary Elderly

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(No relevant relationships reported)

Introduction: Exercise is an effective strategy on improving cognitive function, but most reports emphasize the benefits of high-intensity exercise. **Purpose:** This study is to investigate whether two acute moderate-intensity exercises can improve cognitive function of the sedentary elderly. **Method:** Twenty-eight women without exercise habits were divided into two groups, each performed yoga ($n=19$; 62.25 ± 1.6 yrs old) or circuit training ($n=9$; 59.53 ± 1.96 yrs old). All participants completed 30 minutes of moderate-intensity exercise with moderate efforts, significant accelerated breathing and heart rate. The cognition function tests were performed before, immediately, 30 and 60 minutes after an intervention consisting of 40 min of either Yoga or circuit training exercise and a seated rest control. The cognitive parameters were compared by a mixed-model analysis for repeated measures. **Results:** The results indicated there were no difference in age between the two groups. Acute exercise improved cognitive function immediately after acute exercise, including got a significant higher total response score ($F(3,75)=7.793$, $p<0.001$), and complete Schulte table (as an indicator of attention, $F(3,75)=4.239$, $p=0.008$) and Stroop's neutral test ($F(3,75)=12.64$, $p<0.001$) faster. There were no significant differences in other items such as responsive rate, memory span, and word, congruent, square, incongruent Stroop test after acute exercise. The benefits of exercise on total response score and Stroop's neutral test can even be maintained up to 60 minutes after exercise. For the benefit of two different exercise, only the performance of Schulte table was significantly better in the circuit training group than the yoga group ($F(1, 25)=4.554$, $p=0.043$, Eta value=0.154). The scores of other cognitive tests did not differ between the two exercises. **Conclusion:** The two different exercises significantly improved cognitive function and can maintain up to 60 minutes after exercise. The circuit training exercise represented a better influence on attention than Yoga.

Supported by MOST Grant 107-2410-H-845-018-MY3.

A-21 Thematic Poster - Experimental Studies: Biological Outcomes

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-2011

95 **Chair:** Kevin E. Finn, FACSMM. *Colby-Sawyer College, New London, NH.*

(No relevant relationships reported)

96 Board #1 May 27 9:30 AM - 11:30 AM

Effect Of Frequency Of Breaks During Prolonged Sitting On Postprandial Metabolism In Type 2 Diabetes

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Interrupting prolonged sitting with short activity bouts may be beneficial for glycemic control in adults with type 2 diabetes (T2D). However, the impact of frequency of interruptions has not yet been assessed in T2D. **PURPOSE:** To investigate acute effects of interrupting prolonged sitting with simple resistance activity (SRA) breaks at different frequencies on postprandial glucose and insulin in adults with medication-controlled T2D. **METHODS:** Inactive adults with medication-controlled T2D ($n=23$, $12 \text{ } \text{♀}$, 62 ± 8 y, 32.6 ± 3.5 kg m^2) completed a three-armed randomised crossover trial (6-14 day washout). The experimental conditions were: sitting uninterrupted for 7 h (SIT); sitting with 3-min SRA breaks every 30 minutes (SRA3); and, sitting with 6-min SRA breaks every 60 minutes (SRA6). Fasting and postprandial glucose and insulin concentrations were measured at -1 h and 0 h, and every 30 min thereafter for 7 h. Breakfast was provided at 0 h and lunch at 3.5 h. Total (7-h) and meal-specific (3.5-h) areas under the curve (tAUC; trapezoid method) were calculated. Mixed model regression analyses examined effects of condition on tAUC, adjusting for baseline concentrations and period effects. **RESULTS:** When compared to SIT, 7-h tAUC were attenuated significantly during SRA6 for glucose (SIT: 84.9 mmol L^{-1} , 95%CI 80.3, 89.8; SRA6 80.8 mmol L^{-1} , 95%CI 76.3, 85.3, $p=0.016$), and insulin (SIT: 1982 pmol L^{-1} , 95% CI 1679, 2340; SRA6: 1783 pmol L^{-1} , 95%CI 1510, 2105 $p<0.01$) but not SRA3 (see Figure). Post-lunch insulin tAUC was significantly lower during both SRA3 (907 pmol L^{-1} , 95%CI 776, 1059, $p<0.01$) and SRA6 (875 pmol L^{-1} , 95%CI 750, 1022, $p<0.001$) when compared to SIT (996 pmol L^{-1} , 95%CI 853, 1163). **CONCLUSION:** In adults with medication-treated T2D, interrupting sitting with bouts of SRA's every 60 minutes over 7 hours significantly attenuated postprandial glucose and insulin concentrations when compared with uninterrupted sitting.

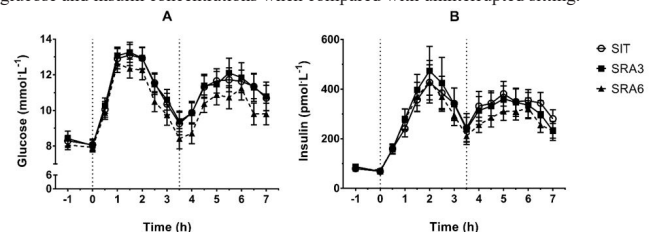


Figure: Effect of the three 7 h trial conditions on postprandial (A) glucose and (B) insulin concentrations in adults with medication controlled T2D ($n=23$). Data are mean \pm SEM. SIT: uninterrupted sitting; SRA3: sitting with 3-minute SRA breaks every 30 minutes; SRA6: sitting with 6-minute SRA breaks every 60 minutes.

97 Board #2 May 27 9:30 AM - 11:30 AM
Effects Of Interrupting Sitting With Walking Only Or Combined With Resistance Activities On Glycemic Responses
 Xia Sheng Ma, Zheng Zhu, Xiao-Mei Liu, Yan-yu Lin, Zhen-Bo Cao. *Shanghai University of Sport, Shanghai, China.*
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 (No relevant relationships reported)

PURPOSE: To examine whether interrupting prolonged sitting with brief bouts of walking only or combined with simple resistance activity improve glucose levels in healthy, sedentary, young adults. **METHODS:** This study included 16 healthy, sedentary adults (9 women; 23.7±2.3 y; BMI 20.8±4.1 kg/m²; VO₂max 39.1±5.3 ml·kg⁻¹·min⁻¹) who completed three 26-h laboratory conditions, including 22.5 h in a whole-room calorimeter, separated by 5-14 day washout period. The same procedures were performed in each of the three conditions except for the following 9-h activity period: uninterrupted sitting time (SIT); sitting with 8 min intermittent, brisk (60% VO₂max) walking bouts (WALK; 7 bouts for a total of 56 min); or alternating 8-min brisk walks and simple resistance activities (RESIST; 3 bouts of walking and 4 bouts of resistance for a total of 56 min). Continuous glucose monitoring (CGM) was performed for 26 h. Standardized meals were consumed during each condition. The incremental areas under the curve (iAUC) for glucose during the entire observation period and the three segmentation periods (activity, evening, and sleep periods) were compared between conditions after adjustment for standard covariates (e.g., age, sex, et al.) and additional adjustment for energy expenditure (EE). **RESULTS:** Compared with SIT, RESIST reduced 26-h iAUC for CGM by 3.04 mmol·L⁻¹·h [95%CI 0.94-6.33] (p = 0.046). Compared with SIT, WALK and RESIST reduced the CGM iAUC by 3.80 mmol·L⁻¹·h [0.19-7.40] (p = 0.036) and 7.37 mmol·L⁻¹·h [4.08-10.66] (p < 0.001) during the 9 h activity period, respectively. The iAUC was lowered by 3.57 mmol·L⁻¹·h [0.06-7.08] (p = 0.045) in RESIST compared to WALK. Upon adjusting for EE, the only effect that remained was the comparison between RESIST and SIT during the activity period. During the evening period, WALK increased the CGM iAUC by 1.91 mmol·L⁻¹·h [0.29-3.54] (p = 0.019) when compared to SIT, this effect was lost after adjustment for EE. **CONCLUSIONS:** Interrupting 9 h of prolonged sitting time with either WALK or RESIST reduced acute glucose responses in healthy, sedentary adults. This effect was more pronounced in RESIST than WALK and was only maintained during the 26-h period in RESIST.

Supported by Shanghai Science and Technology Committee (NO. 16080503300)

98 Board #3 May 27 9:30 AM - 11:30 AM
Simple Resistance Exercise Breaks To Interrupt Sedentary Behavior In College Students
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 (No relevant relationships reported)

Emerging research suggests improvement in fatigue, sleepiness, and muscular discomfort from using simple resistance exercises to interrupt prolonged sitting, yet it is unclear if these improvements are observed in college students.

PURPOSE: To examine if interrupting prolonged sitting with simple resistance exercise helps to reduce daily fatigue, sleepiness, muscular discomfort in college students and if it impacts daily physical activity.

METHODS: Twenty four college students (age 23.1 ± 3.4 years, BMI 27.4 ± 5.0 kg/m²) completed two 7-day assessments of subjective measures for discomfort, fatigue, and sleepiness while wearing an ActiVpal Micro (PAL technologies) to track physical activity for steps, sedentary time, standing time, and sedentary time in 10, 30, and 60-minute bouts. The first week was used as control (CON) and consisted of normal daily activities while completing assessments of all outcomes in the morning (M), mid-day (MD), and evening (E). The experimental week (REX) followed a similar protocol, but added hourly resistance exercise breaks consisting of one bodyweight or resistance band exercise for 2 sets of 15 repetitions per exercise. Paired *t*-tests evaluated difference in physical activity variables. Repeated measures ANOVA (0 between, 3 within) evaluated differences in discomfort, fatigue, and sleepiness variables across treatment (CON, REX), day (Mon-Fri), and time (M, MD, and E).

RESULTS: Comparison of physical activity resulted in no statistical significance between CON vs REX for all outcomes (p ≥ 0.05). A main effect for treatment was observed for overall discomfort (CON: 2.97, REX: 1.72; p = 0.042) and for sleepiness (CON: 4.38, REX: 3.89; p = 0.011). Additionally, a main effect for time was observed for mental fatigue (M: 15.16; MD: 16.19, E: 22.15; p < 0.001), physical fatigue (M: 15.41; MD: 15.91, E: 19.53; p = 0.027), and sleepiness (M: 4.78, MD: 3.36, E: 4.27; p < 0.001). *Post hoc* testing observed a difference for mental fatigue from M to E (p = 0.003) and MD to E (p < 0.001). Sleepiness observed a difference from M to MD (p < 0.001), M to E (p = 0.016), and from MD to E (p < 0.001).

CONCLUSIONS: Hourly simple resistance breaks resulted in no compensation in steps or sedentary time when engaging in the REX condition. Furthermore, the REX condition reduced daytime muscular discomfort and sleepiness.

99 Board #4 May 27 9:30 AM - 11:30 AM
Effects Of 8-week Aerobic Exercise On Markers Of Inflammation And Oxidative Stress In Obese Females
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 (No relevant relationships reported)

PURPOSE: The current study investigated effects of an 8-week moderate intensity aerobic exercise program on changes of body composition and markers of inflammation and oxidative stress in middle-aged obese females.

METHODS: 35 obese females were randomly assigned to either exercise (EX, N=16) or control (CON, N=19) group. The exercise group performed moderate intensity aerobic exercise on the treadmill for 60 minutes at 55% of VO₂max for 8 weeks (3 days/week). Body composition measurement with dual-energy X-ray absorptiometry and blood collection were conducted before and after the 8-week intervention (PRE and POST). Blood samples were used to measure levels of tumor necrosis factor-alpha, C-reactive protein, adiponectin, total antioxidant status, and 8-hydroxydeoxyguanosine. Two-way repeated measures ANOVA and Tukey post hoc tests were used for data analysis.

RESULTS: 8 weeks of aerobic exercise intervention significantly reduced body weight (89.2±14.1 kg mean±SD → 88.1±14.4, P = .023), BMI (34.2±4.6 → 33.7±4.4, P = .035), %body fat (42.1±5.2% → 41.4±5.2, P = .014) and tumor necrosis factor-alpha (4.57±.28 pg/mL mean±SE → 4.24±.028, P=0.027) and increased total antioxidant status (1.76±.1 mM → 1.98±.1, P = .017); however, visceral adipose tissue mass, C-reactive protein, Adiponectin, and 8-hydroxydeoxyguanosine were unaltered. CON showed no significant changes in any variables at POST.

CONCLUSIONS: It is suggested that levels of inflammation and oxidative stress are associated with changes in %body fat, indicating that fat loss is effective in preventing and managing obesity-associated disorders. This study confirmed results of previous studies suggesting that longer period of exercise training with fat loss may be required to induce significant changes in CRP, adiponectin, and 8-hydroxydeoxyguanosine in the middle-aged obese females.

100 Board #5 May 27 9:30 AM - 11:30 AM
Ex-Met Study; Exercise In Prevention Of Metabolic Syndrome

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Purpose: Primary objective of this randomized multicenter trial was to investigate effects of different volumes of high intensity interval training (HIIT) compared to current exercise guideline of moderate-intensity continuous training (MICT) on the composite number of cardiovascular disease risk factors constituting the metabolic syndrome after a 16 week and 1-year, follow-up.

Methods: This randomized international multi-center trial included men and women aged ≥30 years diagnosed with the metabolic syndrome. The study consisted of a supervised and "partly supervised" phase to evaluate the efficacy and feasibility of different exercise doses on the metabolic syndrome in a real world setting. This study included 408 participants to one of the following groups: 3 times/week of 4x4 min HIIT at 85-95% HRpeak; 3 times/week of 1x4 min HIIT at 85-95% HRpeak; or iii) 5-7 times/week of ≥30 min MICT at 60-70% HRpeak. Clinical examinations, physical tests and questionnaires were administered to all participants during all testing time points (baseline, 16 weeks and after 1).

Changes from baseline to 16w and baseline to 1 year were compared between groups using the Kruskal-Wallis test. Change within each group from baseline to 16 weeks and baseline to 1 year were tested using the Wilcoxon signed-rank test. The level of significance was set at 5%.

Results

Between group changes did not show any significant results (16 weeks and 1 year) in any of the risk factors constituting metabolic syndrome. While within group changes induced almost significance in all variables (see table 1)

Conclusion

HIIT exercise with low volume seems to be a time-effective strategy for lowering risk factors constituting metabolic syndrome. Although results from this study show that both HIIT and MICT reduces metabolic syndrome risk factors to a similar degree. Table 1. Metabolic syndrome risk factors, baseline to 1 year

	1 HIIT				4 HIIT				MICT			
	Median Change	CI lower	CI high	P-value	Median Change	CI lower	CI high	P-value	Median Change	CI lower	CI high	P-value
WC	-0.5	-2.5	1.5	0.167	-1	-3	0	0.025	-1	-2	0.5	0.109
BP sys	-7	-12	-2	> 0.001	-6	-10	-3	> 0.001	-3	-9	0	0.004
BP diast	-2	-5	2	0.019	-5	-7	-2	> 0.001	-3	-5	-1	0.081
HDL	-0.025	-0.1	0.04	0.922	-0.02	-0.08	0.07	0.922	0.05	-0.01	0.12	0.025
TG	-0.145	-0.34	0.05	0.023	-0.16	-0.42	-0.05	0.006	-0.14	-0.3	-0.04	0.006
Glucose	-0.2	-0.5	0	0.006	-0.3	-0.4	0.1	0.121	0	-0.22	0.3	0.658

compare the efficacy of a HIIT-low volume protocol vs MICAT on the Homeostatic assessment model, glycated hemoglobin (HbA1c) and skeletal muscle mass, in adults with MS. **METHODS:** controlled, randomized, clinical trial using the minimization method, with two parallel groups for the purpose of showing superiority. Sixty patients with MS, of both genders, 40-60 years old, were included. A clinical evaluation, biochemical tests, an ergospirometry and a dual-energy X ray absorptiometry to determine total and regional skeletal muscle mass were carried out before and after a treadmill exercise program of 12 weeks, 3 sessions/week. Participants were assigned to an intervention with HIIT-low volume (n=29) in 22 min sessions that included six intervals at a load of 90% of maximum oxygen consumption (VO₂max) for 1 min followed by 2 min at 50% of VO₂max. The control group received MICAT (n=31) at an intensity of 60% of VO₂max in sessions of 36 min. **RESULTS:** patients had a mean age of 50.8±6.0 years, body mass index of 30.6±4.0 kg.m⁻², body fat percentage of 38.7±7.0% and VO₂max of 29.0±6.3 mL.O₂.kg⁻¹.min⁻¹; 70% were women. Compared to MICAT, HIIT-low volume was not superior in reducing Ln of IR (marginal mean difference: 0.083 [95% CI -0.092—0.257]; Cohen's d: 0.249; p value=0.346) or increasing Ln of total lean mass (kg) (0.004 [-0.014—0.023]; Cohen's d: 0.120; p=0.637) and Ln of thigh lean mass (g) (0.008 [-0.020—0.038]; Cohen's d: 0.154; p=0.599). After the intervention, the HIIT-low volume group, compared to the MICAT, had a higher HbA1c (5.81% vs 5.69%; 0.119 [0.005—0.233]; Cohen's d: 0.554; p=0.040). When comparing before and after the intervention, both training groups decreased IR. **CONCLUSION:** HIIT-low volume, compared to MICAT, is not superior in reducing IR or increasing skeletal muscle mass in adults with MS. Colciencias 111562638757; Interinstitucional 2016-13041; Doctoral scholarships 727-2015

101 Board #6 May 27 9:30 AM - 11:30 AM
High Intensity Interval Training And Muscular Strength On Academic And Behavioral Outcomes In Children

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 (No relevant relationships reported)

Emerging research demonstrates the link between physical activity and academic outcomes, however, limited evidence exists on whether different modes of physical activity (PA) result in differences in cognitive and academic outcomes in real world settings. **PURPOSE:** The purpose of this study was to evaluate the effects of embedding a high intensity interval training (HIIT) and muscular strength program in physical education (PE) classes on academic and behavioral outcomes. **METHODS:** Seventy children (40 boys & 30 girls; age 8-10 yrs. old) enrolled in Accelerations Academy were assigned into one of three conditions during a one-week period: control (n = 23), High Intensity Interval Training (HIIT) (n = 25), and muscular strength (MS) (n = 22). The HIIT condition consisted of 4 days of HIIT sessions (9 min/session; 30 sec on:30 sec off) followed by X min of standard PE activities; the MS condition consisted of 4 days of strength sessions (3 sets/10-12 reps for 3 exercises/session) followed by ~30 min of standard PE activities; the control condition consisted of ~50 min of standard PE only. PA intensity and duration was measured using actigraph accelerometers (Actigraph, Pensacola, FL). Math Assessment scores and Connor Abbreviated Ratings were conducted at baseline and post-intervention to identify academic and behavioral changes respectively. Intervention effects for outcomes were examined using regression analysis. **RESULTS:** Participation in HIIT predicted higher vigorous (β=2.21, p=0.005) and very vigorous minutes (β=0.80, p < 0.001), but not moderate minutes compared to control. Participation in strength was not statistically different. HIIT participation was also associated with greater improvement on math test scores (β=1.52, p=0.04). No condition was associated with significant changes to behavioral ratings. **CONCLUSION:** Preliminary evidence from this study highlights the potential for embedding an acute HIIT program within PE for improving physical activity levels and academic outcomes in elementary school children. This is consistent with prior studies which show how short bouts of intense exercise can improve cognitive and mental health outcomes in adolescent populations.

102 Board #7 May 27 9:30 AM - 11:30 AM
High-intensity Interval Training Low-volume Vs Moderate-intensity Continuous Aerobic Training On Insulin Resistance In Metabolic Syndrome

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Moderate-intensity continuous aerobic training (MICAT) and high-intensity interval training (HIIT) interventions improve insulin resistance (IR) and glycemic control in patients with metabolic syndrome (MS). Moreover, skeletal muscle mass negatively correlates with IR. However, there are contradictory results about the superiority of any of these interventions on the control of the glucose metabolism in MS. **PURPOSE:** to

103 Board #8 May 27 9:30 AM - 11:30 AM
Resistance Exercise And Cardiometabolic Risk In Prediabetes: A Systematic Review And Meta-analysis

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Prediabetes is a highly prevalent precursor to type 2 diabetes, and is also associated with an increased risk of morbidity and mortality. Resistance exercise (RE) is an effective method of reducing cardiometabolic risk factors in persons with a diagnosis of type 2 diabetes, but its efficacy in individuals with prediabetes is unclear. Determining the cardiometabolic impact of RE in prediabetes is necessary for evidence-based exercise prescription for diabetes prevention. **PURPOSE:** To undertake a systematic review and meta-analysis of randomized and non-randomized control trials examining the effect of RE on cardiometabolic risk factors in individuals with prediabetes. **METHODS:** PubMed, Cochrane, Web of Science, and Embase databases were searched for published studies of adults at risk for diabetes and who participated in a RE intervention. All studies included randomized or non-randomized control trials. The database search and data extraction were performed by two separate reviewers. A systematic review and meta-analysis were conducted to determine changes in adiposity, glycemic control, insulin resistance, blood lipids/lipoproteins, and blood pressure (BP) following the interventions using a random effects model to assess standardized mean differences (SMD) between RE and control. **RESULTS:** 10 studies comprising 404 participants were included in the analysis. For RE compared to controls, there were significant improvements in glycosylated hemoglobin (SMD = -0.688; 95% confidence interval [CI] -1.178 to -0.198; p=0.006), fasting plasma glucose (SMD = -0.747; 95% CI -1.003 to -0.460; p<0.001), and total cholesterol (SMD = -0.723; 95% CI -1.177 to -0.27; p=0.002). No changes in waist circumference (SMD = -0.232, 95% CI -.526 to 0.062; p=0.122), insulin resistance (SMD = -0.597, 95% CI -1.65 to 0.457; p=0.267), high-density lipoprotein (SMD = -0.287, 95% CI -0.748 to 0.174; p=0.223) or low-density lipoprotein (SMD = -0.398, 95% CI -1.027 to 0.231; p=0.215) cholesterol, triglycerides (SMD = -0.400, 95% CI -0.850 to 0.050; p=0.081), systolic BP (SMD = -0.16, 95% CI -0.491 to 0.158; p=0.315), or diastolic BP (-0.476, 95% CI -1.05 to 0.105; p=0.108) were found. **CONCLUSION:** RE appears to be an effective method of improving glucose control, but is less effective in improving blood lipids or blood pressure.

A-22 Thematic Poster - Vascular Function

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-2010

104 **Chair:** Maureen J. MacDonald. *McMaster University, Hamilton, ON, Canada.*
(No relevant relationships reported)

105 Board #1 May 27 9:30 AM - 11:30 AM
Baseline Cardiac Autonomic Predictors Of Blood Pressure Response To Standardized Endurance Training In Hypertensive Women

Marina Livia Venturini Ferreira, Alex Castro, Silas Gabriel Oliveira Nunes, Rafael Rezende Ferreira, Cláudia Regina Cavagliari, Mara Patricia Traina Chacon-Mikahil. *UNICAMP, Campinas, Brazil.*
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Although international recommendations corroborate the antihypertensive effects of regular endurance training (ET), interindividual responses are widely heterogeneous, differing between responders (RE) and non-responders (NR). Previous studies have shown the decrease in the activity of the autonomic nervous system (ANS) is involved in the ET-induced reduction of blood pressure (BP). However, it is not yet known whether this mechanism is related to the variability of BP response. **PURPOSE:** Associate baseline ANS variables with interindividual BP responses in hypertensive women undergoing ET.

METHODS: Forty-four women performed 12 weeks of ET on cycle ergometer (50 min.day⁻¹, 3 days.week⁻¹ at 60-70% heart rate reserve). Pre and post ET 20 min beat-to-beat BP waveforms were recorded by finger photoplethysmography and ANS was assessed by heart rate (HR) variability (HRV) recorded from HR monitor and analyzed in the time and frequency domain. Participants were identified as RE by a magnitude of reduction in systolic BP (SBP) greater than the typical error (TE) of measurement (1xTE=7.4 mmHg) and participants with changes less or increase greater than 1xTE as NR. Associations between baseline HRV variables and changes (Δ) in BP after ET were analyzed using Pearson's correlation coefficient and multiple linear regression. Student's t-test to comparisons RE vs. NR. Receiver operator characteristic (ROC) curve to identify predictors cut-off values for RE and NR discrimination.

RESULTS: Ten individuals were considered RE (Δ=15.6±7.6 mmHg) and 34 NR (Δ=4.3±7.9 mmHg). SBP changes were correlated with: SDNN (r=0.395; p=0.008), RMSSD (r=0.384; p=0.010), LF (r=0.318; p=0.036) and HF (r=0.348; p=0.02). SDNN was able to predict 15.6% of variance in SBP changes (β=0.39, p=0.008). Compared to RE, NR demonstrated greater SDNN (29.6±21.4 vs. 16.1±4.9, p=0.09), RMSSD (32.7±27.3 vs. 17.4±8.6, p=0.013) and LF (591±1380 vs. 110±71, p=0.001) and HF (668±1340 vs. 154±164, p=0.012). For SDNN, a cut-off value of 18.7 discriminated RE and NR with good accuracy (AUC=0.81, sensitivity=80%, specificity=76%, p=0.03).

CONCLUSION: Baseline cardiac autonomic function can predict interindividual SBP responses to ET. Predictors cut-off values could be used to determine whether patients with hypertension are likely to benefit from ET.

106 Board #2 May 27 9:30 AM - 11:30 AM
Vascular Function Following An Acute Mental Stressor Among Fit Versus Non-fit Young Adults

Gabriel Zieff, Mohammod Alzer, Anthony Kostov, Simon Wahba, Jesse Rackley, Jade Blackwell, Jake Diana, Erik Hanson, Lee Stoner, FACSM. *The University of North Carolina at Chapel Hill, Chapel Hill, NC.* (Sponsor: Lee Stoner, FACSM)
(No relevant relationships reported)

Purpose: Acute mental stress impairs vascular function. The purpose of this study was to investigate if stress-induced vascular impairment is moderated by physical fitness. **Methods:** Nineteen young, healthy adults (21.6±2.7 y, 23.9 ± 3.1 kg/m², 10 F) were classified as fit (n=11) or non-fit according to ACSM physical activity guidelines (75 min vigorous, or 150 min moderate-intensity aerobic exercise). Across two randomized visits, subjects underwent an experimental (stress) and control (non-stress) testing session. A five-min mental arithmetic task was given to induce stress in the experimental session following baseline measurements. Measurements were taken throughout the 60 mins after the stress/control period. Measures included central blood pressure (cSBP), augmentation index (AIx), and brachial-radial pulse wave velocity (PWV). Mixed linear models were used to perform statistical analyses, covarying for baseline measures. **Results:** There was a significant fitness x condition interaction for AIx (p=0.038), such that the greatest AIx of fit individuals following stress exposure

was 3.3 percentage points less than non-fit individuals (95% CI -1.29, -0.09, d = -1.34). There was no interaction of fitness and condition on PWV (p=0.785; 95% CI -0.18, 0.16), but there was an inconclusive effect of fitness (p=0.143), such that fit individuals had a PWV 0.37 m/s less than non-fit individuals (CI: -0.27, 0.04; d=-0.43). For cSBP, there was no fitness x condition interaction (p=0.653; 95% CI: -1.14, 1.83), but there was a main effect of condition (p=0.045) where, regardless of fitness, stress elicited a 3.05 mmHg greater increase in cSBP after the stressor compared to the non-stress condition (95% CI 0.01, 3.06; d=0.69). **Conclusion:** Fitness was associated with a healthier wave reflection profile following a stressor, as well as better overall vascular function. These adaptive effects of fitness on hemodynamic and vascular measures ensued despite stress-induced increases in cSBP occurring regardless of fitness status.

107 Board #3 May 27 9:30 AM - 11:30 AM
Cardiorespiratory Fitness And Aortic Hemodynamics Are Associated With Brain Volume In Healthy Older Adults

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(No relevant relationships reported)

Cardiorespiratory fitness (CFR) is positively associated with greater brain volume in older adults; however, the mechanism is unknown. Improved structure and function of the large vessels supplying the brain due to habitual exercise may explain why CFR influences brain volume. **PURPOSE:** The purpose of this study was to determine if aortic hemodynamics modify the association between CFR and brain volume in both young and older adults. **METHODS:** Young (YA; n=27, age =25±5 y, women =15) and older (OA; n =23, age =64±5 y, women =11) healthy adults ranging from sedentary to exercise trained were studied. CFR was assessed using an incremental maximal exercise test on a cycle ergometer (VO₂max). Total brain volume (gray matter + white matter) was determined using a T1 weighted scan on a 3T MRI scanner. Aortic hemodynamics were obtained from applanation tonometry (SphygmoCor) where the aortic pressure waveform was used to calculate aortic augmentation index (AIx). **RESULTS:** Young adults had a larger total brain volume (YA; 1.16±0.02 l vs. OA; 1.10±0.02 l, p<0.05), higher VO₂max (YA; 40±1 ml/kg/min vs. OA; 32±2 ml/kg/min, p<0.05), and lower AIx (YA; 2.9±2.5 % vs. OA; 19.2±2.4 %, p<0.05) compared with older adults. VO₂max was not associated with AIx in young adults (p>0.05); however, VO₂max was negatively associated with AIx in older adults (r =-0.61, p<0.05) such that older adults with higher CFR demonstrated lower aortic hemodynamics. There were no associations between VO₂max, AIx, and total brain volume in young adults (p>0.05 for all). Conversely, both VO₂max (r =-0.51, p<0.05) and AIx (r =-0.64, p<0.05) were associated with total brain volume in older adults. When VO₂max and AIx were entered into the model using multiple linear regression, VO₂max was no longer a significant predictor of total brain volume in older adults (VO₂max; p =0.41, AIx; p =0.03). **CONCLUSIONS:** High CFR and low aortic hemodynamics are associated with larger total brain volumes in older adults. Using multiple linear regression, aortic hemodynamics are a better predictor of total brain volume than CFR in older adults. Improved aortic hemodynamics may be a mechanism by which habitual exercise protects the brain from age-related volume decline. Supported by NIH grant HL118154.

108 Board #4 May 27 9:30 AM - 11:30 AM
Acute Adolescent Concussion: Cerebrovascular Reactivity, Symptom Burden, And Exercise Response

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Cerebral vasoreactivity (CVR) disruptions have been observed following concussion, which may exacerbate concussion-related symptoms. These CVR disruptions may also influence the cerebral blood flow (CBF) responses during aerobic exercise and thus limit exercise capacity post-concussion. **PURPOSE:** To examine the relationships between concussion-related symptoms, cerebral vasculature's ability to respond to changes in CO₂ (vasoreactivity), and CBF responses during sub-maximal aerobic exercise in adolescents post-concussion. **METHODS:** Adolescents less than two weeks post-concussion completed the Post-Concussive Symptom Checklist (PCSC), cerebral vascular assessments, and a modified YMCA exercise protocol. CVR at rest was estimated from the slope (cm/s/mmHg) of the relationship between the increases in breath-by-breath end-tidal CO₂ and responses of CBF velocity during an air rebreathing task (i.e., increasing end-tidal CO₂). CBF velocity was measured

via transcranial Doppler ultrasonography at the M1 segment of the middle cerebral artery unilaterally during the air rebreathing task and during the aerobic exercise test. Only physical and vestibular-related symptoms were included in analysis: headache, nausea, balance problems, dizziness, fatigue, and % activity level. Two stepwise linear regressions were conducted to test (1) if concussion symptoms are related to CVR and (2) if CVR predicted relative change in CBF velocity during the aerobic exercise test. **RESULTS:** The majority of the variance in CVR was explained by symptoms of nausea, dizziness, as well as current physical activity levels. Age, sex, resting heart rate, balance, and fatigue also contributed to a lesser degree. Exercise caused a significant increase in MCA blood flow ($p < 0.001$). This exercise induced increase in CBF was largely explained by CVR and estimated $\dot{V}O_2$ peak, with resting heart rate, prior concussion(s), and time since injury also contributing. **CONCLUSIONS:** Our findings suggests that symptom burden is related to disruptions in CVR in adolescents in the early weeks after a concussion. In turn, the cerebral blood flow response to exercise was related to both CVR and aerobic capacity, suggesting that disruptions in CVR may impact exercise tolerance post-concussion.

109 Board #5 May 27 9:30 AM - 11:30 AM

Potential Racial Disparity In Peripheral Vascular Function Regardless Of Menstrual Cycle Phase

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(No relevant relationships reported)

African American women (AAW) have the highest rates of cardiovascular disease (CVD) across the lifespan compared to women of other races. Vascular dysfunction is a non-traditional risk factor for CVD and is understudied in AAW. Previous studies have reported fluctuations in vascular function across the menstrual cycle (MC) with the changing levels of estrogen, but this relation has never been explored in the context of race. **PURPOSE:** To compare nitric oxide-mediated peripheral vascular function across 3 phases of the MC between AAW and CW using passive leg movement (PLM). **METHODS:** PLM was performed on premenopausal, healthy, female participants not using hormonal contraceptives; 7 AAW (24 ± 2 years, BMI: 21.2 ± 1.4 kg/m², BP: 112 ± 3/74 ± 3 mmHg) and 12 CW (23 ± 1 years, BMI: 23.4 ± 0.9 kg/m², BP: 113 ± 2/70 ± 2 mmHg). Phases of the MC were identified as early follicular (EF) (1-5 days post onset of menstruation; low estrogen), ovulation (OV) (within 1-3 days of luteinizing hormone surge determined by an ovulation test; high estrogen), and mid-luteal (ML) (8-10 days post ovulation; moderate estrogen). Blood velocity and diameter of the femoral artery were measured using Doppler ultrasound. A 2x3 repeated measures ANOVA was used to identify differences in vascular function between AAW and CW across 3 phases of the MC. **RESULTS:** The overall change in leg blood flow from baseline to peak (mL) was significantly lower among AAW compared to CW across the MC phases. EF (AAW: 195 ± 49, CW: 356 ± 64), OV (AAW: 156 ± 47, CW: 451 ± 102) and ML (AAW: 224 ± 65, CW: 369 ± 41) ($p = 0.02$). The hyperemic response to PLM, calculated as area under the curve (mL), was significantly reduced in AAW compared to CW across the MC phases. EF (AAW: 45 ± 21, CW: 131 ± 40), OV (AAW: 49 ± 28, CW: 144 ± 40) and ML (AAW: 67 ± 22, CW: 130 ± 26) ($p = 0.03$). **CONCLUSION:** AAW are experiencing an attenuated peripheral vascular response to PLM compared to CW across the menstrual phases. These preliminary data suggest an overall race-derived disparity in peripheral vascular function regardless of MC phase in young premenopausal women.

110 Board #6 May 27 9:30 AM - 11:30 AM

Acute Effects Of Interrupting Prolonged Sitting On Vascular Function In Type 2 Diabetes

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(No relevant relationships reported)

In overweight/obese adults, frequent interruptions to sitting time by brief activity bouts can mitigate the impairment of vascular function. However, it is unknown whether the

benefits extend to those with type 2 diabetes (T2D), and whether there is an optimal frequency of activity break. **PURPOSE:** To examine the acute effects on vascular function in those with T2D, of interrupting sitting time with simple resistance activities (SRAs): 3min every 30min; or, 6min every 60min.

METHODS: In a randomised crossover trial, 20 sedentary adults with T2D and overweight/obesity (35-70 yr; 11 males; 9 females) completed three 7-hour conditions (6-14 day washout between conditions): 1) uninterrupted sitting (SIT); 2) sitting with 3-min bouts of SRA every 30 min (SRA3); and, 3) sitting with 6-min bouts of SRA every 60 min (SRA6). Shear rate, blood flow and femoral artery flow-mediated dilation (FMD) were measured at 0h, 1h, 3.5h, 4.5h, 6.5h. Mixed models examined effects of condition and condition-by-time interactions, with adjustment for age, sex, BMI, baseline measurements and treatment order. Post-hoc analyses compared vascular measurements at individual timepoints and were re-run with adjustment for multiple comparisons (Šidák correction).

RESULTS: Mean (±SD) resting shear rate across timepoints was significantly lower in the SIT condition ($32.2 \pm 23.3 \text{ s}^{-1}$) relative to SRA3 ($42.2 \pm 27.9 \text{ s}^{-1}$, $P_{\text{Condition}} < 0.0001$) and SRA6 ($44.6 \pm 29.1 \text{ s}^{-1}$, $P_{\text{Condition}} < 0.0001$). Mean (±SD) resting blood flow, was significantly lower in the SIT condition ($64.7 \pm 45.2 \text{ ml/min}$), relative to SRA3 ($86.1 \pm 77.5 \text{ ml/min}$, $P_{\text{Condition}} < 0.0001$) and SRA6 ($85.0 \pm 61.7 \text{ ml/min}$, $P_{\text{Condition}} < 0.0001$). There were no condition differences in the temporal change in femoral artery FMD measurements across the 7h day ($P_{\text{time} \times \text{condition}} > 0.05$ for all). However, FMD was significantly lower at the 6.5h timepoint in SIT compared with SRA3 ($2.8 \pm 3.5\%$ vs $5.3 \pm 2.7\%$, $P = 0.0007$).

CONCLUSIONS: The results demonstrate that when the volume of activity is the same, one activity break per hour is just as effective as two activity breaks per hour for increasing lower-limb blood flow and shear rate. Interrupting sitting twice per hour was also beneficial for FMD at the final reading, however changes between sitting and activity breaks remained relatively unchanged at earlier timepoints.

111 Board #7 May 27 9:30 AM - 11:30 AM

The Ascending Aortic Function In Elite Endurance Athletes: An Mri Study

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(No relevant relationships reported)

High-intensity chronic endurance training has chronotropic and inotropic effects on the heart; however, adaptations of the ascending aorta which is directly exposed to cardiac pulsations remain unclear. **PURPOSE:** We investigated the functional and structural properties of the thoracic aorta, including the ascending and descending locations, in elite endurance athletes. **METHODS:** Fourteen young endurance-trained men (21 ± 1 years, peak oxygen uptake = 69.6 ± 3.1 ml/kg/min) were compared with 19 sedentary control men (21 ± 2 years). The ascending and descending aortic cross-sectional areas were measured by 2D CINE phase-contrast magnetic resonance imaging (MRI), and the aortic strain, compliance, and distensibility were calculated. Aortic blood pressure was measured during MRI using the general transfer function method. Two-way mixed analysis of variance was used to determine the effects of exercise status and aortic locations. **RESULTS:** Endurance athletes had similar body mass index and aortic blood pressures to sedentary control subjects. At rest, heart rate was slower (58 ± 9 vs. 48 ± 5 bpm, $P = 0.001$) and stroke volume was greater in athletes (82.1 ± 10.8 vs. 95.8 ± 18.5 ml/beat, $P = 0.012$) while cardiac output was similar between the groups. The systolic aortic cross-sectional areas were increased in athletes compared with sedentary subjects (ascending: 6.32 ± 0.99 vs. $6.95 \pm 1.00 \text{ cm}^2$, descending: 4.08 ± 0.64 vs. $4.85 \pm 0.83 \text{ cm}^2$, $P = 0.012$). The diastolic aortic areas ($P = 0.062$) and the aortic compliances ($P = 0.069$) showed a trend of elevations in athletes. The greater ascending aortic strain and compliance were associated with slower heart rate ($r = -0.56$ and -0.43 respectively) and higher stroke volume ($r = 0.44$ and 0.35 respectively) across all participants (all $P < 0.05$). **CONCLUSIONS:** Our findings suggest that endurance athletes have dilated thoracic aorta and better recoiling function of the ascending aorta due to increased systolic expansion and a longer time of relaxation with slower heart rate.

This study was supported by the JSPS (19K19970, TT) and the ARIHHP Cooperative Grant (University of Tsukuba, TT)

112 Board #8 May 27 9:30 AM - 11:30 AM

Vascular Dysfunction In The Lower Limbs Of Young Black Males: Evidence From Passive Leg Movement

Stephen J. Ives¹, Meaghan Lynch¹, Brian Lora¹, Tawn Tomasi¹, Gaia Giuriato², Emma Basso¹, Emma Finegan¹, Jack Schickler¹, Massimo Venturelli², Robert Restaino¹. ¹Skidmore College, Saratoga Springs, NY. ²University of Verona, Verona, Italy. Email: sives@skidmore.edu

(No relevant relationships reported)

Cardiovascular morbidity and mortality rates are highest among Black Americans, the mechanisms of which remain elusive. While it has been postulated that exaggerated autonomic reflexes or responsiveness could contribute to elevations in baseline or exercise blood pressure, increasing CVD risk, no studies have explored the movement-induced changes in hemodynamics. **PURPOSE:** Using passive leg movement (PLM), as model of the mechanoreflex (a component of the exercise pressor reflex) and an assessment of lower limb vascular function, the aim of this study was to compare the central and peripheral hemodynamic responses in young healthy Black (BA) and White Americans (WA). **METHODS:** Young (21±4 yr) healthy BA (n = 9) and WA (n = 10) males were instrumented with continuous central hemodynamic monitor (Finger Photoplethysmography), while peripheral hemodynamics were monitored using frequency domain multi-distance near infrared spectroscopy (NIRS) of the vastus lateralis, and ultrasound Doppler of the common femoral artery. After 1 minute of baseline, subjects underwent continuous PLM at 1 hz for two minutes, while tissue oxygen saturation (StO₂), leg blood flow (LBF), cardiac output (CO), heart rate (HR), stroke volume (SV), and mean arterial pressure (MAP) were recorded. **RESULTS:** Resting HR (61±3 vs. 62±3 beats/min), SV (89±5 vs. 92±5 ml/beat), CO (5.4±0.4 vs. 4.4±0.5 L/min), and MAP (92±5 vs. 86±3 mmHg) were not different between BA and WA, respectively (all, p>0.05). The peak PLM-induced changes in HR (6±2 vs. 11±3 Δbeats/min, p = 0.06), SV (7.3±1.6 vs. 11.4±1.9 Δml/beat, p = 0.04), and CO (0.7±0.2 vs. 1.0±0.2 Δl/min, p = 0.09), while MAP (5.3±1.4 vs. 6.0±0.8 ΔmmHg, p > 0.05) was not different. The peak PLM-induced change in StO₂ was significantly attenuated in BA (1.6±0.5 vs. 3.8±0.4 Δ%, p = 0.01). **CONCLUSION:** This research provides novel insights into potential racial differences in mechanoreflex sensitivity and lower limb vascular function. Black American men had an attenuated mechanoreflex response to PLM as compared to White American men; however, Black Americans also had a lower peripheral hemodynamic response, perhaps suggestive of lower limb vascular dysfunction, which might explain a propensity towards greater peripheral vascular disease rates in Black Americans.

A-23 Free Communication/Slide - Exercise Immunology

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-3014

113 Chair: Vanessa D. Sherk. *University of Colorado Anschutz Medical Campus, Aurora, CO.*

(No relevant relationships reported)

114 May 27 9:30 AM - 9:45 AM

Abstract Withdrawn

115 May 27 9:45 AM - 10:00 AM

The Effects Of 16-weeks Of Exercise Training On Neutrophil Functions In Breast Cancer Survivors

Grace A. MacDonald¹, David B. Bartlett¹, Erik D. Hanson², William S. Evans², Jordan T. Lee², Chad W. Wagoner², Eli Hanson², Paige Harrell², Stephanie Sullivan², Kirsten A. Nyrop², Hyman B. Muss², Brian C. Jensen², Claudio L. Battaglini, FACSM². ¹Duke University, Durham, NC. ²University of North Carolina, Chapel Hill, NC. (Sponsor: Claudio Battaglini, FACSM)

(No relevant relationships reported)

PURPOSE: Following therapy, breast cancer survivors have impaired immune functions which are associated with increased risk of recurrence and infectious diseases. Neutrophils are critical to host protection against infectious diseases. The aim of this study was to use acute exercise as an immunological stressor before and after 16-weeks of exercise training to determine changes in neutrophil functions consistent with a reduced infection risk.

METHODS: 16 breast cancer (BC) survivors completed 45 minutes of intermittent cycling at 60% of peak CPX wattage before (BASE) and after 16-weeks (FINAL) of exercise training. Eleven healthy sedentary women (Control) completed the same acute bout of exercise at BASE. Blood was taken at rest (PRE), immediately after (POST) and 1 hour after (1Hr POST) exercise. Neutrophil phagocytosis and oxidative killing of *E. coli*, and expression of CD16, CXCR2 and TLR4 were assessed by flow cytometry (MFI ± SD).

RESULTS: Compared to Controls, at BASE PRE, BC survivors had lower phagocytosis of bacteria (4250±718 v 3991±1232; p=0.03), and elevated oxidative burst (4495±651 v 6254±1434; p=0.005). At BASE, BC survivors' phagocytic response to acute exercise was impaired. BC survivors PRE to POST phagocytosis was unchanged (p=0.224) while Controls increased 15±20% (p=0.003). BC survivors PRE to 1Hr POST phagocytosis increased by 10±17% (p=0.046) while Controls increased 14±14% (p=0.003). Following training, BC survivor PRE phagocytosis increased from BASE to FINAL by 10% (p=0.08), to similar levels as Controls (p=0.765). BC survivors FINAL PRE to POST phagocytosis increased by 10% (p=0.001) and PRE to 1Hr POST by 11% (p=0.008). Oxidative killing of bacteria was unchanged by acute exercise or exercise training. At BASE, BC survivor expression of CD16 reduced during acute exercise, PRE to 1Hr POST by 9% (p=0.04) which annulled following training.

CONCLUSIONS: Following cancer therapy, BC survivors have impaired neutrophil functions at rest and to a stressor, which are improved by 16-weeks of exercise training. The improved phagocytosis of bacteria in BC survivors may represent an intrinsic improvement in neutrophil functions consistent with reduced risk of infectious disease. *Supported by Breast Cancer Research Foundation (New York, NY).*

116 May 27 10:00 AM - 10:15 AM

Stress-related Genetic Variants Modulate Electrodermal Response To Maximal Exercise

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(No relevant relationships reported)

Previous research from our lab established electrodermal activity (EDA) as a valid, surrogate marker of sympathetic nervous system activity during treadmill exercise. We have subsequently reported dose dependent effects of aerobic fitness, combat exposure and blast exposure on the electrodermal response to acute exercise stress. **PURPOSE:** As an extension of our prior work, this study evaluated the effect of stress related genetic variants on EDA during maximal exercise in specialized military men. **METHODS:** Sixty-four male (age = 34.2±7.0 yrs) Explosive Ordnance Disposal operators completed a graded exercise test to assess maximal oxygen consumption (VO_{2max}). EDA was recorded at baseline, during exercise and recovery. Percent change from baseline was calculated for stages of 25, 50, 75 and 100% VO_{2max}, and active and seated recovery. Genetic variants of catechol-o-methyltransferase (COMT), brain-derived neurotrophic factor (Val66Met) and serotonin transporter (5HTTLPR) were determined from saliva. Combination groups of 2 (COMT + Val66Met) or 3 (COMT + Val66Met + 5HTTLPR) variants (2 or 3GCOM) were created and divided into "low" and "high" EDA groups. A 2 or 3 (GCOM) x 6 (STAGE) repeated measures ANOVA evaluated EDA changes across stages for 2 or 3GCOM groups, separately. **RESULTS:** All GCOM groups showed linear increases in EDA percent change throughout exercise. Low 2GCOM response peaked at 75% VO_{2max} and plateaued in recovery. High 2GCOM had a larger change, peaked at 100% VO_{2max} then declined in recovery. There was a borderline main effect of 2GCOM (p=.06, η_p²=.108) and a main effect of STAGE (p<.001, η_p²=.183). Low 3GCOM had a similar pattern as low 2GCOM, but on a smaller scale. High 3GCOM demonstrated the largest change in magnitude, peaked at 100% VO_{2max} and sharply declined in recovery. There was a 3GCOM x STAGE interaction effect (p<.001, η_p²=.352). **CONCLUSION:** When combined, genetic variants implicated in the human stress response modulate EDA during and after maximal exercise. Influence of COMT was expected, as EDA is a proxy of plasma catecholamine levels during exercise. Val66Met and 5HTTLPR have been shown to modulate exercise responses and cardiovascular reactivity, respectively. Future work will comprehensively evaluate biobehavioral characteristics and genetic variants in this sample.

117 May 27 10:15 AM - 10:30 AM

INVOLVEMENT OF PURINERGIC SIGNALING AND LYMPHOID ORGANS IN THE BENEFICIAL EFFECTS OF AEROBIC TRAINING IN ASTHMARodolfo P. Vieira¹, Alana Santos-Dias², Manoel Carneiro Oliveira-Junior². ¹Universidade Brasil / Anhembi Morumbi / UNIFESP, São José dos Campos, Brazil. ²Brazilian Institute of Teaching and Research in Pulmonary and Exercise Immunology, São José dos Campos, Brazil.

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(No relevant relationships reported)

PURPOSE: Asthma is a chronic airway inflammatory disease affecting more than 300 million people around the world. Purinergic signaling via purinergic receptors (mainly P2X7, P2Y2 and P2Y6) are thought play a key role in asthma pathogenesis and severity. High intensity aerobic exercise is known to trigger asthma attacks, while low to moderate intensity training reduces inflammation and improves asthma control. Therefore, this study investigated whether low intensity aerobic exercise reduces asthma phenotype by modulation of purinergic signaling. **METHODS:** Aerobic exercise (AE) was performed in a treadmill at low intensity, 5x/week, 1h/session, for 4 weeks, beginning 2 weeks after HDM administration. HDM (*dermatophagoides pteronyssinus*; 100mg/mouse) was administered 3x/week, for 6 weeks. **RESULTS:** The results demonstrated that AE reduced adenosine triphosphate (ATP) accumulation ($p < 0.001$), IL-1 β , IL-4, IL-5, CXCL1/KC, IL-13, IL-17, IL-23, IL-33 and TNF- α ($p < 0.001$), while increased IL-1ra, IL-2, IL-10 and IL-12p40 in bronchoalveolar lavage (BAL). Total number of leukocytes, eosinophils, lymphocytes and neutrophils in BAL and the number of eosinophils, neutrophils and lymphocytes in the airway wall ($p < 0.01$) were reduced by AE. Airway remodeling (collagen, elastin, smooth muscle and mucus) were reduced by AE ($p < 0.01$). TGF- β , IGF-1 and VEGF levels was reduced by AE ($p < 0.001$). Lung mechanics (Resistance, Elastance, GTIS, HTIS, RAW) and airway hyperresponsiveness (AHR) to methacholine was ameliorated by AE ($p < 0.01$). IL-4, IL-5 and IL-13 production by re-stimulated mediastinal lymph nodes, splenocytes and bone marrow cells was also reduced by AE. The expression of P2X7, P2Y2 and P2Y6 by peribronchial leukocytes ($p < 0.01$) and also by airway epithelial cells ($p < 0.01$) were reduced by AE. **CONCLUSIONS:** Low intensity aerobic training reduces asthma phenotype by inhibiting purinergic signaling and lymphoid organs hyperactivation.

118 May 27 10:30 AM - 10:45 AM

The Immune Response To Cardiorespiratory Exercise Testing In Heart Failure Patients With Reduced Ejection FractionMartin Bahl¹, Aycen Koc², Sabine Kaczmarek¹, Kristin Lehnert¹, Ines Urbaneck¹, Ulf Landmesser², Stephan B. Felix¹, Marcus Dörr¹, Nicolle Kränkel². ¹University Medicine Greifswald, Greifswald, Germany. ²Charité Campus Benjamin Franklin, Berlin, Germany.

(No relevant relationships reported)

PURPOSE: Long-term exercise training reduces systemic inflammation in heart failure patients. However, due to the impaired immune system in these patients, an acute exercise challenge may trigger pro-inflammatory responses. We compared the acute response to a standardized cardiopulmonary exercise test (CPET) in patients with heart failure with reduced ejection fraction (HFrEF) to age and gender matched controls.

METHODS: Patients with HFrEF (n=13; left ventricular ejection fraction [LVEF] < 40%) and controls (n=14, LVEF > 50%) participated in a CPET. Blood samples were taken before, immediately after and 2 hours after CPET. Flow cytometry was used to assess quantitative and morphological alterations in leukocyte subpopulations as well as the formation of leukocyte-platelet aggregates. Only significant findings are reported ($p < 0.05$) and are given as median and inter-quartile range (IQR).

RESULTS: HFrEF (mean LVEF: 36%) and controls (mean LVEF: 57%) were 59 (range: 41 to 80) and 57 (range: 50 to 65) years old, respectively. CPET increased the leukocyte (control: 1.37-fold [IQR: 1.16 to 1.49]; HFrEF: 1.24-fold [IQR: 1.20 to 1.32]), natural killer (NK) cell (controls: 2.11-fold [IQR: 1.30 to 3.13]; HFrEF: 1.67-fold [IQR: 1.56 to 1.71]) and NK-T cell (control: 1.69-fold [IQR: 1.52 to 3.60]; HFrEF: 1.62-fold [IQR: 1.60 to 2.53]) concentration in the HFrEF and control group. CD4+ cells (control: 1.15-fold [IQR: 0.84 to 1.54]; HFrEF: 1.45-fold [IQR: 1.10 to 1.98]) and CD8+ T-cells (control: 1.33-fold [IQR: 1.01 to 1.68]; HFrEF: 1.70-fold [IQR: 1.25 to 2.15]) only increased in HFrEF patients. Aggregation of thrombocytes with monocytes (control: 0.86-fold [IQR: 0.78 to 1.49]; HFrEF: 1.59-fold [IQR: 1.05 to 7.30-fold]), T-lymphocytes (control: 1.27-fold [IQR: 1.05 to 1.68]; HFrEF: 1.49-fold [IQR: 1.03 to 2.64]) and neutrophils (control: 1.08-fold [IQR: 0.87 to 1.25]; HFrEF: 2.13-fold [IQR: 1.62 to 2.19]) increased 2 hour post CPET in patients with HFrEF, but not in controls.

CONCLUSIONS: CPET differentially induced specific immune responses in patients with HFrEF compared to age and gender matched controls. The prolonged immune response in these patients suggests differences in immune resolving mechanisms which deserve further research.

119 May 27 10:45 AM - 11:00 AM

Mitochondrial Characteristics Of Adaptive Immune Cells Associated With Aerobic Fitness

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(No relevant relationships reported)

Recent findings in immunometabolism have demonstrated that the function of immune cells is largely dictated by their metabolism, with mitochondrial characteristics reflecting distinct metabolic phenotypes. A limitation of previous exercise immunology studies is the failure to describe the effect of exercise on specific immune cell subsets. Since exercise may have differential effects that vary by cell population according to metabolic phenotype, analyzing peripheral blood mononuclear cells as a whole may mask adaptations. **PURPOSE:** To determine the effect of aerobic training on mitochondrial characteristics of specific T cell subsets. **METHODS:** Non-smokers who self-identified as either completing more than six hours of aerobic-type exercise (ACTIVE) or less than 90 minutes of any type of physical activity (INACTIVE) per week were recruited. Blood was collected and participants returned for a later visit to complete a treadmill maximal oxygen consumption ($\dot{V}O_{2max}$) test. Mitochondrial mass and membrane potential (MMP) of CD4⁺ and CD8⁺ naïve (CD45RA⁺ CCR7⁻) and effector memory (CD45RO⁺ CCR7⁺) cells were assessed by geometric mean fluorescence intensity (gMFI) of MitoTracker Green FM and TMRE, respectively. **RESULTS:** Preliminary statistical analyses (n = 11 each group) revealed that ACTIVE had higher cardiorespiratory fitness than INACTIVE (60.0 \pm 9.9 vs. 43.6 \pm 8.2 mL/kg/min relative $\dot{V}O_{2max}$; $p = 0.0004$, independent t-test). There were no differences in cell counts between ACTIVE and INACTIVE T cell subsets. Although gMFI indicating mitochondrial mass of CD8⁺ naïve T cells approached significance between groups (594.7 \pm 127.7 ACTIVE vs. 495.4 \pm 70.9 INACTIVE; $p = 0.0355$, independent t-tests), this difference was not statistically significant after correcting for multiple comparisons. Mitochondrial mass and MMP of CD8⁺ naïve T cells were, however, significantly correlated with relative $\dot{V}O_{2max}$ ($r = 0.5375$ and 0.5343 , $p = 0.0099$ and 0.0104 , respectively, Pearson correlation). **CONCLUSION:** These preliminary data suggest that mitochondrial adaptations in certain adaptive immune cells may be associated with aerobic fitness and lay the groundwork for follow-up studies to directly evaluate differences in cellular respiration of these subsets.

Funding provided by the ACSM NASA Space Physiology Research Grant.

120 May 27 11:00 AM - 11:15 AM

Systemic β_1 -Adrenergic Receptor Blockade Augments NK-Cell Mobilization In Response To Acute Exercise In HumansKyle A. Smith¹, Nadia H. Agha², Forrest L. Baker², Austin B. Bigley², Hawley E. Kunz², Grace M. Niemi¹, Jamie N. Colombo¹, Richard A. Bond², Catherine M. Bollard³, Emmanuel Katsanis¹, Richard J. Simpson, FACSM¹. ¹University of Arizona, Tucson, AZ. ²University of Houston, Houston, TX. ³The George Washington University, Washington, DC. (Sponsor: Richard Simpson, FACSM)

(No relevant relationships reported)

PURPOSE: Recent research has demonstrated that the release of catecholamines, myokines, and the mobilization and redistribution of effector lymphocytes (e.g. NK-cells) with each bout of exercise plays a mechanistic role in the anti-tumor effects provided by regular exercise. We tested the hypothesis that blocking the β_1 -AR in vivo would increase catecholamine signaling toward the β_2 -AR to augment NK-cell mobilization in response to a single exercise bout. **METHODS:** Thirty healthy subjects (ages 22 - 43) completed a single 30-minute bout of steady state exercise on a cycle ergometer at +10 to +15% of their predetermined lactate threshold to determine the number of NK-cells mobilized to blood with exercise. Eighteen of these subjects then participated in a randomized double-blind controlled trial with a cross-over design, whereby a placebo, a non-preferential β_1 / β_2 -antagonist (80 mg nadolol), or a preferential β_1 -antagonist (10 mg bisoprolol) was ingested orally 3 hours before a 30-minute exercise bout performed on separate days. Blood samples were collected before and immediately after exercise for the enumeration of effector lymphocytes (NK-cells, $\gamma\delta$ T-cells and CD8+ T-cells) by flow cytometry. **RESULTS:** The median number of NK-cells mobilized to blood with exercise was $\Delta 524$ cells/ μ L, with those subjects below the median demonstrating a smaller epinephrine response to exercise than those above the median ($\Delta 0.05 \pm 0.03$ vs $\Delta 0.13 \pm 0.08$ ng/mL; $p < 0.05$). Larger numbers of NK-cells were mobilized with exercise in the bisoprolol trial ($\Delta 703.8 \pm 352.2$ cells/ μ L) compared to the placebo trial ($\Delta 573.9 \pm 198.1$ cells/ μ L; $p < 0.05$), both of which were larger than the nadolol trial ($\Delta 285.1 \pm 165.6$ cells/ μ L; $p < 0.05$). Bisoprolol did not augment the mobilization of $\gamma\delta$ T-cells or CD8+ T-cells relative to

placebo. 44% of subjects who mobilized less than $\Delta 524$ NK-cells/ μ L with exercise in the placebo trial were able to mobilize $>\Delta 524$ NK-cells/ μ L after ingesting bisoprolol ($n = 4$). **CONCLUSION:** Systemic β_1 -AR blockade augments NK-cell mobilization in response to acute exercise. These findings may have implications for cancer patients on cardioprotective β -blockers and also provide insights on how certain β -AR antagonists may enhance or inhibit immune responses to exercise.

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Intestinal Epithelial Cell-specific Deletion Of Hif1a Affects The Intestinal Barrier Function In High-fat Diet-fed Mice

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(No relevant relationships reported)

High-fat diet (HFD) feeding disrupts the intestinal barrier integrity, inducing the translocation of bacteria into the portal circulation, leading to the whole-body inflammation. Intestinal epithelial cells (IEC), producing antimicrobial proteins to prevent the attachment and entry of pathogens, are affected by the tissue hypoxia. The hypoxia-inducible factor (HIF)-1 α is pivotal in the transcriptional response to oxygen flux. **PURPOSE:** To determine the role of HIF-1 α signaling pathway in the regulation of intestinal barrier function on HFD fed mice. **METHODS:** The Villin-Cre mediated, IEC-specific deletion of *Hif1a* (*Hif1a*^{CKO}) and the control *Hif1a*^{fl/fl} mice (male, 8-week) were used in this study. The *Hif1a*^{CKO} and *Hif1a*^{fl/fl} were fed HFD (HFD-*Hif1a*^{CKO} and HFD-*Hif1a*^{fl/fl}, $n=6$ /group) or normal chow for 12 weeks. Immediately after euthanasia, the serum, abdominal fat, intestine and feces were sampled. The intestinal mucus structure was observed by the AB-PAS staining. The intestinal permeability was quantified with FITC-dextran. Fasting plasma glucose, albumin, alanine aminotransferase, aspartate aminotransferase, total bilirubin, triglycerides (TG), total cholesterol (TC), LDL cholesterol (LDL-C), and HDL cholesterol levels were measured. The fecal microbial DNA was extracted and sequenced on an Illumina MiSeq platform. Student's t-tests and one-way ANOVA were used. Differences with $P < 0.05$ were considered significant. All animal experiments were performed in compliance with and approved by the Shanghai University of Sport ethical review board. **RESULTS:** We found that HFD feeding markedly increase the intestinal permeability without significant morphological changes. Compare with HFD-*Hif1a*^{fl/fl}, the HFD-*Hif1a*^{CKO} mice were higher in the body weight (40.55 ± 3.94 vs. 35.06 ± 5.31 g, $p < 0.05$), TG (1.75 ± 0.56 vs. 1.08 ± 0.31 mmol/l, $p < 0.05$), TC (4.28 ± 0.92 vs. 3.74 ± 0.56 , $p < 0.05$) and LDL-C (0.83 ± 0.08 vs. 0.68 ± 0.14 , $p < 0.05$). Principal coordinates analysis based on unweighted UniFrac distances highlighted a clear clustering of the microbial populations of *Hif1a*^{CKO} away from that of *Hif1a*^{fl/fl}. **CONCLUSIONS:** IEC HIF-1 α signaling is involved in the intestinal barrier function maintenance in HFD fed mice. Supported by the National Natural Science Foundation of China (31701040, 31801003 and 31471135).

A-24 Free Communication/Slide - Skeletal Muscle Regulation of Hypertrophy/Atrophy

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-3020

122 **Chair:** Nicholas P. Greene, FACSM. University of Arkansas, Fayetteville, AR.
(No relevant relationships reported)

123 May 27 9:30 AM - 9:45 AM

Increasing Mitochondrial Content Does Not Protect Against Disuse-induced Muscle Atrophy

Megan E. Rosa-Caldwell, Seongkyun Lim, Wesley S. Haynie, Lisa T. Jansen, Kirsten R. Dunlap, Tyrone A. Washington, Nicholas P. Greene, FACSM. University of Arkansas, Fayetteville, AR. (Sponsor: Dr. Nicholas Greene, FACSM)
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Skeletal muscle mass is maintained by a balance in protein synthetic and degradative pathways. Deteriorations to skeletal muscle health can have significant implications for whole body health and quality of life. This is particularly true for disuse-associated muscle wasting, a common pathology associated with ICU stays, casting and space flight. Mitochondrial aberrations have been hypothesized to underlie these muscle pathologies, as such; improving mitochondrial content is an enticing therapeutic

target. **PURPOSE:** To investigate the sufficiency of increased mitochondrial content on mitigating disuse-induced muscle atrophy. **METHODS:** Mice overexpressing muscle PGC-1 α (PGC-1 α) and WT mice were bred at the University of Arkansas. At 10 wks of age, male and female mice (~8-10/group, ~70 mice total) underwent hindlimb unloading (HU) or normal cage activity (CON) for 7 days. Tissues were then collected, weighed and prepared for mRNA analysis of mediators of proteasomal degradation. Data for males and females were analyzed by 2X2 ANOVA with a Tukey post-hoc. **RESULTS:** In both male and female mice, overexpression of PGC-1 α was not sufficient to protect gastrocnemius, tibialis anterior, or soleus muscle atrophy (~17%, ~13%, ~27% lower muscle weights, respectively). In the gastrocnemius, *MuRF-1* mRNA content was ~2.5-fold greater in male and female WT-HU mice compared to WT-CON; however, both male and female PGC-1 α mice had ~40% less *MuRF-1* content compared to WT-CON, regardless of intervention. Correspondingly, *Atrogin1* mRNA content in the gastrocnemius was ~4-fold greater in male and female WT-HU mice compared to WT-CON; whereas both male and female PGC-1 α mice had no differences in *Atrogin1* content compared to WT-CON regardless of intervention. **CONCLUSION:** Although increased mitochondrial content appears to blunt the induction of the ubiquitin proteasomal degradation system during disuse atrophy, these blunted responses do not appear sufficient to mitigate disuse-induced muscle loss. This study was funded by the National Institutes of Health, Award number: R15 AR069913/AR/NIAMS

124 May 27 9:45 AM - 10:00 AM

Aging Blunts The Repeated Bout Effect In Skeletal Muscle

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PURPOSE: The ability of skeletal muscle to adapt to eccentric contraction-induced injury is known as the repeated bout effect (RBE), a well-established phenomenon observed in young human and rodent muscle. It has been suggested aged muscle may lack this adaptive potential, which would limit strength gains that could be achieved through training. Therefore, the purpose of this study was to determine if the RBE is blunted in aged muscle when compared to young muscle. **METHODS:** The anterior crural muscles of young (4 mo) and aged (21 mo) female mice were subjected to repeated bouts of eccentric contractions using an *in vivo* model. Specifically, mice performed 50 maximal eccentric contractions with isometric torque being measured immediately pre- and post-injury, and 2 and 7 days into recovery. These procedures were then repeated four times (making five total bouts) with 7 days between each bout. **RESULTS:** Following the initial injury bout, isometric torque of young and aged muscle were reduced to a similar extent ($p=0.12$) and did not differ throughout recovery (2 days, $p=0.15$ and 7 days, $p=0.82$). Over the course of the next four injuries, both young and aged muscle adapted to the prior injuries, experiencing less strength deficits immediately post-injury and an enhanced rate of recovery. However, the adaptive response measured by the fifth injury was less in aged muscle, with strength improvements being only 10-15% in aged muscle while 20-32% in young muscle ($p < 0.05$). **CONCLUSIONS:** The extent of injury and ensuing rate of recovery governs how frequently and how intensely subsequent bouts can be completed. Here, we demonstrate the RBE is blunted in aged muscle compared to young muscle over the course of five injurious bouts of eccentric contractions. These data suggest there is an age-related impairment in the mechanisms underlying the RBE, which could be due to a slowed adaptation rate or a compromised ability to adapt to eccentric contractions.

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Intake Of Essential Amino Acids Stimulates Mtorc1 Signaling And Inhibits Autophagy Following Glycogen-depleted Resistance Exercise

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(No relevant relationships reported)

Autophagy is responsible for degrading and recycling cellular proteins under conditions of energetic stress and low nutrient availability. Activation of autophagy is mediated by AMPK which is activated by high-intensity exercise and low glycogen availability and performing resistance exercise with low glycogen levels may result in enhanced autophagy activation which in turn may have negative effects on muscle protein balance. Autophagy is inhibited by mTORC1 which is potently activated by essential amino acids (EAA). The opposing effects of AMPK and mTORC1 on autophagy suggests that any potential negative effects of performing resistance exercise with low glycogen availability may be rescued by EAA intake. **PURPOSE:** To study the effect of EAA intake on autophagy and mTORC1 signaling following resistance exercise with high and low glycogen availability.

METHODS: Using a unilateral study design in which one leg was glycogen loaded and the other leg was glycogen depleted, men and women underwent two experimental trials wherein they consumed either a placebo (PLA) or an EAA drink after resistance exercise. Unilateral differences in muscle glycogen content were achieved through glycogen loading and subsequent one-legged glycogen depleting exercise the evening prior to each experimental trial. Muscle biopsies were collected at baseline, post exercise and 1 and 3 h after drink intake in both legs in both trials.

RESULTS: Mean glycogen content was ~69 % lower in the depleted leg compared to the loaded leg (228 vs 724 mmol/kg dry weight) across all time points in both trials. Phosphorylation of ULK1 at the AMPK-specific site S317 was elevated ~5-fold immediately post exercise in the depleted leg while remaining unchanged in the loaded leg with no differences between trials. In the PLA-trial, S317 phosphorylation remained elevated 60 min post drink ingestion, while in the EAA trial at the same time point, it had returned to baseline values. Phosphorylation of S6K1 at the mTORC1-specific site T389 remained largely unchanged at all time-points in the PLA-trial while being increased by ~33-fold in both legs at 60 min in the EAA-trial.

CONCLUSIONS: Intake of EAA blunt the elevations in autophagy signaling induced by resistance exercise performed in a glycogen-depleted state while simultaneously stimulating the mTORC1 pathway.

126 May 27 10:15 AM - 10:30 AM

Testosterone Supplementation Upregulates Myogenesis And Attenuates Proteolytic Gene Expression During Severe Energy Deficit

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(No relevant relationships reported)

BACKGROUND: Testosterone supplementation promotes whole-body lean mass accretion during severe energy deficit in non-obese, young men. The intramuscular mechanisms mediating this effect remain undefined.

PURPOSE: Determine the effect of supplemental testosterone on androgen receptor (AR), anabolic, proteolytic, inflammatory, and myogenic pathways during energy deficit.

METHODS: Fifty men (mean ± SD; 25 ± 5 y, 25 ± 3 kg/m²) completed a 14-d weight maintenance (WM) phase, followed by a 28-d, 55% diet and exercise-induced energy deficit (ED) with 200 mg testosterone enanthate/week (TEST, n = 24) or placebo (PLA, n = 26). Muscle biopsies (vastus lateralis) from a subset (n = 10 per group) of participants exhibiting the greatest increase or decrease in leg lean mass (DEXA) and total testosterone were assayed to assess phosphorylation status, total protein and gene expression using Western blotting and RT-qPCR. Biopsies were collected at the end of WM and ED at baseline, and at 1 and 6 h after exercise (1 h cycle ergometry matched between phases for power and total work), with a mixed-meal (40 g protein) consumed following the first post-exercise biopsy.

RESULTS: Change (ED – WM) in leg lean mass (1.2 ± 0.7 vs. -0.7 ± 0.4 kg) and total testosterone concentrations (712 ± 159 vs. -193 ± 78 ng/dL) differed between TEST and PLA (*P* < 0.05). Relative to WM, baseline AR total protein was 118 % higher for TEST than PLA (*P* < 0.05) and was associated with changes in leg lean mass and fibroblast growth factor-inducible 14 (Fn14) gene expression (*r* = .540 and -.563, *P* < 0.05). Baseline Fn14 gene expression relative to WM was 52 % lower for TEST than PLA (*P* < 0.05) and tended to associate with changes in leg lean mass (*r* = -.455, *P* = 0.058). After exercise (6 h), muscle atrophy F-box and muscle ring finger-1 gene expression was lower (61 and 44 %) and MyoD expression was 122 % higher for TEST than PLA (*P* < 0.05), relative to WM. Mechanistic target of rapamycin-mediated anabolic signaling was not different between groups.

CONCLUSIONS: The hypertrophic effect of testosterone on lean mass during severe energy deficit may be due, in part, to reduced ubiquitin-mediated proteolysis and increased myogenesis after exercise and feeding, subsequent to modulation of upstream AR and Fn14 signaling. Supported by USAMRDC; authors' views not official U.S. Army or DoD policy.

127 May 27 10:30 AM - 10:45 AM

Skeletal Muscle Raptor And Tsc1/2 Differential Responses To Activity And Fasting In The Tumor Environment

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(No relevant relationships reported)

Cancer is a debilitating disease that is often accompanied by decreased physical activity and chronic energetic stress that disrupts muscle proteostasis. Skeletal muscle protein turnover is highly sensitive to changes in feeding and activity. Raptor serine 792 and TSC1/2 serine 1387 phosphorylation sites, when activated, can inhibit mTORC1 activation leading to suppressed anabolic signaling, and has been implicated in the regulation of skeletal muscle wasting with cancer. **Purpose:** To examine the effect of a 12-hour fast on the phosphorylation of Raptor and TSC1/2 in male *Apc^{Min/+}* mice, and if voluntary wheel activity can alter the fasting response. **Methods:** Male C57BL/6 (B6, N=24) and *Apc^{Min/+}* (MIN, N=31) mice were either sacrificed under *ad libitum* conditions (B6-fed, M-fed), fasted for 12hrs (B6-fast, M-fast), or fasted for 12hrs following 4wks of voluntary wheel running (B6+W, M+W). TSC1/2 serine 1387 and Raptor serine 792 were measured in the gastrocnemius muscle as phosphorylation to total ratio by western blot. Protein synthesis was measured by puromycin incorporation. **Results:** All MIN mice exhibited body weight loss (*p* < 0.001) and reduced gastrocnemius mass (*p* < 0.001) when compared to all B6 mice. Raptor phosphorylation (pRaptor) was induced in M-fast compared to M-fed (*p* = 0.019), but there was no change in B6+fast compared to B6-fed (*p* = 0.414). TSC1/2 phosphorylation was induced in M-fast compared to M-fed (*p* = 0.001) and in B6-fast to B6-fed (*p* = 0.039). Puromycin was trending to be reduced in M-fast compared to MIN-fed (*p* = 0.070), but there was no change in B6-fast to B6-fed (*p* = 0.323). Raptor phosphorylation was not different in M-fast compared to M+W (*p* = 0.302), however pRaptor was reduced in B6+W compared B6-fast (*p* = 0.028). TSC1/2 phosphorylation (*p* = 0.001) and puromycin (*p* = 0.016) were induced in MIN+W compared to M-fast, with no changes in the B6-fast to B6+W (*p* = 0.360, *p* = 0.196; respectively). **Conclusions:** Our results provide evidence that the cancer environment disrupts anabolic suppression of mTORC1 in skeletal muscle. Interestingly, TSC1/2 phosphorylation was sensitive to fasting independent of the tumor environment. Wheel activity induced protein synthesis independent of Raptor phosphorylation therefore, further studies are warranted to determine this specific mechanism.

128 May 27 10:45 AM - 11:00 AM

Effects Of Lactate Infusion On Resistance Exercise Induced MTORC1-signaling And Protein Synthesis In Human Muscle

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(No relevant relationships reported)

Lactate has recently been highlighted as a potential signaling molecule. In myotubes, lactate incubation increase mTORC1-signaling, reduce myostatin expression and induce myotube growth. This indicates that lactate could be a potential mediator of muscle adaptations to resistance exercise. **PURPOSE:** Here we wanted to study the acute molecular response in human skeletal muscle to resistance exercise performed with or without a venous infusion of lactate. The primary outcomes of the study was intracellular signaling, rate of protein synthesis (FSR) and blood/muscle levels of lactate and pH. **METHODS:** 16 healthy females and males participated in the study which consisted of two resistance exercise sessions performed under venous infusion of sodium lactate or saline, in a randomized, blinded and counterbalanced fashion. In the overnight fasted state infusion was employed during ~60 min of rest and unilateral knee-extension exercise. Blood was sampled repeatedly during trials and muscle biopsies were collected at rest and at 0, 90, 180 min and 24 h after exercise. Oral D2O ingestion was used to determine FSR during 24 h of recovery. **RESULTS:** With saline, blood lactate levels reached 3.0 mmol/l post exercise, while lactate infusion resulted in 130% greater lactate levels post exercise that also remained higher than at rest and saline up to 90 min of recovery. Post exercise muscle levels of lactate were 20% higher with lactate compared to saline infusion (32 vs 27 mmol/kg d.w). Lactate infusion had an alkalinizing effect in blood with pH being 7.44 after exercise with lactate and 7.34 with saline. This effect was not noted in muscle where pH was reduced by 0.06 units after exercise in both trials. Exercise increased the phosphorylation of mTOR^{S2448} (~40%), S6K1^{T389} (~3-fold) and S6^{S240/244} (~9-fold) during recovery, without any differences between trials. Effects of exercise without any influence of lactate infusion was also noted for eEF2^{T56}, AMPK^{T172}, PRAS40^{T246} and p44^{T202/T204}. FSR over

24h of recovery did not differ between saline (0.067 %/h) and lactate infusion (0.060 %/h). **CONCLUSIONS:** In this model blood lactate levels did not modulate resistance exercise induced mTORC1-signaling or FSR. As only small differences were noted for muscle levels of lactate, its potential role as signaling molecule should not be discarded.

129 May 27 11:00 AM - 11:15 AM

OXIDATIVE METABOLISM DURING THE TIME-COURSE OF DISUSE ATROPHY IN MALE AND FEMALE MICE

Madeline G. Amos¹, Megan E. Rosa-Caldwell¹, Wesley S. Haynie¹, Kirsten R. Dunlap¹, Seongkyun Lim¹, Lisa T. Jansen¹, Jacob L. Brown¹, David E. Lee¹, Tyrone A. Washington¹, Michael P. Wiggs², Nicholas P. Greene, FACS^M. ¹University of Arkansas, Fayetteville, AR. ²University of Texas at Tyler, Tyler, TX. (Sponsor: Dr. Nicholas Greene, FACS^M)
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Muscle loss is an important predictor of morbidity and mortality across a variety of diseases. Males and females appear to differ on clinical outcomes in relation to disuse-induced muscle atrophy, however reasons for these different responses have not been investigated.

PURPOSE: To investigate measures of muscle oxidative metabolism during the time-course of disuse atrophy in male and female mice. **METHODS:** Disuse atrophy was induced using hindlimb unloading in 50 male and 50 female mice for 0 (CON), 1, 2, 3, or 7 days (n=10/group). Muscle sections of the tibialis anterior were stained for succinate dehydrogenase (SDH). Cross sectional area (CSA) by SDH staining was used to assess the effect of disuse on different muscle fiber phenotypes. mRNA content of *Ppara* was measured in the gastrocnemius, soleus, and extensor digitorum longus (EDL) muscles. Data were analyzed within each sex by one way ANOVA and trend analysis. A p<0.05 indicated statistical significance. **RESULTS:** CSA of SDH positive fibers progressively decreased in both male and female mice. CON animals (male and female) had SDH positive fiber CSA of ~400 μm² and 7 day unloaded animals had CSAs of ~300 μm². Both male and female mice had an SDH negative CSA of ~650 μm², with no significant differences in fiber CSA noted across groups. In the gastrocnemius muscle, *Ppara* content was ~50-60% lower at 1 day of unloading in males and females and remained depressed in all experimental groups. In soleus muscles of females, *Ppara* was ~60% lower at days 1, 2, and 3 compared to CON, but then recovered back to CON levels. Whereas in males, *Ppara* was ~60% lower with 1 day of unloading and remained depressed in 1, 2, 3, and 7 day groups. In females, there were no differences in *Ppara* content in EDL across all groups. In males, there was ~50-75% lower *Ppara* in EDL content that reached statistical significance at 2 days and remained depressed throughout intervention groups. **CONCLUSION:** Disuse results in muscle loss in males and females and appears to result in similar alterations to oxidative metabolism across multiple tissues. Future studies should investigate if improving oxidative metabolism is protective against disuse atrophy in males and females.

This study was funded by the National Institutes of Health, Award number: R15 AR069913/AR/NIAMS

130 May 27 11:15 AM - 11:30 AM

High-Volume And High-Intensity Resistance Training Effects On Upper-Leg Lean Tissue Mass And Muscle Cross-Sectional Area

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PURPOSE: Evaluate the effects of 6 weeks of unilateral high-intensity resistance training and high-volume resistance training on upper-leg lean tissue mass and mid-thigh lean muscle cross-sectional area. **METHODS:** Well-trained, college-aged males (n = 15) underwent 6 weeks of unilateral resistance training, with one limb training with high-volume (HV), and the other with high-intensity (HI). Dual-energy X-ray absorptiometry (DEXA) scans and peripheral quantitative computed tomography (pQCT) scans were collected both before training (PRE) and after the 6 weeks of resistance training (POST). Upper-leg lean tissue mass (LTM) was quantified by selecting a region of interest to isolate the upper-leg compartment from the whole-body DEXA scan, while lean muscle cross-sectional area (mCSA) of the mid-thigh was measured using pQCT and analyzed through an open source plug-in through ImageJ (NIH). Changes in LTM and mCSA between conditions and over time were evaluated statistically using a 2x2 [CON (HI vs. HV) x TIME (PRE vs. POST)] repeated measures ANOVAs. LSD pairwise comparisons were used as follow-up analyses when a significant interaction was detected. Statistical significance was set at p 0.05.

RESULTS: There were no significant condition * time interactions for lean mCSA or LTM. However, there was a main effect of time for both lean mCSA (p<0.001) and LTM (p<0.001). Both HV and HI increased upper-leg LTM post-training (HV: pre = 8.96 ± 1.07 kg vs. post = 9.24 ± 1.14 kg; HI: pre = 8.95 ± 1.05 kg vs. post = 9.18 ± 1.06 kg). Similarly, both HV and HI increased lean mCSA post training (HV: pre = 185.8 ± 24.0 cm² vs. post = 191.8 ± 24.3 cm²; HI: pre = 185.7 ± 20.0 cm² vs. post = 195.1 ± 25.7). **CONCLUSION:** Six weeks of HV and HI training similarly increased upper-leg LTM and lean mCSA in previously trained college-aged males.

A-25 Clinical Case Slide - Hip I

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-2005

131 **Chair:** Lauren Elson. *Spaulding/Harvard University.*
(No relevant relationships reported)

132 **Discussant:** Andrea Stracciolini, FACS^M. *Children's Hospital Boston, Boston, MA.*
(No relevant relationships reported)

133 **Discussant:** Keri L. Denay, FACS^M. *University of Michigan, Ann Arbor, MI.*
(No relevant relationships reported)

134 May 27 9:30 AM - 9:50 AM

RARE CASE OF ACETABULAR FRACTURE FROM BEACH VOLLEYBALL

Priyanka Raju¹, Steven C. Liu¹, Kenneth Vitale, FACS^M. ¹Eastern Virginia Medical School, Norfolk, VA. ²USCD School of Medicine, San Diego, CA. (Sponsor: Kenneth Vitale, FACS^M)
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(No relevant relationships reported)

HISTORY: A 59-year-old beach volleyball player sustained a hip injury during a match. While playing, he landed on soft sand from a jump on his right leg. He felt a 'jolt and pop' in his right hip that radiated to his deep thigh, and felt his leg seemed 'locked out of place.' No past history of hip dysplasia, dislocation, hip surgery. He asked someone to pull on his leg to try and improve symptoms. After the incident, he was able to walk off on his own power, but noted discomfort upon weight bearing and walking.

PHYSICAL EXAMINATION: Examination revealed no focal tenderness, full ROM of the hip, but had discomfort with FABER maneuver. He was able to walk around at the clinic without assistance.

DIFFERENTIAL DIAGNOSIS: Hip dislocation, Acetabular labral tear, loose body, Coxa saltans, Occult fracture

TEST AND RESULTS: X-rays were obtained and suggested a posterior rim acetabular fracture; Same-day CT showed a comminuted intra-articular posterolateral acetabular wall fracture with effusion, femoral head impaction, and irregularity of the central fovea suggested ligamentum teres femoris avulsion

FINAL WORKING DIAGNOSIS: Right posterior wall acetabulum fracture with femoral head impaction

TREATMENT AND OUTCOMES: 1. Referred to Orthopedic Trauma; surgeon recommended evaluation under anesthesia (EUA) due to possibility of transient hip dislocation to evaluate for instability, which he declined. Recommended toe-touch weightbearing with crutches which he also declined as he felt able to ambulate. Hip dislocation precautions given.

2. At 1 month, he ended up using two canes to walk but was able to without significant symptoms. Advanced to weightbearing as tolerated.

3. At 3 months, felt better but still unable to play volleyball or run. X-rays showed interval healing in unchanged alignment.

Case reports unusual etiology of a posterior wall fracture after seemingly 'minor' injury on soft sand, and providers should have a low threshold to proceed with further workup such as CT. Unknown if bystander pulling on leg worsened injury. May even had transient hip dislocation, a rare injury due inherently stable hip bony anatomy.

Case raises awareness to counsel patient on recurrent dislocation, osteonecrosis, and arthritis risks with these injuries, and consider bone density testing if a low-energy injury.

135 May 27 9:50 AM - 10:10 AM

A Busy Adult With Hip Pain

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 (No relevant relationships reported)

HISTORY:

51yr old F with PMH significant for hip dysplasia. Presented to clinic in June 2017 for recurrent R hip pain. Sxs began in Feb 2016 when her hip subluxed. She had intermittent sharp pains to medial hip that radiated down to the toes with varied hip ROMs; without paresthesias. Prior to eval, dx with anterosuperior labral tear. Tx with PT with home exercise program (HEP), two intra-articular steroid injections, and a greater trochanteric bursa injection. Steroid injections improved pain and relieved some of the "catching," but sxs still persisted.

PHYSICAL EXAMINATION:

Mild valgus knee alignment
 Guarded FADIR, not clearly positive
 Tenderness to palpation, posterolateral troch/ gluteal area

DIFFERENTIAL DIAGNOSIS:

1. Labral tear
2. Snapping hip syndrome (tendon/muscle)
3. Femoroacetabular impingement (FAI) syndrome
4. Hip OA
5. Lumbar referred pain
6. Iliopsoas bursitis
7. Gluteal tendinopathy

TESTS AND RESULTS:

Hip Xray (8/26/2016): WNL
 MR arthrogram (2/28/2017): Degenerative tear, anterosuperior labrum.
 MSK Ultrasound (6/23/2017): Proximal IT band: thickened/hyperechoic. Cortical irregularities at the greater trochanter. Negative snapping hip maneuvers. Positive sonopalpation over posterior hip joint.
 MSK Ultrasound (9/29/2017): No snapping hip sx with log rolling, FABER, or FADIR. RF was observed rolling over the iliopsoas, without snapping. No labrum catching was noted.

FINAL/WORKING DIAGNOSIS:

R hip anterosuperior degenerative labral tear with sx of catching

TREATMENT AND OUTCOMES:

1. R hip intra-articular steroid injection (2/21/18); pain control only.
2. Discussed Platelet Rich Plasma (PRP), prolotherapy, continued steroid injections, and surgery. Did not want surgery due to work schedule/lifestyle. Was agreeable to try prolotherapy.
3. Anterior Superior Labral tear was visualized on Ultrasound in clinic and an ultrasound guided dextrose/lidocaine intra-lesional labral injection was performed (1/23/19) - doing well at 5 mo. follow-up - no pain with ROM, pain level 0.
4. MSK Ultrasound (6/10/2019): R labral tear noted in anterior labrum with improved mild hyperechoic signal.
5. HEP with avoiding of high resistance exercise due to aggravated gluteal tendinopathy

136 May 27 10:10 AM - 10:30 AM

Pelvic Pain- Ballet

Alexandria Joann Haselhorst, Monica Rho. *Shirely Ryan Ability Lab, Chicago, IL.* (Sponsor: Dr. Joe Ihm, FACSM)
 (No relevant relationships reported)

HISTORY: Patient is a 13 yo female pre-professional ballerina who developed pelvic pain during her training. She was doing an arabesque with her leg in single stance with the opposite leg extended. She then moved to a penché position with her torso leaned forward over a leg in single stance with her legs at 180 degrees. She felt an immediate pop in her left groin. She continued to dance through pain during 6 weeks of intensive ballet training prior to presentation to clinic. Pain described as 3/10, aching in left groin and buttock pain at rest. Pain better with rest and worse with walking, leg extensions and entrenchment which is a vertical jump with repeated adduction of feet. She denied any numbness, tingling or weakness. Patient had no prior history of stress fractures, is not menstruating and eats a balanced diet.

PHYSICAL EXAMINATION: Tenderness to palpation over left pubic bone. Full pain free ROM in both hips. Special tests positive on the left side included FABER, FADIR, single leg hop and resisted adduction more than abduction. She had 4/5 hip abduction strength in side lying bilaterally.

DIFFERENTIAL DIAGNOSIS:

1. Ischiopubic stress fracture
2. Pubic apophysitis at adductor insertion
3. Femoral acetabular impingement

4. Hip labral tear
5. Ischiopubic synchondrosis with stress reaction

TESTS AND RESULTS:

Pelvis and hip AP and Dunn radiographs: There is a healing fracture of the left inferior pubic ramus, with a faintly visible fracture line and surrounding periosteal reaction. MRI pelvis w/o contrast: Findings consistent with Asymmetric incomplete fusion of the ischiopubic chondrosis with stress reaction.

FINAL WORKING DIAGNOSIS:

Ischiopubic synchondrosis with stress reaction also known as Van Neck Disease

TREATMENT AND OUTCOMES:

1. Patient was made NWB on crutches for 2 weeks at her MRI follow up appointment.
2. At 2 week follow up patient had decreased pain to palpation over left pubic bone. She was progressed to WBAT, PT, no ballet for 6-8 weeks and continue with the sports nutritionist.
3. At 4 week follow up, patient had no pain on physical examination. Patient was progressed to return to barre class for 10 minutes for one week. She could increase her time each week as instructed by her PT. Patient was not allowed to do speed work, jump or move her leg past 90 degrees in abduction, flexion or extension.
4. Patient will follow up in 6 weeks

137 May 27 10:30 AM - 10:50 AM

Non-remitting Gluteal Pain In An Adolescent Soccer Player

Kristopher Paultre¹, Thomas Best, FACSM². ¹JMH/UM, Miami, FL. ²University of Miami, Miami, FL. (Sponsor: Dr. Thomas Best, FACSM)
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 (No relevant relationships reported)

HPI:

14 y/o male soccer player presents to clinic with 12 months of right gluteal pain when active or sitting for a prolonged time. He described the pain as dull with normal activity and sharp with low levels of exertion particularly in hip flexion. His pain is maximal during soccer while kicking the ball with his opposite foot. In addition, he reports point tenderness over the proximal right hamstring and while sitting down on hard surfaces. He was evaluated roughly 1 year ago by an outside physician with a normal XR of the pelvis. Per patient and father reported an "injury to the Sits bone". Patient was subsequently taken out of sports for 6 months and had a non-US guided corticosteroid injection into the posterior thigh 3 months prior to clinic visit. The injection provided short term relief, no additional treatment (PT) was prescribed.

ROS:

CONSTITUTIONAL: No fevers, chills, sweats, night pain or weight changes.
 CARDIOVASCULAR: No chest pains, palpitations, orthopnea and paroxysmal nocturnal dyspnea.
 RESPIRATORY: No dyspnea on exertion, no wheezing or cough.
 MUSCULOSKELETAL: per HPINEUROLOGIC: No numbness, tingling or weakness.

Physical exam:

Gait: Able to bear weight with a normal gait
 MSK: No swelling, ecchymosis
 ROM: Full ROM intact both actively and passively. There was mild pain with active deep flexion during squat

Straight leg raise: Significant for pain on proximal right hamstring
 Tenderness: Over ischial tuberosity and toward proximal hamstring
 Strength: 4/5 on hip extension remainder of strength testing unremarkable

Log Roll: neg
 FABER/FADIR neg/neg
 Ober Test: neg
 Thomas Test: neg
 Sensation: intact to light touch

Differential Diagnosis:

Chronic hamstring strain
 Bone contusion
 Tumor
 Osteomyelitis

Initial Testing In clinic:

X-Ray Hip AP/lateral:
 Irregular lucency along inferolateral aspect of right ischium. Correlates to insertion of the hamstring. However, the appearance is not typical for an avulsion injury or tendon strain. Femoro-acetabular joints preserved.

MRI: Ill-defined area within the ischium approximately 1.7 x 0.6 x 3.6 cm corresponding to the suspicious area seen on prior x-ray. Findings are likely due to a healing avulsion fracture of the right ischial tuberosity.

Final Working Diagnosis:

Healing avulsion fracture over right ischial tuberosity, clinically improving with PT

138 May 27 10:50 AM - 11:10 AM

Rare Case Of Avascular Necrosis In A Dodgeball Player

Steven C. Liu¹, Alpha Anders², Kenneth Vitale, FACSM.
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 (No relevant relationships reported)

History:

A 27-year-old male presented with left anteromedial hip/groin pain for 2 weeks. He competes in a dodgeball league and plays occasional racquetball as well. After a dodgeball game, he noted onset of hip and groin pain, which became progressively severe, and went to a local Emergency Department. He had x-rays and were told they were normal, however he had significant pain even with weightbearing at this point. No past history of hip dysplasia, dislocation, hip surgery.

Physical Examination:

Hip flexion was 110°, internal rotation 20°, external rotation 60°, abduction 45°; significant pain with flexion, adduction, and internal rotation, and positive FABER. He was able to ambulate without assistance.

Differential Diagnosis:

- Labral tear
- Femoroacetabular impingement
- Femoral neck stress fracture
- Loose body
- Chondral defect
- Athletic pubalgia

Tests and results:

X-rays were obtained and suggested minimal left femoral head collapse, and did suggest mild right femoral head sclerosis; an MRI showed large areas of grade 2 avascular necrosis bilaterally. The left had a joint effusion, edema in addition to necrotic fatty signal in the femoral head compatible with early collapse.

Final/Working Diagnosis:

Bilateral hip avascular necrosis with early left collapse.

Treatment/Outcome:

- Internal Medicine and Rheumatology referral for serological work up.
- Referred to Orthopedic Surgeon; recommended toe-touch weightbearing, counseled on risk of progression. Alendronate was considered as with precollapse Ficat stages 0-II.
- At 8 months, left hip pain was progressing, and noted onset of right hip pain. X-rays showed visible left AVN on the entire weightbearing surface with collapse and flattening of the superior articular surface; right hip now showed subtle sclerosis.
- His only pertinent history included a brief course of oral corticosteroids when he got his wisdom teeth removed, which he did not initially disclose. This case reports an unusual etiology of an avascular necrosis after taking a short-term dose of corticosteroids. Case raises awareness to counsel health providers about collaborating to provide patients with optimal care and avoid potential serious side effects.

139 May 27 11:10 AM - 11:30 AM

Bilateral Hip Pain - Soccer Player

Samantha Lucrezia, Danielle Hirsch, Patrick Mularoni. *Johns Hopkins All Children's Hospital, St. Petersburg, FL.* (Sponsor: Dilipkumar R. Patel, MBBS, MBA, MPH, FACSM)
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 (No relevant relationships reported)

History: A 16-year-old Asian male presented with 2 weeks of worsening groin pain. Pain began after a difficult soccer practice, without a specific inciting injury. Patient was evaluated by team's athletic trainer and was referred to orthopedic surgery where x-rays were negative. One week later, patient presented to local pediatric emergency center with intermittent fevers, worsening pain and inability to ambulate. He denied any recent travel outside the US or new exposures.

Physical Exam: afebrile in no acute distress with tenderness to palpation over paraspinal muscles, costovertebral processes L3-L4 and quadriceps musculature. Patient walked with antalgic gait and found to have 2/5 strength hip flexion bilaterally with 5/5 strength in all other muscle groups. Cardiac, pulmonary and abdominal exam were unremarkable. There was no lymphadenopathy present on exam.

Differential Diagnosis:

1. Ankylosing Spondylitis
2. Iliopsoas Abscess
3. Epidural abscess
4. Osteomyelitis
5. Malignancy

Test and Results:

- ESR: elevated at 94 mm/hr, CRP: elevated at 4.57 mg/dL
- CBC: mild normocytic anemia without leukocytosis or thrombocytopenia
- CK, CMP, Uric Acid, LDH within normal limits

- Blood culture: negative
- Rheumatologic studies: ANA, adolase, ANCA were negative
- Testicular US: negative
- MRI of lumbar spine and pelvis: signal enhancement within the bones of pubis symphysis with significant surrounding soft tissue edema
- Bone biopsy: focally degenerated bone, mixed chronic inflammation, fibrosis with reactive changes. No microorganisms present on special stains
- Bone aerobic/anaerobic cultures: negative
- Quantiferon gold: POSITIVE, mycobacterium sputum PCR: POSITIVE
- Chest x-ray: negative

Final/Working Diagnosis:

Tuberculosis osteomyelitis of the pelvis

Treatment and Outcomes:

1. Treatment with ethambutol, isoniazid, pyrazinamide, and rifampin daily until cleared by infectious disease
2. Close follow up with Infectious disease clinic with monitoring labs every 2 weeks
3. Indomethacin PRN for pain
4. Range of motion and strengthening exercises for bilateral hip flexors with physical therapy
5. Regular follow up with local department of health

A-26 Clinical Case Slide - Knee I

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
 Room: CC-2016

140 Chair: Peter Gerbino, FACSM. *Monterey Sports Medicine, Monterey, CA.*

(No relevant relationships reported)

141 Discussant: Ashley Zapf. *Schwab Rehabilitation Hospital, Chicago, IL.*

(No relevant relationships reported)

142 Discussant: Siobhan Statuta. *University of Virginia, Charlottesville, VA.*

(No relevant relationships reported)

143 May 27 9:30 AM - 9:50 AM

Knee Injury- A Tragic Tackle In A Weekend Warrior

Laura A. Shaffer, John R. Deitch. *WellSpan Health, York, PA.* (Sponsor: Mark E. Lavalley, M.D., C.S.C.S., F.A.C.S.M., FACSM)
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 (No relevant relationships reported)

History: A 25-year-old male sustained a left knee hyperextension injury while being tackled by a friend in his backyard. He had immediate pain, swelling, and was unable to ambulate. X-Rays in the ED demonstrated an avulsion fracture of unknown origin. Patient was placed in a knee immobilizer and advised to follow up with orthopedics. Three days later, he presented to clinic with pain, swelling, significant instability, numbness and coolness in left foot, and inability to dorsiflex his left ankle.

Physical Exam: Knee examination revealed significant ecchymosis of the posterior-lateral aspect of the knee and positive effusion. Coolness and decreased sensation to distal one third of left leg. He had a positive foot drop. Difficulty palpating dorsalis pedis pulse. Good capillary refill. Significant laxity to lateral collateral ligament in full extension (0 degrees). Positive Lachman's as well as laxity with posterior drawer testing.

Differential Diagnosis:

1. Knee dislocation with peroneal neuropraxia and possible popliteal artery injury 2. Multi-ligament left knee injury with peroneal neuropraxia and possible popliteal artery injury

Tests and Results: CT angiogram- No arterial injury

MRI - Edema and nonorganized hematoma involving gastrocnemius, soleus, popliteus, and tibialis anterior. Detached medial and lateral patellar retinaculum, medial and lateral meniscus tears. Partial tear of PCL, MCL strain, ruptured ACL and LCL. Thin but intact peroneal nerve noted. Avulsion fracture of biceps femoris and tear of popliteus tendon. Medial femoral condyle osteochondral impaction fracture.

Final Working Diagnosis:

Multi-ligament left knee injury. Avulsion fracture of biceps femoris. Meniscal tears. Peroneal nerve injury without arterial injury.

Treatment and Outcomes:

1. Surgical repair 2 weeks after injury.
2. Extensive rehabilitation (0-6 weeks post-op: ROM exercises 0-90; 6-12 weeks post-op: strengthening exercises and advancing weight bearing 25% weekly).
3. Functional brace.
4. Continued monitoring for peroneal nerve improvement in motor and sensation.
5. Had discussion with patient regarding limited outcome and primary goal of function.
5. Unlikely to return to sport.

144 May 27 9:50 AM - 10:10 AM

114 Kilograms Overhead Too Much For This Knee

Erin S. Barnes, MD¹, Joseph Medellin, MD, MPH, MBA², Ryan Rompola, DAT, AT, ATC². ¹Temple University/MossRehab, Philadelphia, PA. ²Henry Ford Allegiance Health Sports Medicine, Jackson, MI. (Sponsor: Mark Lavallee MD, FACSM)
Email: esbarnes89@gmail.com
(No relevant relationships reported)

HISTORY: History: 61 year old male competing in the 102 kg category in the International WeightLifting Federation World Masters Championships, on his third attempt at clean and jerk (114 kg), was able to power clean the bar into the front rack position and subsequently performed a power jerk. As the bar was stabilized overhead, the patient's right knee collapsed medially and he fell to the ground. Medical staff assessed the patient immediately on the platform. **PHYSICAL EXAM:**Right knee exam: no obvious deformity with the leg in extension. Local edema quickly developing superior to patella, passive flexion and extension elicited pain, flexion with notable gapping between the superior pole of the patella and quadriceps muscle bulk. Patella was midline in femoral condyles, no tenderness along the medial or lateral joint lines. There was a palpable defect between the superior pole of the patella and quadriceps muscle bulk. Pulses: palpable DP pulses, good capillary refill Sensation: grossly intact to light touch in the right lower extremity **DIFFERENTIAL DIAGNOSIS:**Tibial-femoral dislocationPatellar dislocationQuadriceps tendon rupture Medial collateral ligament tear ACL tear

TESTS & RESULTS:No immediate imaging available in medical tent, ER X-ray with no fracture, ER CTA without vascular compromise and evidence of complete right quadriceps tendon rupture, which was later confirmed on pre-surgical MRI. **FINAL DIAGNOSIS:** Complete right quadriceps tendon rupture **TREATMENT & OUTCOMES:**EMS was called and the patient's knee was immobilized. Pulses were palpable throughout the duration of the exam. While in the ER there was concern for vascular injury therefore CTA was obtained. Once vascular injury was ruled out, patients' knee was placed in a knee immobilizer and he was cleared to travel home. Patient underwent surgical repair one-week post-injury in his native state. He began physical therapy several days after surgery and rehab is ongoing. Return to sport estimated at 9-12 months post-injury.

145 May 27 10:10 AM - 10:30 AM

LEG BUMP- SOCCER

George Ross Malik, Samuel Chu. *Shirley Ryan Ability Lab, Chicago, IL.* (Sponsor: Dr. Joseph Ihm, FACSM)
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(No relevant relationships reported)

HISTORY:

A 12-year-old male with a past medical history of Celiac's disease and growth deficiency on hormone supplementation presented to sports medicine clinic with a large, painless bump on the medial aspect of his left knee. He noticed it three months prior, but reported enlargement over the last few weeks. He described it as firm and non-mobile. He denied any trauma or inciting event to the knee. He reported playing soccer 8 hours and squash 2 hours per week with both school and club teams. He did not describe any swelling around the knee itself and there was no history of locking or buckling of the knee. The bump did not limit his ambulation or mobility. He endorsed a mild decrease in his ability to flex the knee. He denied any other bumps or masses, fevers, chills, weight loss, erythema, ecchymosis, or edema.

PHYSICAL EXAMINATION:

Examination revealed an approximately 1x2cm firm, non-mobile mass over the superomedial aspect of the left tibia. No knee effusion was noted bilaterally. The left knee was non-tender to palpation along the medial and lateral joint lines as well as the patellar facets. There was no crepitus in the bilateral knees. The range of motion was minimally restricted in flexion on the left compared to the right. Full extension was intact without pain bilaterally. Sensation to light touch and motor strength was normal in the lower extremities. There was no varus or valgus laxity. McMurray's and Lachman's tests were negative bilaterally.

DIFFERENTIAL DIAGNOSIS:

1. Tumor (Osteosarcoma)
2. Ganglion Cyst
3. Parameniscal Cyst
4. Soft Tissue Sarcoma

TESTS AND RESULTS:

Left Knee X-ray: No acute fracture or traumatic malalignment. No bone mass visualized
Left Knee Bedside Ultrasound: Hypoechoic mass superficial to medial joint line and posterior to MCL
Left Knee MRI: 1.1 x 2.3 x 1.9cm multi-loculated parameniscal cyst. Tear in the posterior horn of the medial meniscus connecting to the parameniscal cyst

FINAL/WORKING DIAGNOSIS:

Multi-loculated parameniscal cyst secondary to a medial meniscus tear

TREATMENT AND OUTCOMES:

1. Referred to orthopedic surgery to rule out any surgical intervention
2. Consideration of ultrasound-guided percutaneous drainage of the parameniscal cyst
3. Instructed to current activity and exercise as tolerated
4. Counseled to report any pain or changes in symptoms
5. Follow up in 2 months

146 May 27 10:30 AM - 10:50 AM

Knee Injury Football

Michelle L. Walls. *Michigan State University, East Lansing, MI.* (Sponsor: Susan M. Ott, FACSM)
(No relevant relationships reported)

HISTORY: 14 year old male football athlete sustained an unwitnessed injury to his left knee at football practice. He presented to the emergency room and subsequently to the orthopedic department. CO left knee pain and swelling with difficulty bearing weight

PHYSICAL EXAMINATION: Moderate effusion. ROM 0-40 degrees, no joint line pain, stable to varus and valgus stress testing at 0 and 30 degrees of flexion. Positive lachmans. Unable to do further testing due to pain and decreased ROM

DIFFERENTIAL DIAGNOSIS: 1-ACL injury 2-locked knee due to bucket handle meniscus tear 3-fracture 4-patella dislocation/subluxation

TEST AND RESULTS: Plain radiographs : skeletally immature, displaced tibial spine fracture CT: same with the center of the physis closed MRI: Same no other intra-articular pathology and further definition of the size of the intra-articular fragment

FINAL WORKING DIAGNOSIS: tibial spine fracture

TREATMENT AND OUTCOMES: arthroscopically assisted fixation of fracture, non weight bearing for 4 weeks in post operative brace ROM 0-30, Gradual return to full weight bearing and full ROM in post operative brace over the next 2 weeks. Placed in hinged knee sleeve and into ACL protocol physical therapy at 6 weeks PO. Negative lachmans achieved and maintained from immediately post op onward. Radiograph union of the fracture at 6 weeks PO. Anticipate return to basketball with brace at 3 months post op

147 May 27 10:50 AM - 11:10 AM

Knee Injury-Football

Alexander A. Spiewak. *Western Michigan University School of Medicine, Kalamazoo, MI.* (Sponsor: Robert J Baker, FACSM)
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(No relevant relationships reported)

HISTORY: A 17-year-old senior high school football quarterback sustained a right knee injury during the third quarter of a game. During the third quarter while the player was attempting to cut and change directions he planted hard on his right leg and attempted to push off. He subsequently fell to the ground screaming in pain. There was no contact with another player. Athletic trainers and the team physician ran onto the field to aid him.**PHYSICAL EXAMINATION:** Examination demonstrated a deformed right knee. The tibia was displaced laterally in relation to the femur. The patella was midline. His sensation was intact, no dorsalis pedis pulse was palpable. His range of motion was severely limited. Reduction of his true knee dislocation was performed on the field due to the lack of palpable DP pulse. His knee was easily reduced on the field and his dorsalis pedis pulse was then easily palpated. He was carried to the sideline. On sideline he had a grade II Lachmans with his exam being limited by pain. He was placed in a straight leg immobilizer and taken to the emergency department.**DIFFERENTIAL DIAGNOSIS:**1. Knee dislocation2. Patellar dislocation3. Ligamentous injury **TEST AND RESULTS:**CT Angiography lower extremity right-Normal vascular structures with normal pop. Artery-Moderate right knee effusion -No visualized fractures seenKnee complete 4 view right-Skeletally mature with physiologic valgus alignment-Large knee effusionMR right knee without contrast-Complete tear of ACL-Lateral femoral condyle cortical impaction fracture with deepened femoral notch-Large joint effusion-Suspected longitudinal tear of the posterior horn of the lateral meniscus **FINAL/WORKING DIAGNOSIS:**True knee dislocation with complete ACL tear and lateral meniscus tear as well as lateral femoral condyle impaction fracture**TREATMENT AND OUTCOMES:**1. The patient was kept in hinged knee brace for 4 weeks to allow for capsular healing2.Patient underwent right knee arthroscopic ACL reconstruction with bone-tendon-bone autograft and lateral meniscus repair. No posterolateral corner injury was noted on

arthroscopy.3.Patient began physical therapy. He demonstrated significant quadriceps atrophy which improved throughout his course.4.Patient returned to sport with a functional brace, but did not return to football

148 May 27 11:10 AM - 11:30 AM

Bone Injury In A Gymnast

Philip Zhang¹, Jacob Joseph², Jorge Rojas¹, Edward G. McFarland¹, Brian J. Krabak³. ¹The Johns Hopkins University, Lutherville, MD. ²The Johns Hopkins University, BALTIMORE, MD. ³University of Washington, Seattle, WA. (Sponsor: Brian J Krabak MD MBA FACSM, FACSM)
Email: phzhang@augusta.edu
(No relevant relationships reported)

Bone Injury - Gymnastics

HISTORY: A 14-year old female level 10 USGA gymnast presented with right knee pain and swelling after hyperextending her knee during a landing while competing on vault. She did not feel or hear a pop but was unable to walk due to pain. The knee subsequently swelled and she sought medical treatment at a local facility. Radiographs were negative but she continued to have pain while walking with loss of motion. She had no previous knee injuries and did not complain of any paresthesias. She otherwise was in good health with no history of illnesses or medical conditions
PHYSICAL EXAM: The patient was in no distress but could not weight bear on her leg. She had a 2+ effusion and her knee motion was limited from 20 to 125 degrees. She was neurologically intact for sensation and motor strength in the extremity. She was tender only on her proximal tibia near the patellar tendon attachment. Her patellar tendon and quadriceps mechanism was intact. She had no laxity to varus or valgus stress testing of the collateral ligaments with the knee extended or flexed 30 degrees. A McMurray's test was too painful to perform. She had a negative Lachman's and posterior drawer test. Her vascular examination (pulses, color, capillary refill, temperature) of the extremity were all normal.

DIFFERENTIAL DIAGNOSIS:

1. Patellar dislocation
2. Partial tear patellar tendon
3. Meniscal tear
4. Cartilage contusion
5. Occult fracture - tibial plateau

TESTS AND RESULTS:

Plain radiographs of the knee (sunrise, true AP and lateral): Normal
MRI of the Knee: Normal ACL and PCL. Moderate knee effusion. Contusion of the lateral femoral condyle and the anterolateral tibial plateau.
CT scan of the Knee: Cortical break in the lateral tibial plateau anteriorly

FINAL WORKING DIAGNOSIS:

TREATMENT AND OUTCOMES:

1. Non-operative treatment: crutches until free of symptom (3 weeks) then progressive weight bearing
2. Ibuprofen 800 mg up to three times per day prn for two weeks; cryotherapy daily
3. Conditioning only at gymnastics with no WB on extremity for 6 weeks followed by slow progression back to sport
4. Returned to gymnastics at 3 months?

A-27 Clinical Case Slide - Neurological

Wednesday, May 27, 2020, 9:30 AM - 11:30 AM
Room: CC-2022

149 **Chair:** Kathryn E. Ackerman, FACSM. *Boston Children's Hospital, Boston, MA.*
(No relevant relationships reported)

150 **Discussant:** James Dunlap, FACSM. *Maine-Dartmouth Sports Medicine, Augusta, ME.*
(No relevant relationships reported)

151 **Discussant:** Terry Nicola, FACSM. *UIC Sports Medicine Center, Chicago, IL.*
(No relevant relationships reported)

152 May 27 9:30 AM - 9:50 AM Isolated Infraspinatus Weakness Due To Suprascapular Neuropathy In A National Level Volleyball Player

Jason Lou¹, Daniel Krasna¹, Terry Nicola, FACSM². ¹Schwab Rehabilitation Hospital/University of Chicago, Chicago, IL. ²University of Illinois, Chicago, Chicago, IL.
(No relevant relationships reported)

HISTORY: 15-year-old female national-level volleyball player with no PMH who presented for nagging right shoulder pain and subjective right arm weakness for 1.5 years. The patient did not endorse a specific inciting injury. The pain was located at the anterolateral aspect of the deltoid with radiation down the arm without numbness or tingling, made worse with volleyball activity and made better with rest. Due to her continued pain and right shoulder weakness, she was held from participating in volleyball matches. MRI arthrogram was negative for pathology, so she was referred for EMG.

PHYSICAL EXAMINATION: General Appearance: Young Caucasian female in no acute distress

Musculoskeletal: 4 out of 5 strength at right shoulder external rotation. 5 strength in bilateral upper extremities otherwise. No atrophy of the bilateral shoulder muscles. Normal bilateral scapulothoracic movement. Full range of motion at the bilateral upper extremities. Bilateral shoulders non-tender to palpation over the anterior, lateral, or posterior aspects. Neck non-tender to palpation. No pain noted with cervical neck flexion, extension, or rotation.

DIFFERENTIAL DIAGNOSIS: 1) Labral Tear 2) Rotator Cuff Tendinopathy 3) Suprascapular nerve palsy at the spinoglenoid notch

TEST AND RESULTS: Bilateral upper extremity EMG: On nerve conduction studies, no response obtained from the right infraspinatus, response normal at the suprascapular when stimulating at Erb's point. On needle EMG, 4+ fibrillations and no recruitment seen at the right infraspinatus; normal suprascapular. Electrodiagnostic evidence suggestive of a right suprascapular nerve neuropathy selectively affecting the infraspinatus. Findings compatible with suprascapular nerve palsy proximal to or at the spinoglenoid notch.

FINAL WORKING DIAGNOSIS: Suprascapular neuropathy selectively affecting the infraspinatus due to repetitive overhead activity.

TREATMENT AND OUTCOMES: The patient was prescribed a 4-week course of physical therapy for range of motion exercises and shoulder rotator cuff muscle strengthening. She was advised to initiate a return-to-play graduated exercise program after completion of PT based on strength and tolerance to pain. The patient's pain significantly improved with PT and rest. She was able to return to competitive play within 8 weeks.

153 May 27 9:50 AM - 10:10 AM

Unilateral Pectoralis Atrophy

Stefanie Lewis. *Maine Dartmouth, Augusta, ME.* (Sponsor: James Dunlap, MD, FACSM)
(No relevant relationships reported)

History:

A 49 year old male, right hand dominant, referred for evaluation of right sided pectoralis weakness and atrophy first noted incidentally 2 months prior at routine physical. He subsequently noted weakness as he was no longer able to do bench press or even a single push-up which were standard exercises in his workout routine. He

denied any history of specific injury or inciting event. Further questioning revealed numbness of the 2nd and 3rd fingers on the right. Notably he did not have any neck or shoulder pain.

Physical Examination:

Visual inspection revealed right sided pectoralis atrophy and winging of the inferior border of the scapula on the right. There was no tenderness to palpation in the cervical spine or shoulder girdle. There was full active cervical and shoulder range of motion without pain. Strength testing was normal and symmetric aside from weakness with forearm supination on the right compared to the left. Spurling test of the cervical spine was negative bilateral. Patient noted mild sensory deficits in the 2nd and 3rd digits on the volar aspect on the right. Normal radial and ulnar pulses bilateral.

Differential Diagnosis:

- 1) Pectoral nerve entrapment
- 2) Brachial plexopathy
- 3) Cervical radiculopathy

Test and Results:

EMG/NCS

-Electrodiagnostic evidence of multiple right cervical radiculopathy, mostly involving C5 and C6 roots. Incidental finding of mild right ulnar neuropathy.

MRI C spine

-Right-sided hypertrophic changes are seen about the Luschka joints at C3-C4, C5-C6 and C6-C7. Most prominent at C5-C6 where there is moderate to severe narrowing. No evidence of disc herniation, canal stenosis or cord effacement.

Final Working Diagnosis:

Cervical radiculopathy, primarily of the C6 nerve root. As the imaging findings did not fully correlate with physical exam findings and EMG findings, patient was referred to neurosurgery for consultation and second opinion which is currently pending.

Treatment and Outcomes:

Provided neurosurgery recommends non-operative treatment patient will be referred to physical therapy to regain appropriate strength in hopes of returning to his prior workout routine.

154 May 27 10:10 AM - 10:30 AM

Arm Weakness In A Recreational Weightlifter

Ashkan Alkhamisi. *University of Florida, Gainesville, FL.*

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(No relevant relationships reported)

HISTORY:

A 47-year-old RHD male presented to sports medicine clinic with 3-4 month history of left shoulder weakness. He first noticed the weakness while working out, specifically during overhead shoulder press. He denied any specific injury or trauma of his left shoulder. He reported intermittent pain extending from the posterior shoulder to his neck. Pain was described as dull. Pain was 2/10 at rest and 4/10 with overhead activity. The patient noticed progressive muscle atrophy in his posterior shoulder region since the onset of symptoms. He denied any numbness or tingling of the left arm. Denied any recent illnesses. He denied prior treatment for this issue, including PT, injections, or surgeries.

Physical Exam:

General: No acute distress. Left shoulder: No swelling or erythema. Notable atrophy of body of infraspinatus. Sensation intact to light touch. Normal range of motion in all directions. Strength 5/5 with shoulder abduction, forward flexion, and internal rotation. Strength 3/5 with external rotation with elbow at side. Negative Empty Can, Drop Arm, Hawkins', Neer, O'Brien, and Speed's tests.

Differential Diagnoses:

1. Rotator cuff tendinopathy
2. Ganglion cyst at spinoglenoid notch
3. Subacromial impingement syndrome
4. Cervical radiculopathy
5. Brachial plexopathy
6. Parsonage-Turner Syndrome

Initial Test and results:

AP, Axillary, lateral xray views of left shoulder were normal. MRI left shoulder indicated supraspinatus and infraspinatus muscle edema without tendon tear without space-occupying lesion. EMG/NCS indicated focal conduction abnormality of the suprascapular nerve proximal to the level of the supraspinatus muscle and distal to the brachial plexus.

Final Diagnosis:

Suprascapular Nerve Entrapment

Treatments and Outcomes:

Patient was referred to orthopaedic surgery and recommended shoulder arthroscopy for suprascapular nerve release. During the case the surgeon noted a small cyst at the spinoglenoid notch (not apparent on MRI imaging). 2 weeks post-op, the patient reported doing light daily activities with no pain or weakness. 4 weeks post-op patient was asymptomatic performing home exercises up to 5x/week. He returned to activities as tolerated with no restrictions.

155 May 27 10:30 AM - 10:50 AM

Foot Drop In A Runner: A Novel Treatment For An Uncommon Problem

Ross Quinn Osborn. *The Center for Health and Sports Medicine, Fruit Cove, FL.* (Sponsor: James Churilla, PhD, MPH, MS, FACS, FACS)

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(No relevant relationships reported)

History: A 59-year-old recreational runner presented to the office with right sided foot pain and weakness, which began insidiously 3 weeks prior and mostly noticed with plantar flexion while running and improved but not resolved by non-weightbearing. He noticed diffuse, minimal swelling around the foot, but no bruising or numbness. Celecoxib offered minimal relief and he had no history of injury to the foot nor was he complaining of any pain in the knee or opposing foot. He underwent a 6-week course of physical therapy and home exercise program. He returned 5 weeks later with worsening weakness in the foot, to the extent of having foot drop in the foot. There was no significant history of injury to the back or knee, nor was he complaining of pain in either. He was referred to a neurologist, who performed a nerve conduction study, revealing a peroneal nerve entrapment, prompting referral for MRI of the right knee. **Physical Examination:** Initial exam revealed diffuse mild swelling around the ankle. His active dorsiflexion lacked 20 degrees when compared to the left and he reported pain with resisted eversion and dorsiflexion of the foot. His resisted dorsiflexion was 3/5 and eversion was 4/5.

Follow up exam 5 weeks later demonstrated 1/5 strength with resisted dorsiflexion and 3/5 with eversion, but normal sensation and patellar and Achilles reflexes. Examination of the lumbar spine was negative. There was no atrophy.

Differential Diagnosis:

1. Peroneal nerve entrapment
2. Anterior tibial tendonitis
3. Peroneal tendon strain
4. Osteoarthritis

Tests and Results:

X-ray, right ankle/foot - minimal osteoarthritic changes diffusely in the tarsal bones. Calcifications within the Achilles tendon.

Ultrasound - swelling around the anterior tibial tendon and hypochoic signal in the peroneal tendon.

NCS - peroneal nerve entrapment

MRI - periarticular ganglion extending into proximal calf

Final Working Diagnosis: peroneal nerve palsy secondary to periarticular ganglion

Treatment:

1. Ultrasound guided aspiration of the ganglion, with corticosteroid injection following aspiration
2. Repeat physical therapy course following aspiration
3. Medical weight loss program
4. Gait assessment prior to return to running

The patient experienced a full recovery 3 months after aspiration and has resumed running at his previous level.

156 May 27 10:50 AM - 11:10 AM

Arm Pain And Weakness In A Soccer Player

Melissa Lau, Jeffrey Strakowski. *Ohio State University,*

Columbus, OH.

(No relevant relationships reported)

HISTORY Patient is a 17 year old right hand dominant male soccer player with history of infectious mononucleosis. He complains of spontaneous, progressive distal right upper limb weakness and cramping for one year. His cramping pain is 1-4/10 in severity, worse with exercising. He has early fatigue and approximately 30% of his baseline strength in his elbow, wrist and finger extensors; he denies neck pain, numbness, paresthesias or history of stingers. He reports no lower limb involvement, incontinence or gait disturbances.

PHYSICAL EXAMINATION: MSK:-ROM: Neck, bilateral upper limb ROM intact -Strength: **RUL:** 5/5 SAb; 5/5 EF; 5/5 EE; 4+/5 WE; 3+/5 FE; 5/5 FF LUL, RLL, LLL: 5/5 in all muscles -Palpation: No palpable mass, edema in forearm/arm

Neuro: -Provocative: +Tinel along dorsal aspect of RUL brachium -Sensation: grossly intact -Cranial nerves: grossly intact -Reflexes: 1+ biceps, triceps, brachioradialis bilaterally

DIFFERENTIAL DIAGNOSIS: -Radial nerve neuropathy -Posterior cord brachial plexopathy -Peripheral nerve sheath tumor (eg schwannoma, neurofibroma) -Diffuse neuritis -Soft tissue mass

TEST AND RESULTS: -MRI R wrist, forearm, arm (with and without contrast): Area of mild enlargement around the spiral groove (possible cyst vs tumor) -PET scan: No suspicious focal uptake or other evidence of malignancy -NCS/EMG 4/2018: severe right radial neuropathy proximal to the brachioradialis and distal to the triceps brachii/anconeus innervation -Ultrasound 4/2018: Enlargement of the radial nerve near the

spiral groove. Hypochoic central fascicles (ie the motor axons); normal appearing peripheral fascicles (ie the sensory axons). Fascicle enlargement is consistent with a demyelinating process, not an axonal process

FINAL WORKING DIAGNOSIS: Neuralgic amyotrophy AKA Parsonage-Turner Syndrome

TREATMENT AND OUTCOMES: He underwent physical therapy without improvement in symptoms. However, NCS/EMG revealed a demyelinating process that was consistent with spontaneous or autoimmune process such neuralgic amyotrophy; ultrasound revealed mostly motor axonal involvement. He opted for conservative management, monitoring for spontaneous improvement. He did not seek further follow up.

157 May 27 11:10 AM - 11:30 AM

Hockey Player With Weakness In His Extremities

Ima Vera Jonkheer, D.O., MSc, Philip F. Skiba, D.O., Ph.D.
Advocate Lutheran General Hospital, Park Ridge, IL.

(No relevant relationships reported)

HISTORY: A 63 yo M hockey player w/ PMhx of OA, HLD, kidney stones, & chronic pupillary anisocoria presented to the ED after 24 hours duration of LE weakness & paresthesias in both hands. He also reported difficulty ambulating. He denied trauma, new ingestions, pain, visual disturbances, incontinence of bowel/bladder, or recent travel. He admitted to recent sick contacts in his family & a personal hx of preceding flu-like illness 2 weeks prior from which he recovered with no apparent sequelae.

PHYSICAL EXAMINATION: Vitals: HR 120s, BP 160-275/100-175. Gen: NAD. Neck: No bruits, full ROM w/o pain/meningeal signs. HEENT: B/L pupils reactive to light; L>R pupil. CV: Tachycardic. Chest: Clear, non-labored. Abd: Soft, BSx4. Back: No tenderness. Skin: No rash. Neuro: A&Ox3, no facial droop, uvula midline, speech clear, neg pronator drift, tone normal. Strength test: deltoid 5 R&L, bicep 4+ R&L, tricep 4+ R&L, hand intrinsic 5- R&L, psoas 4+R, 5-L, quad 5- R&L, hamstring 4+ R&L, tibialis 5 R&L, gastroc 5 R&L. Light touch/vibratory/pinprick sensations intact. Reflexes 2-. Difficulty lifting R>L leg to walk.

DIFFERENTIAL DIAGNOSIS: 1. Acute inflammatory demyelinating polyradiculoneuropathy 2. Acute inflammatory myopathy 3. Myasthenia gravis
TEST AND RESULTS: LABS: Hgb 18.9 gm/dL, Hct 51.5%, Total protein 9.2 gm/dL, CK: 625 units/L, DDimer: 0.70 mg/L, IMAGING: CXR Neg, CT Head Neg, CT Chest/Abd/Pelvis Neg

FINAL WORKING DIAGNOSIS: Acute Inflammatory Demyelinating Polyradiculoneuropathy (Guillain-Barré Syndrome)

TREATMENT AND OUTCOMES: 1. Neurology assessed in the ED, w/ hx of antecedent URI, progressive weakness, preserved sensation w/areflexia, novel hypertension/tachycardia representing dysautonomia, recommended LP. 2. LP consistent w/ AIDP w/ elevated protein, admitted & started on IVIG 2g/kg divided over 3 days monitored in Neuro Tele Unit. 3. PT/OT while inpatient & PM&R admission after hospitalization. 4. Underwent prolonged course of PT for LE/UE weakness for 1 year initially requiring assistive devices including walker/cane, slowly normalizing gait over time. 5. Completed PT, assessed by Sports Med for gradual return to sport program focused on strength training, cardiovascular conditioning, & diet modification w/ inc protein. 6. Continues to follow w/ Neuro, Sports Med, & PM&R for intermittent weakness.

A-40 Free Communication/Poster - Recovery

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

185 Board #1 May 27 9:30 AM - 11:00 AM

EFFECTS OF CONTRAST WATER THERAPY ON THE RECOVERY OF HEART RATE VARIABILITY FOLLOWING ECCENTRIC EXERCISE

Hsing Yu Kang, Wei Chin Tseng, Szu Kai Fu, Yen Min Teng, Jo Ning Chang, Cheng Hsiu Lai. *University of Taipei, Taipei City, Taiwan.*

(No relevant relationships reported)

Abstract

Purpose: The aim of this study was to compare the effects of hot/cold immersion therapy and passive recovery following maximal eccentric exercise of the bilateral knee extensors on heart rate variability.

Methods: 14 health college males (18-22 yrs) were recruited and randomly assigned into the contrast water therapy (CWT) or passive recovery (CON) group (n=7 per group). Each participant performed 10 sets of 10 maximal isokinetic (30°/s) eccentric contractions (MaxECC) of each knee extensors. Contrast water therapy (8°C × 1 min and 45°C × 4 minutes, 3 reps), or the passive recovery interventions (15-min

consecutive rest) were taken at 30 minutes post-MaxECC. Heart rate variability (HRV) parameters were collected by the portable heart rate monitor at 5 mins before, and 0-5, 10-15 and 25-30 mins after interventions.

Results: During the first 5 mins after interventions, mean HR (95.4 ± 11.1 bpm) and the normalized units of high frequency power (23.6 ± 10.3 nu) of the CWT group showed significantly higher value than the CON group (81.5 ± 11.6 bpm, 18.5 ± 9.0 nu; $P < 0.05$), the mean R-R intervals (636.8 ± 78.8 ms), the standard deviation of normal R-R intervals (26.1 ± 6.6 ms) and the square root of the mean squared differences between adjacent R-R intervals (17.2 ± 7.7 ms) for CWT showed significantly lower than that of CON (749.3 ± 105.4 ms, 46.1 ± 17.7 ms, 33.0 ± 12.8 ms; $P < .05$). However, 10-15 and 25-30 mins after interventions, all HRV parameters between the two groups showed no significant difference ($P > .05$).

Conclusion: These findings supported the hypothesis and suggested that one session of 15 mins CWT after eccentric exercise could be increased parasympathetic-related activation in cardiac autonomic regulation, but the effect only lasting for 10 mins.

Keywords: autonomic nervous system, parasympathetic activation, normalization of high-frequency power

186 Board #2 May 27 9:30 AM - 11:00 AM

The Effects Of Contrast With Compression Therapy On Muscle Recovery Post Exercise

Shabnam Lateef, Ryan Oakley, Vinny Colantuno, Robert Lavellee, Anders LaFortune, Disa L. Hatfield, Jonathan McLinden, Jacob E. Earp. *University of Rhode Island, Kingston, RI.*

Reported Relationships: S. Lateef: Industry contracted research; Solid State Incorporated.

Intense eccentric exercise causes muscle damage that leads to a decrease in subsequent performance. Accelerating muscle recovery between bouts of exercise minimizes the risk of injury and is essential for optimal athletic competitive performance.

PURPOSE: The purpose of this study was to determine if the contrast with compression (CwC) therapy proprietary device by Solid State Inc was able to improve muscle recovery post intense eccentric exercise. **METHODS:** Ten physically active men (age = 21.3 ± 2.1 years; height = 182 ± 8.5cms; weight = 88 ± 19.5kg; body fat = 17.2 ± 7%) completed two separate single-arm elbow flexor workouts on an isokinetic dynamometer. After one workout each participant received contrast with compression (CwC) therapy immediately after, 24h and 48h after the workout. After the other workout the same person received no treatment (CON). Post-exercise recovery of selected characteristics were measured at 1h, 24h, 48h and 72h. Comparisons were made between the CwC and CON groups using a Mixed Model ANOVA with repeated measures to identify time effects and an ANCOVA was used to identify interaction effects. A Bonferroni post-hoc test was used to assess timepoint differences in between interventions in recovery post eccentric exercise. A $p \leq 0.05$ was used for all analysis.

RESULTS: CwC therapy post exercise resulted in a significantly faster recovery rate of strength and power to baseline levels ($p = 0.00$) as well as a greater recovery of overall relative strength ($p = 0.004$). Treatment with CwC significantly suppressed the post-exercise inflammatory response ($p = 0.05$) and significantly reduced the secondary muscle damage response as measured by levels of Creatine Kinase post exercise. CwC therapy also resulted in a significantly quicker recovery of the maximal elbow flexion range of motion ($p = 0.00$) within the hour post exercise. Lastly, participants experienced significantly less soreness 48 hours and 72 hours post-exercise with CwC therapy. **CONCLUSION:** Contrast with compression therapy significantly increases the recovery rate of muscle strength and power post eccentric exercise. CwC is also effective at reducing exercise associated muscle damage, delayed onset muscle soreness and mitigates the loss of range of motion post intense exercise.

187 Board #3 May 27 9:30 AM - 11:00 AM

An Examination Of The Effects Of Various Procedures To Improve Delayed Onset Muscle Soreness

Michael Vela, Amanda Skaggs, Andrew Gutierrez, Caitlin Tagle, Kevin Canales, Mayra Limas, Gabriel Figueroa, Ulku Karabulut, Murat Karabulut, FACSM. *University of Texas Rio Grande Valley, Brownsville, TX.*

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(No relevant relationships reported)

PURPOSE: To examine the acute effects of various recovery methods on delayed onset muscle soreness (DOMS). **METHODS:** Following intense DOMS-inducing exercise, nine males (age = 23.6 ± 2.4 years) were exposed to three treatment conditions (foam rolling (FR); body tempering (BT); blood flow restriction (BFR)) or control in a random order. Resting blood pressures were observed and recorded each laboratory visit. Subjects warmed up with a 5-minute treadmill walk at a speed of 3.5 mph at 0% grade and performed three vertical jump (VJ) tests. The DOMS protocol consisted of 5 sets of leg extensions at 85%1RM until failure. Each repetition required a one-second of concentric contraction followed by a four-second of eccentric contraction. Soreness levels were objectively (Force Gauge; FG) and subjectively

(Likert Scale; LS) measured. Participants received a randomized treatment 24 and 48 hr. after their respective exercise session for a 20-minute period. VJ tests identical to the pretest were executed prior to treatment and 24 and 48 hr. after each treatment. A leg extension endurance test was performed until failure 48 hr. after treatment. **RESULTS:** Significant time main effects ($p < .05$) were indicated for subjective and objective pain perception. VJ values were significantly lower 48 hr. after inducing DOMS compared to the values recorded on the first day ($p < .05$). Our results also demonstrated that FR significantly increased muscular endurance performance when compared to the BFR treatment ($p < .05$) and there was a trend for improved endurance performance for FR compared to control ($p = .06$). Furthermore, a trend for a better endurance performance existed when using BT treatment as opposed to control ($p = .06$). **CONCLUSION:** This study suggests that FR was a more effective treatment method compared to BFR. Prior research suggests that applying external pressure to muscle following DOMS may aid in muscle adhesion separation, promote vasodilation and O₂ delivery, and stimulate mitochondria and energy production due to increased blood volume. Therefore, our findings also indicate that FR and BT may serve as practical modes of treatment for DOMS due to one or a combination of factors such as improved O₂ delivery, increased waste product removal from the muscle, and augmented restoration of the muscles' length-tension relationship.

188 Board #4 May 27 9:30 AM - 11:00 AM
Effects Of Different Non-pharmacological Methods On Recovery From Delayed Onset Muscle Soreness

Tabitha Abraham, Zulema Mendez, Roel Ruiz, Marcos Cruz, Robert Martinez, Sael Elizondo, Concepcion Chapa, Ulku Karabulut, Murat Karabulut, FACSM. *University of Texas Rio Grande Valley, Brownsville, TX.*
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 (No relevant relationships reported)

PURPOSE: To investigate the effects of diverse recovery methods on delayed onset muscle soreness (DOMS) and muscle performance. **METHODS:** Ten healthy males (age = 24.1 ± 3.2 years; height = 173.3 ± 7.7 cm; weight = 81.5 ± 17 kg) participated in a crossover study with three randomized recovery treatment methods that were foam rolling (FR), Theragun (TGUN), or vibration platform (VP). The first session started with a 5-min seated rest, followed by the recording of the subjects' resting systolic blood pressure (RSBP) and heart rate (HR) values. The subjects warmed-up on a treadmill at 4.5 mph, 0% gradient, for 5-min. Three trials of vertical jump (VJ) test were performed and the best jump performance was recorded. Subjects continued to leg extensions, which consisted of 1 warm-up set and then 4 sets at 80-85% of one repetition maximum (1-RM) until failure to induce DOMS. Rep tempo involved 1-sec concentric and 3-sec eccentric contractions. Subjects returned on day 2, which included 5-min rest followed by RSBP and HR measurements, then soreness levels were measured with Likert scale and Forge Gage. The subjects warmed-up on a treadmill, followed by the recovery method chosen for that session. VP consisted of 10 1-min sets with 1-min rest in between. FR and TGUN were used for 10-min on each side of the lower limb with 1-min rest in between. Following recovery methods, subjects repeated VJ test and leg extension exercises and number of reps were recorded. The exact procedure of day 2 was performed on day 3. **RESULTS:** A significant main effect for condition with the VP method showing higher RSBP values than the TGUN ($p < 0.01$). There were significant condition*time interaction and condition and time main effects for the total number of reps ($p < 0.03$). A higher number of reps performed following TGUN compared to VP and higher number of reps were performed on day 1 compared to day 2 ($p < 0.03$), with no contrast between day 1 and day 3. Significant time main effect was also seen in VJ values, suggesting day 1 values were higher compared to day 2 ($p < 0.05$) and day 3 values ($p < 0.05$). **CONCLUSION:** The results suggest that TGUN is an effective recovery method for reducing soreness, which can be attributed to higher muscle adhesion breakdown, and/or increased blood flow and O₂ delivery to the muscle, and/or reduced pain perception due to inhibition of nociceptor activity.

189 Board #5 May 27 9:30 AM - 11:00 AM
The Influence Of Flotation Restricted Environmental Stimulation Therapy On Recovery From High Intensity Resistance Exercise

Lydia K. Caldwell, Emily M. Post, Matthew K. Beeler, Brian C. Focht, FACSM, Jeff S. Volek, Carl M. Maresh, FACSM, William J. Kraemer, FACSM. *The Ohio State University, Columbus, OH.*
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 (No relevant relationships reported)

Flotation-restricted environmental stimulation therapy (flotation-REST) attenuates afferent nervous system signaling to promote relaxation of the body and mind. Despite limited research, the intervention has become increasingly popular among high performance populations (e.g., athletes, military) seeking to accelerate recovery and enhance performance readiness. **PURPOSE:** to determine whether flotation-REST

augments recovery from high intensity resistance exercise known to induce significant metabolic, adrenergic and mechanical stress. **METHODS:** Eleven resistance trained males (age: 22.5± 2.3 years; height: 176.4±6.0 cm; weight: 85.7±6.2 kg; back squat 1RM: 153.1±20.1 kg; strength to weight ratio: 1.8±0.2) participated in a randomized, crossover-controlled research study. In one testing block high intensity resistance exercise (6 x 10 back squats at 80% 1RM, 2 min rest) was followed by a one-hour flotation-REST session, while recovery in the remaining block consisted of a sensory stimulating control. Markers of neuroendocrine signaling (catecholamines, cortisol, testosterone), structural damage (myoglobin, creatine kinase), inflammation (IL-6, TNF-alpha) and psychological perception (soreness, mood, fatigue) were measured before exercise (PRE), immediately post exercise (IP), post 1-hour recovery (1R), twenty-four hours post exercise (+24) and forty-eight hours post exercise (+48). Mean differences were assessed using repeated measures ANOVA with pairwise post-hoc comparisons ($p \leq .05$). Effect sizes (ES) were calculated to evaluate magnitude of significant treatment differences. **RESULTS:** Flotation-REST significantly decreased soreness across the 48-hour recovery period (ES, 1R: 0.68, +24: 0.47, +48: 0.28). Immediate improvements in positive affect (ES, 1R: 0.74), negative affect (ES, 1R: 1.03) and fatigue (ES, 1R: 1.13) were accompanied by differences in neuroendocrine signaling. Norepinephrine was significantly reduced (ES, 1R: 0.99) and testosterone significantly increased (ES, 1R: 0.32) in flotation-REST compared to control. No treatment differences were displayed for structural damage or inflammation. **CONCLUSION:** The data suggest a positive impact of flotation-REST in the first 48 hours of recovery, particularly where psychological appraisal is involved.

190 Board #6 May 27 9:30 AM - 11:00 AM
Effects Of Foam Rolling For Delayed-onset Muscle Soreness On Military Performance And Perceived Recovery

Veronika Pribyslavskaya, Brianna Sayer, Brian Church, Lance Bryant, Eric Scudamore. *Arkansas State University, Jonesboro, AR.*
 (No relevant relationships reported)

Table 1. Results of military performance tasks for baseline, foam roll, and passive recovery sessions (mean ± SD)

Recovery method		Baseline	Foam roll	Passive	p	η ² _{partial}
SC	Peak	13.7 ± 3.4	13.3 ± 3.4	13.5 ± 3.7	.293	.062
	Mean	14.7 ± 4.1 [†]	13.8 ± 3.8	14.2 ± 4.4	.038	.625
CC	Peak	10.8 ± 1.8	10.8 ± 1.6	11.1 ± 1.9	.118	.109
	Mean	11.2 ± 2.1	11.1 ± 1.6	11.6 ± 2.1 [†]	.047	.582
AC	Peak	12.7 ± 3.7	12.8 ± 3.0	13.4 ± 3.6 ^{†*}	.011	.224
	Mean	13.1 ± 3.7	13.3 ± 3.2	13.9 ± 3.6 ^{†*}	.003	.270
SR	Peak	49.0 ± 7.5	50.3 ± 7.7	50.9 ± 8.4 [*]	.036	.162
	Mean	50.1 ± 8.2	51.4 ± 7.5	52.3 ± 8.9 [*]	.034	.164

Note. AC = simulated Ammunition can Carry; CC = Cover to Cover sprint; s = seconds; SC = Stair Climb; SR = Shuttle Run
[†]statistically slower than baseline, ^{*}statistically slower than foam roll, α = < .05

PURPOSE: Evaluate the effects of post-exercise foam rolling (FR) and passive recovery (PR) on short-term symptoms of delayed-onset muscle soreness (DOMS) and military performance tasks (MPT). **METHODS:** Twenty participants (23.6 ± 4.1 years) completed a baseline session that included four MPTs: 1) stair climb, 2) cover-to-cover sprint, 3) ammunition can carry, and 4) 200-yd shuttle run. All tasks were completed while participants wore a 12-kg weighted vest and timed using photocell laser timing gates. Participants then completed two experimental sessions that included a DOMS-inducing exercise protocol followed by either a 20-min FR or 20-min PR, and a follow-up MPT test 24 hours later. Ratings of perceived exertion (RPE) were measured after each MPT. Ratings of muscle pain (RMP) were assessed prior to MPT and after FR and PR. A one-way repeated measures ANOVA was used to compare peak and mean MPT times across baseline, FR and PR sessions. If necessary, a post-hoc pairwise comparison with least significant difference was performed. Friedman test compared perceptual variables between the three sessions. Wilcoxon matched-pairs signed-ranks test evaluated post-recovery RMP between FR and PR. **RESULTS:** MPT times after PR were slower than baseline or post-FR measurements (Table 1). MPT mean and peak times differed for all but two tasks. In addition, a medium-large effect size was found for all variables. Post-recovery RMP approached significance ($p = .06$) showing a slightly lower median of 3.0 (IQR 2.3 - 4.0) for FR compared to a median of 4.0 (IQR = 3.0 - 6.0) for PR. There was no difference ($p = .21$) in RPE across the sessions. Similarly, no difference ($p = .09$) was found for RMP assessed before each MPT session. **CONCLUSION:** FR appears to be an effective and practical recovery

method for mitigating the negative performance effects associated with DOMS. Given the importance of military readiness, practitioners should consider including FR after strenuous exercise.

191 Board #7 May 27 9:30 AM - 11:00 AM
The Effects Of Foam Rolling On Exercise Induced Muscle Damage

Lauren M. Visconti, Brandon Beimborn, Kurt Escobar, Joshua A. Cotter, FACSM, Evan E. Schick. *California State University, Long Beach, Long Beach, CA.*

(No relevant relationships reported)

Exercise-induced muscle damage (EIMD) occurs following strenuous and unaccustomed exercise. EIMD is associated with elevated creatine kinase (CK) blood concentrations, limitations in range of motion (ROM), and cellular swelling. EIMD may negatively affect training quality and performance thus methods to mitigate EIMD may be useful to resistance training populations. Self-myofascial release, in particular foam rolling (FR), has been utilized by competitive and recreational athletes to ameliorate the effects of EIMD. However, the effect of FR on EIMD has yet to be established. **PURPOSE:** The purpose of this study is to investigate the effect of FR on markers of EIMD after an acute bout of high volume resistance exercise. **METHODS:** Eight participants (five males and three females), between the ages of 18 and 35, completed two acute resistance exercise bouts (10 sets of 10 repetitions barbell back squat at 60% 1RM) separated by a minimum of seven days. Following one exercise bout, subjects performed FR targeting the thigh (i.e. hamstrings and quadriceps), the shank (i.e. calf and tibialis anterior), and the gluteus maximus immediately post, 24, and 48 hours post exercise, while no FR was performed following the alternate bout (CON). In both conditions, participants were asked to refrain from additional recovery methods following exercise. Outcome measures included serum CK, hip ROM, knee ROM, and thigh circumference. All measurements were pre-exercise, immediately post, 24, and 48 hours post. **RESULTS:** There was a significant increase in serum CK from pre to 24 hours post ($p = 0.04$), as well as 24 and 48 hours post ($p = 0.04$). Hip ROM ($p = 0.02$) and knee ROM ($p = 0.03$) decreased and thigh circumference ($p = 0.03$) increased 48 hours post exercise. No significant differences between FR and CON were found for any measures. **CONCLUSION:** FR does not attenuate markers of muscle damage (i.e. serum CK, hip ROM, knee ROM, and thigh circumference) after an acute bout of high volume resistance training. This study suggests that despite its common practice, FR may not be an effective strategy for mitigating EIMD.

192 Board #8 May 27 9:30 AM - 11:00 AM
Artificial CO₂-water Immersion Facilitates Recovery From Muscle Fatigue Caused By High Intensity Anaerobic Exercise

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(No relevant relationships reported)

In response to the CO₂-water (CO₂ ≥ 1000 ppm) immersion, the reduction of sympathetic nerve activity may imply the facilitation of muscle fatigue recovery. **PURPOSE:** In the present study, we investigated whether the whole body bath with CO₂-water influences recovery of the muscle fatigue after high intensity exercise. **METHODS:** The healthy male college students ($n=6$, 18-21yrs, 171.3±6.7cm, 73.6±13.0kg) participated in this study. The cycle ergometer work tests lasting 30 seconds were used to estimate anaerobic power with leg pedaling exercises. Exercise loads of the tests were 0.075kp per body weight. Anaerobic power was determined by measuring the highest power output during 30 seconds. Core temperature (CoreT) and ECG were recorded continuously throughout the experiment. The subjects performed 30-s maximal pedaling exercise, and took bath in tap- or CO₂-water at 35 °C for 10 minute after exercise. Subjective thermal sensation (TS) in the body bath was also recorded. Vastus lateralis (VL) dominant muscle hardness using the elastography, muscle pain by visual analog scale (VAS), and blood lactate (BLa) and were evaluated at pre- and immediately after-exercise, and at 10 min after exercise. **RESULTS:** The strain ratio (SR) between the VL and a reference material was calculated. TS in the CO₂-water was significantly higher than in the tap-water (tap-water vs. CO₂-water, $-0.17±0.76$ vs. $1.17±0.41$, $p<0.01$). At 10 min in recovery, in the CO₂-water compared with the tap-water, SR significantly decreased quicker ($0.49±0.25$ vs. $0.91±0.25$, $p<0.01$). However, there was no significant difference in CoreT, BLa and VAS between these two water kinds. **CONCLUSIONS:** We reported previously that the muscle blood flow in the immersed part was larger in CO₂-water than tap-water of a same temperature. In addition to a local effect of CO₂, suppression of muscular sympathetic activity may also contribute to the increase in local blood flow. Facilitation of muscle hardness recovery shown in this study might be caused by the increased muscle blood flow. The present results suggested that CO₂-water immersion may contribute to rapid recovery from the muscular hardness induced by high intensity exercise.

193 Board #9 May 27 9:30 AM - 11:00 AM
Neuromuscular, Endocrine, And Perceptual Recovery Following A Youth American Football Game

Jon K. Davis, Anthony S. Wolfe, Steven A. Basham, Eric C. Freese. *GSSI Frisco, Frisco, TX.*

Reported Relationships: J.K. Davis: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..

PURPOSE: American football is a high-intensity intermittent sport consisting of various movements and repeated collisions which makes recovery from a game challenging to adequately prepare for the next competition. Therefore, the purpose of this study was to determine the time course of recovery assessed by neuromuscular function, salivary biomarkers, and perceptual fatigue following a youth American football game. **METHODS:** Thirteen male American football youth athletes were monitored for 7 days following a single football game. Baseline measures were taken at 28h pre-game for lower body neuromuscular function via countermovement jumps (CMJ) to determine peak power (PP), jump height (JH), flight time (FT), and takeoff velocity (TOV). Saliva was analyzed for cortisol, testosterone, and C-reactive protein (CRP). Perceptual recovery was assessed by modified profile of mood states (POMS), perceived recovery status (PRS), and a daily wellness questionnaire consisting of four 10-point Likert scale questions examining stress, muscle soreness, sleep quality, and energy. These measures were repeated immediately post-game (30min), and at 20h, 44h, 68h, 92h, 116h, 140h post-game. **RESULTS:** Compared to baseline values there was a significant decrease ($p<0.05$) in CMJ PP, JH, TOV up to 68h post-game and FT 44h post-game. No significant difference existed among time points for salivary testosterone and CRP. Salivary cortisol concentration significantly increased following the game (baseline $0.12±0.09\mu\text{g/dl}$, post-game $0.34±0.25\mu\text{g/dl}$; $p<0.05$). Daily wellness ratings for energy were significantly decreased (baseline $7.2±1.6$, post-game $4.7±2.4$; $p<0.05$) while daily wellness ratings for soreness were significantly increased (baseline $4.6±2.6$, post-game $6.3±1.3$ ($p<0.05$) immediately following the game. POMS total mood disturbance, significantly increased (baseline $-1.5±7.0$, post-game $15.6±9.4$; $p<0.05$) following the game. Athletes PRS exhibited a significant decrease in recovery up to 44h post-game ($p<0.05$), similar to the decrease in neuromuscular function. **CONCLUSION:** Neuromuscular function and PRS are impaired for up to 44-68h post-game. Coaches should consider the time course of post-game recovery when implementing practices and strength training to ensure adequate recovery from competition.

194 Board #10 May 27 9:30 AM - 11:00 AM
Effects Of Respiratory Impedance On Performance And Recovery

Ro-Anne Khrystel Galleta, Julia C. Robbert, Peggy A. Plato. *San Jose State University, San Jose, CA.* (Sponsor: Craig J. Cisar, FACSM)

(No relevant relationships reported)

Respiratory impedance has been studied as a possible countermeasure against fatigue during repeated bouts of high-intensity exercise. By creating resistance during inspiration, an impedance threshold device (ITD) decreases intrathoracic pressure and pulls more blood back to the heart, resulting in increased stroke volume and cardiac output. This increased blood flow may enhance exercise recovery by clearing metabolites and increasing tissue perfusion. **PURPOSE:** To examine the effects of breathing with an ITD during recovery between repeated bouts of high-intensity exercise. **METHODS:** Eleven participants (8 men, 3 women, 19-29 years-of-age) performed a total of 9, 20 s bouts of high-intensity exercise interspersed with 3 min of active recovery on an electronic bicycle ergometer. Participants were instructed to perform each exercise bout at an intensity that would elicit a rating of approximately 7 (very strong) on the Borg Category-Ratio scale of perceived exertion. The same exercise protocol was performed on different days, with and without the ITD during recovery. **RESULTS:** As expected, the exercise protocol significantly increased blood lactate (1.7 ± 0.2 mM pre-exercise vs. 11.5 ± 0.6 mM after bout 9, $p < .001$). Ratings of perceived exertion also increased across exercise bouts (4.9 ± 0.4 after bout 1, 7.5 ± 0.2 after bout 5, and 9.0 ± 0.2 after bout 9, $p < .001$). Participants rated their perceived recovery lower as the number of exercise bouts increased ($p < .001$). There were significant differences in peak and mean power output, as well as total work between exercise bouts, with the highest values recorded during the 9th bout (total work: 7434 ± 380 joules during bout 1, 8015 ± 266 J during bout 5, and 8391 ± 303 J during bout 9, $p < .01$). Thus, participants paced themselves during early bouts and gave a near maximal effort during the last bout. However, results were not significantly different between the control and ITD conditions. **CONCLUSION:** Use of an ITD during recovery periods between repeated, high intensity exercise bouts that required pacing did not positively impact subsequent performance. Results may be different if individuals perform repeated, high-intensity exercise that requires a maximal or near maximal effort during each exercise bout rather than a pacing strategy.

195 Board #11 May 27 9:30 AM - 11:00 AM
The Effects Of Foam Rolling On Fatigue-induced Performance Decrements In Trained Females: A Sham-control Study

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It remains commonplace for athletes to utilize self-myofascial release techniques like foam rolling during muscular fatigue situations to acutely support or at least preserve subsequent performance capacities. However, currently, there is limited evidence to support this specific application of foam rolling. **PURPOSE:** The purpose of this investigation was to examine the effects of foam rolling vs. a sham ultrasound control treatment following fatiguing exercise on subsequent performance in trained female subjects. **METHODS:** Twenty female subjects (age = 21.4 ± 1.1y) participated in this crossover design study. Subjects were tested for reactive strength index (RSI), peak isometric mid-thigh pull (IMTP) force, and fatigue perception followed by an exercise fatigue protocol. Then, subjects underwent either a foam rolling (FR) or sham ultrasound (CTL) treatment which was followed by repeat testing. A repeated measures ANOVA was used to examine the interaction of treatment (FR vs. CTL) x time (pre-vs. post-fatigue protocol) for each outcome measure. A dependent student T-Test was used to make comparisons between treatments on the pre- to post-fatigue protocol Δ score for each outcome measure. **RESULTS:** There was a significant treatment x time interaction for fatigue perception (p=0.03) and RSI (p=0.03) but not peak IMTP force. Both treatments resulted in a significant (p<0.05) increase in fatigue perception (FR: +3.2 ± 1.8 cm; CTL: +4.1 ± 2.1 cm) and decrease in RSI (FR: -8.9 ± 6.9 %; CTL: -11.9 ± 7.5%) from pre- to post-fatigue protocol. Further analyses revealed that the increase in fatigue perception following FR was significantly less than CTL (p=0.03). Additionally, the decrease in RSI following FR was significantly less than CTL (p=0.02). The fatigue-induced decrease in peak IMTP force did not differ between treatments. There was no significant correlation between the pre- to post-fatigue change in RSI and fatigue perception (p=0.10; r = -0.3). **CONCLUSIONS:** In conclusion, this study corroborates a prior non-sham-controlled investigation in that foam rolling during neuromuscular fatigue situations may aid in the preservation of performance while reducing perception of fatigue.

196 Board #12 May 27 9:30 AM - 11:00 AM
Soreness And Fatigue As The Key Perceptual Indicators For Previous Day Workload In Athletes

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PURPOSE: As monitoring of athletes has become prominent throughout competitive sport, objective and subjective methods have proven valuable in informing of an athlete's physical condition and preparedness. However, it remains unclear how objective load metrics are reflected in self-reported subjective indices. Thus, the purpose of this study was to examine the relationship between objective markers of workload and subjective assessments of soreness, fatigue, and stress the following day. **METHODS:** Twenty-six collegiate male soccer players (mean±SD; 20±1y; 75.83±5.90kg; 178.5±6.8cm) wore GPS-enabled heart rate monitors during every training session and match within the 2017 season. Objective load variables (total distance covered (TD), number of sprints (SP), number of accelerations (AC), number of decelerations (DC), and training load (TL)) were collected each day. Subjective load (soreness, fatigue, and stress) were reported on a 1-10 Likert scale the following morning. Mixed models tested the relation between subjective metrics and the objective metrics of the previous day's training or match. **RESULTS:** Training load and deceleration numbers from the day before showed significant relevance to reported scores of soreness and fatigue. Heavier training loads resulted in higher soreness and fatigue scores (TL P<0.001), just as lighter training loads resulted in lower soreness and fatigue scores. A similar positive correlation was found with the number of decelerations to reported soreness and fatigue (DC P=0.023). **CONCLUSIONS:** Lasting physiological impacts of the previous day's training load and decelerations were reflected in player-reported soreness and fatigue the following morning. This information may be utilized by coaching staff to; 1) adjust training based on subjective metric scores and 2) inform tapering strategies to maximize performance in matches.

197 Board #13 May 27 9:30 AM - 11:00 AM
Self-reported Sleep Habits During A Professional American Football Season

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Reported Relationships: S.A. Basham: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc...

American football is physically and psychologically demanding, thus highlighting the potential need for adequate sleep for recovery. **Purpose:** To investigate self-reported sleep habits over the course of a seven-week football season and determine how game load may impact sleep. **Methods:** Professional football players (n = 24; 25.9 ± 2.7 y) were recruited from the Alliance of American Football league. A customized sleep survey was used to ask about sleep duration (SLD), "How many hours of sleep did you get last night?" and sleep quality (SQ), "What was your quality of sleep", while a total sleep score (TSS) was calculated using SLD and SQ, with higher scores meaning better sleep. Players completed the sleep survey sent via automated text message at 0800h the day before each game (GD-1), game day (GD) and each day following game day (GD+1, GD+2, GD+3, GD+4, and GD+5) during the seven-week season. Game load was recorded and defined as total snaps played for each game. A mixed-effects model was used to measure changes in all variables, while a Pearson's correlation coefficient was used to assess relationships between game load and sleep variables. Two, three, and four-day averages for all sleep variables were calculated and correlated with the respective game load. **Results:** A significant interaction for GD x time (p < 0.05) for SLD was observed, where players slept less on GD (6.1 ± 1.3 h) and GD+2 (6.7 ± 0.7 h) compared to GD-1 (8.5 ± 0.9 h) for week three, and GD+5 (6.3 ± 0.8 h) compared to GD-1 (8.4 ± 0.6 h) for week seven. Overall, SLD was higher on GD-1 (8.1 ± 0.9 h) than all other time points (p < 0.05). No significant main effect or interaction was found for SQ (p > 0.05). Overall, the TSS was significantly higher on GD-1 (7.0 ± 1.8 AU; p < 0.01) compared to GD, GD+2, GD+3, and GD+4 (5.4 ± 2.2; 5.6 ± 1.6; 5.8 ± 1.4; 6.1 ± 0.9 AU; respectively). Significant positive correlations for game load were found with SQ for two (r = .34, R² = 0.119, p < 0.05), three (r = .39, R² = 0.155, p < 0.01) and four (r = .50, R² = 0.247, p < 0.01) day averages and the TSS for two (r = .29, R² = 0.083, p < 0.05), three (r = .29, R² = 0.084, p < 0.05), and four (r = .37, R² = 0.139, p < 0.01) day averages, but not for SLD. **Conclusions:** Professional football players reported impaired SLD and TSS up to 5 days following a football game. Higher game load was associated with better SQ in the days following the game.

198 Board #14 May 27 9:30 AM - 11:00 AM
Effects Of Percussion Massage On Delayed Onset Muscle Soreness

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 (No relevant relationships reported)

Delayed-onset muscle soreness (DOMS) is common 24-72 hr after engaging in resistance training. Manufacturers of percussion massage devices have stated that such devices decrease muscle soreness. **PURPOSE:** To determine the effects of percussion massage on pain and performance in those with DOMS. **METHODS:** 25 untrained college-aged adults (16 women and 9 men; 22.9±0.9 yr; 69.1±7.2 kg; 155.0±14.6 cm) participated in the study and were instructed to refrain from exercise and consuming or applying any type of anti-inflammatory medication 24 hr before, and throughout the duration of, the study. Participants initially rated leg pain using a scale ranging from 0 (no pain) to 10 (pain as bad as it could be) and performed a vertical jump test. Then, after determining 1-RM, they performed 10 sets of 10 repetitions of barbell back squats at 60% of their 1RM to elicit DOMS. Squats were performed to a predetermined depth using stacked 5-cm spacers so the femurs were parallel to the floor at the end of the eccentric phase. 48 hr later, participants, rated leg pain, performed the vertical jump test, and then had percussion massage applied to each leg (5 sets of 1 min per quad for 10 min total). Following this, participants again rated leg pain and repeated the vertical jump test. **RESULTS:** Participants reported no pain (0.0) and had a vertical jump height of 61.33 cm at baseline. 48 hr later, pain was rated as 6.55 (severe pain) and had 8.0% lower (p<0.05) vertical jump height (56.42 cm) compared to baseline. After percussion massage, pain declined (p<0.01) to 5.38 (moderate pain) and vertical jump height increased (p<0.05) by 4.2% to 58.77 cm, although this was still lower (p<0.05) than baseline. **CONCLUSIONS:** This study supports previous studies that have found that a single bout of resistance training can inflict severe DOMS. Results also indicate that percussion massage reduces pain and improves performance in those with DOMS. However, additional studies are needed to determine the effects of percussion massage on other types and levels of pain as well as on other types of performance measures.

199 Board #15 May 27 9:30 AM - 11:00 AM
Effects Of Percussion Massage On Hamstring And Low Back Flexibility

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 (No relevant relationships reported)

The sit and reach (SR) test is a common field test used to measure hamstring and low back flexibility. It is believed that hamstring and low back flexibility may prevent acute and chronic musculoskeletal injuries. Manufacturers of percussion massage devices have stated that such devices increase range of motion (ROM). **PURPOSE:** To determine the effects of percussion massage versus traditional static stretching on hamstring and low back flexibility. **METHODS:** 25 untrained college-aged adults (16 women and 9 men; 22.9±0.9 yr; 69.1±7.2 kg; 155.0±14.6 cm) participated in the study. Percussion massage and static stretching were performed on two separate days in random order with 48 hr between trials. At baseline on each day, participants performed the SR test. Participants then had vibration massage applied to the hamstrings and low back (1 min for each leg and low back in alternating fashion for 3 sets) or performed static stretching of each hamstring using a stretch strap and a low back stretch (1 min for each leg and low back in alternating fashion for 3 sets). Participants then performed the SR test again. The best of three SR test trials in each of the four testing conditions was used for analysis. **RESULTS:** Static stretching resulted in an improvement ($p=0.03$) of 7.2% (pre=13.1±4.4 cm; post=14.0±4.7 cm). Percussion massage did not affect ($p=0.13$) ROM (pre=13.4±4.4 cm; post=13.7±4.7 cm). **CONCLUSIONS:** Results indicate that percussion massage does not affect hamstring and low back flexibility. However, additional studies are needed to determine if longer applications of percussion vibration may improve ROM.

200 Board #16 May 27 9:30 AM - 11:00 AM
The Efficacy Of Prolonged Cooling Using Phase Change Material For Enhancing Recovery Following A Marathon

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PURPOSE: Athletes often utilize cryotherapy interventions following exercise to mitigate muscle damage, inflammation and feelings of soreness. The literature has shown only small benefits from cryotherapy on accelerating recovery from exercise. The practical utility of modalities such as cold water immersion is questionable. Phase change material (PCM) packs can provide prolonged cooling while simultaneously allowing the wearer to continue with activities of daily living and, thus, is a more practical alternative to other cryotherapy modalities. The aim of this study was to test the efficacy of a single prolonged cooling treatment using PCM following completion of a marathon on soreness, strength, muscle damage and inflammation on the days after running a marathon.

METHODS: Twenty-four participants (8 male, 16 female) completed a marathon and were randomized to receive the post-race intervention (3 h of 15°C PCM covering the quadriceps) or recover without an intervention (control). Soreness, knee extension strength, vertical jump height, creatine kinase (CK), and high sensitivity c-reactive protein (hsCRP) were recorded at baseline, 1, 2, and 3 days following the marathon. **RESULTS:** Soreness increased following the marathon ($P < 0.0001$) in both groups, but was lower in the PCM group (treatment effect $P = 0.028$) and resolved faster (treatment by time $P < 0.044$; D3 soreness: 1.1 ± 0.9 PCM vs 2.7 ± 1.6 control). Strength decreased following the marathon in both groups ($P < 0.0001$) with no difference between groups. Although not significant, by Day 3 strength recovered more in the PCM (98.6 ± 15.6%) vs. control group (90.4 ± 7.6%). PCM had a beneficial effect on jump height (treatment effect $P = 0.037$, treatment by time $P = 0.031$); over the 3 days post-race, jump height averaged 101 ± 10% of baseline in PCM treatment versus 89 ± 10% in the control condition ($P = 0.037$). CK and hsCRP increased over time (both $P = 0.0001$) peaking on D1, with no difference between groups.

CONCLUSIONS: Prolonged post-marathon PCM cooling accelerated resolution of soreness and recovery of vertical jump performance, but had no effect on other indices of damage or inflammation. PCM cooling is a practical, wearable cryotherapy modality that can facilitate recovery following excessive exercise stress.

201 Board #17 May 27 9:30 AM - 11:00 AM
The Effect Of Percussive Massage Versus Foam Rolling On Recovery Between Two 91 Meter Swims

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Reported Relationships: R. Mullin: Industry contracted research; Theragun®.

Swim competition often requires repeat bouts of the same event, as well as several different events for each swimmer. Multiple events during the competition may influence subsequent outcomes, thus various strategies are employed to enhance recovery and reduce fatigue. The search for the optimal recovery is never ending. Two of the more popular recovery techniques include foam rolling massage and percussive massage. There is a paucity of research to support the efficacy of either. **Purpose:** The purpose of this study was to assess the effect of no massage (NM), foam roller massage (FM) and percussive massage (PM) on repeated swim performance separated by 30 minutes of recovery. **Methods:** 8 male and 12 female college-aged swimmers (age: 20.9 ± 2.8 yr., height: 171.7 ± 8.6 cm., weight 70.3 ± 10.9 kg.) volunteered to participate in three 91 meter repeat swim trials. Blood lactate (BL) was measured two minutes pre-swim and three minutes post-swim. A randomized, single blind crossover application of FM, PM, or NM was conducted between each of the two 91meter maximal velocity swims. For both FM and PM the treatment was applied bilaterally for a total of 16 minutes with 2 minutes per muscle group (calves, hamstring, quadriceps, and upper arms). **Results:** For the first vs second bout of each trial, male times were 52.3 ± 2.5 vs 52.7 ± 2.7 sec, 52.2 ± 2.7 vs 52.3 ± 2.8 sec, and 52.5 ± 2.3 vs 52.4 ± 2.6 sec and female times were 63.7 ± 3.6 vs 63.9 ± 3.8 sec, 63.4 ± 3.9 vs 63.8 ± 3.8 sec and 63.9 ± 4.0 vs 63.0 ± 3.8 sec for FM, PM, and NM trials, respectively. Statistical analysis by dependent T-test ($P < .05$) revealed NSD ($p > .05$) pre vs post between trials, except that the second swim was slower than the first swim in the male FM trials. Mean BL values post first swim were 8.5 ± 3 mmol, 8.8 ± 2.56 mmol, 9.1 ± 2.2 mmol, and pre second swim lactate values were 3.4 ± 1.8 mmol, 3.9 ± 1.6 mmol, 4.0 ± 1.7 mmol for FM, PM, and NM respectively. Statistical analysis of BL by ANOVA revealed no significant difference across all trials ($p > .05$). **Conclusion:** The mode of recovery did not improve velocity in repeat 91 meter swim bouts or alter the time course for post-swim BL recovery. Supported, in part by a grant from Theragun®.

202 Board #18 May 27 9:30 AM - 11:00 AM
The Effect Of Percussive Massage Versus Foam Rolling On Recovery Between Two 1000 Meter Runs

Casey Spor, Jessica Diaz, Peter Byrne, Ryan Mullin, Jacob Virginia, John Petrizzo, Robert Otto, FACSM, Michele Aquino, John Wygand, FACSM. *Adelphi University, Garden City, NY.* (Sponsor: Robert Otto, FACSM)
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Reported Relationships: C. Spor: Industry contracted research; Theragun®.

Interest in effective methods to reduce recovery time related to athletic performance is an area of interest in competitive sports. Many of the methods purported to enhance recovery and improve repeat performances are unproven. These methods include foam rolling and more recently, percussive massage. **Purpose:** The purpose of this study was to compare repeated running performance under the conditions of no massage (NM), foam rolling (FR) and percussive massage (PM) when implemented during the rest period between two running trials. **Methods:** 20 recreationally active college-age students (age: 22.5 ± 2.8 yrs., height: 176.2 ± 8.0 cm, body mass: 70.8 ± 11.1 kg, 11 ♂) volunteered to participate in a randomized, single-blind, crossover design study. Three trials consisting of two repeat 1000m runs separated by 30 minutes of rest were conducted with a minimum of 48 hrs. between trials. The 30 minute recovery was to simulate the time between races in a track event. Finger stick blood lactates were taken three minutes post run, as well as before the second run. During the 30 minute recovery the subjects received one of the three treatments NM, FR, and PM. For PM the treatment was applied bilaterally, for a total of 12 minutes with two minutes per muscle group (calves, hamstrings, and quadriceps). FR trials followed the same protocol. Run time(sec) and lactate values(mmol) were recorded for all trials. **Results:** Statistical analysis by ANOVA ($P < .05$) revealed no significant difference in run performance time among all conditions. Mean pre-intervention times were: 245 ± 24, 244 ± 23, and 246 ± 24 and post-intervention times were: 246 ± 22, 245 ± 23 sec, and 247 ± 23 for NM, FR, and PM respectively. Blood lactate significantly decreased from post first run: 11.2 ± 2.3, 11.7 ± 2.3, and 10.7 ± 2.0 to the pre-second run with values of 5.1 ± 2.1 mmol, 5.5 ± 2.2mmol, and 5.1 ± 1.7 mmol for NM, FR, and PM respectively, with no significant difference among conditions. **Conclusion:** Although subjects reported enhanced recovery with the interventions, the results of this study suggest that

percussive and non-percussive massage do not affect performance time in a 1000m run nor do they alter the time course for blood lactate attenuation. Supported, in part by a grant from Theragun®.

A-41 Free Communication/Poster - Testing

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

**203 Board #19 May 27 9:30 AM - 11:00 AM
Test-retest Reliability And Performance Differences Between Traditional Upper Quarter Y-balance Test And Two Modifications**

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The traditional Upper Quarter Y-Balance Test (TUQYBT) tests mobility and stability of the shoulder. The TUQYBT is performed in a push-up position, while the contralateral arm is pushing a reach indicator maximally in the medial, superolateral, and inferolateral directions. The TUQYBT has proven to be beneficial in analyzing shoulder function, specifically for athletic and active populations. It has not been proven to be suitable for the older adults and obese populations. Research shows that 67% of bodyweight is carried during the up position of push-up. During the TUQYBT this weight is shifted to one shoulder, which place a lot of stress on it. A decrease of 15% of the body load was found during a modified push-up (knees down) position. Moreover, load will further be reduced when performing a push-up in standing position on the wall.

PURPOSE: To determine test-retest reliability of two modified UQYBTs (modified push-up and standing positions) and to identify performance differences with respect to TUQYBT. **METHODS:** Twenty-five students (nine men, 16 women; mean age 24.4±3.3 and 23.6±3.3 years), performed three variations of the UQYBT. Cronbach's Alpha test-retest reliabilities were performed to analyze data consistency. Two separate one-way repeated measures ANOVAs were performed to determine the effect of the three starting UQYBT positions on the composite reach scores for each side, followed by post-hoc analyses. **RESULTS:** Findings revealed consistency for the two UQYBT modifications in all three reach directions, Cronbach's Alpha values 0.87-0.99. Significant main effects were found on the right ($F(2,72) = 6.19, p = 0.003$) and left ($F(2,72) = 4.12, p = 0.004$) sides. Post-hoc analyses revealed that the standing UQYBT composite scores were significantly higher for both sides (right 73.1±7.5 cm, left 73.1±7.2 cm) than the modified push-up (right 68.5±7.5 cm, left 69.5±7.9 cm) and TUQYBT (right 65.2±9.0 cm, left 66.5±9.0 cm) scores ($p < 0.05$). The modified UQYBT composite scores, for both sides, were significantly higher than TUQYBT scores ($p < 0.05$). **CONCLUSION:** It appears that the modified UQYBTs may be suitable for populations such as older adults and obese, who may have difficulty holding themselves up during the TUQYBT. Future research is needed to determine applicability in these populations.

**204 Board #20 May 27 9:30 AM - 11:00 AM
Measuring Energy Expenditure Independent Of The Respiratory Quotient During Rest And Exercise**

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(No relevant relationships reported)

Widely used measures of energy expenditure (EE) are based on Weir's (1949) equation that relies on oxygen utilization and carbon dioxide production to derive a respiratory quotient (RQ). However, Weir's RQ-free equation, presented in the same article, was only recently validated to measure home-cage EE in rodents. It has not yet been used to measure EE in humans.

PURPOSE: To evaluate an RQ-free method for measuring EE at rest and during submaximal and maximal intensity treadmill running. **METHODS:** A convenience sample of 27 physically-active college students (17 women) were recruited to perform a maximal treadmill test until volitional exhaustion (Bruce protocol). EE (kcal/min) was measured continuously at 10 Hz using an open-flow respirometry system (Sable Systems Intl.; Las Vegas, NV). EE was down-sampled and averaged at rest (EE_{Rest}), during the first stage (EE_1), during the last completed stage (EE_{Submax}), and during the final stage (EE_{Max}). The intensity (VO_2 ; ml/kg*min) of the last completed stage and the final stage were calculated based on speed and incline using ACSM equations. Heart rate (HR) was measured at rest and every minute during the test. Participants rated their perceived exertion (RPE) at the end of each stage. VO_{2max} was estimated based on the total time spent walking/running on the treadmill. Four multiple regression models were used to predict EE from participant traits (PT;

gender, age, weight), stage intensity, HR, RPE, and estimated VO_{2max} (EE_{Max} only). A repeated-measures ANOVA was used to test the degree to which changes in EE were explained by changes in HR (treated as a time-varying covariate).

RESULTS: EE_{Rest} was predicted by PT and resting HR [$p < .001, R^2 = .658$]. EE_1 was predicted by PT and HR and RPE in Stage 1 [$p < .001, R^2 = .871$]. EE_{Submax} was predicted by PT, the intensity of, and HR and RPE response to, the last completed stage [$p < .001, R^2 = .844$]. EE_{Max} was predicted by PT, VO_{2max} , and the intensity of, and HR and RPE response to, the final stage [$p < .001, R^2 = .746$]. 83% of the increase in EE, from rest to the final stage, was explained by increasing HR.

CONCLUSIONS: The reliability (R^2) of our models for predicting EE at rest and during exercise are comparable to published RQ-dependent models, supporting the utility of an RQ-free method for measuring EE during submaximal exercise.

**205 Board #21 May 27 9:30 AM - 11:00 AM
Comparison Of Sweat Vs. Serum Lactate And Glucose Concentrations During Exercise**

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Research has been equivocal on whether or not sweat lactate ([Lac]) and glucose ([Gluc]) are related to serum [Lac] and [Gluc]. **Purpose:** To determine the relationship between sweat [Lac] and [Gluc] versus serum [Lac] and [Gluc] during cycling exercise in the heat for 90 min. **Methods:** Twelve moderately-trained recreational athletes (38 ± 6 y, 75.6 ± 14.5 kg, $VO_{2max} 45.6 \pm 7.7$ ml/kg/min) completed 90 min of cycling at $78 \pm 5\%$ HR_{max} in the heat ($31^\circ C, 50\% RH$). Prior to exercise, the forehead was cleaned with alcohol and deionized water, then three absorbent patches (10 cm² absorbent pad, 3M Tegaderm™ + Pad) were applied sequentially (at 0, 30, and 60 min) and each patch was removed after 30-min increments of exercise alongside a synchronous blood draw. The forehead was re-cleaned with deionized water between each patch removal/application. Sweat and serum [Lac] and [Gluc] were measured using ion chromatography. Descriptive statistics were conducted across all collection time points for sweat and serum [Lac] and [Gluc]. Pearson's product-moment correlations were performed to assess the relation between sweat and serum [Lac] and [Gluc] at the 90-min collection period. Due to limited sample volume the final n was 10 for each marker. Data are shown as mean \pm SD. **Results:** Forehead sweat [Lac] was $13.88 \pm 3.29, 11.49 \pm 3.13, 11.91 \pm 4.08$ mM and serum [Lac] was $2.89 \pm 1.33, 2.84 \pm 0.64, 3.09 \pm 1.13$ mM, at 30, 60, and 90 min, respectively. Forehead sweat [Gluc] was $0.425 \pm 0.417, 0.270 \pm 0.239, 0.357 \pm 0.284$ mg/dL and serum [Gluc] was $69 \pm 15, 73 \pm 16, 73 \pm 13$ mg/dL, at 30, 60, and 90 min, respectively. There was a moderate, but non-significant, positive correlation between sweat and serum [Lac], $r(8) = 0.485, p = 0.155$ and a minimal, but non-significant, positive correlation between sweat and serum [Gluc], $r(8) = 0.186, p = 0.606$. **Conclusion:** Sweat [Lac] and [Gluc] explain only 24% and 3% of the variation in serum [Lac] and [Gluc], respectively; suggesting other factors (aside from serum) impact sweat [Lac] and [Gluc]. Further research is warranted to understand the presence of lactate and glucose in the sweat and their applicability and relevance for use as biomarkers.

**206 Board #22 May 27 9:30 AM - 11:00 AM
Elite Athletes Have Mildly Elevated Serum Bilirubin Concentrations**

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Bilirubin is a potent endogenous antioxidant and immune system-modulating substance, which is implicated also in the cell signaling and in various metabolic pathways. Mild elevation of its systemic concentrations seems to provide substantial protection against numerous pathological conditions such as atherosclerotic and inflammatory diseases. Scarce reports in the literature suggest that serum bilirubin might have relevance also to the physical performance. **Purpose:** The aim of the current study was to assess serum bilirubin concentrations in the Czech elite athletes and to compare them with the Czech general population. **Methods:** The study was performed in 145 consecutive healthy Czech elite athletes (M:F ratio=1.78) and in 2597 individuals (M:F ratio=0.91) of the Czech post-MONICA study randomly selected from the Czech general population. Serum bilirubin concentrations as well as prevalence of benign hyperbilirubinemia >17 $\mu mol/L$ (1 mg/dL, a phenotypic sign of Gilbert's syndrome) were evaluated. **Results:** The medians of serum

bilirubin concentrations in the elite athletes were substantially higher compared to the general population (11.75 vs. 9.6 $\mu\text{mol/L}$, $p < 0.001$), and this substantial difference was observed in both men (13.02 vs. 11.3 $\mu\text{mol/L}$, $p = 0.006$) and women (10.29 vs. 8.3 $\mu\text{mol/L}$, $p < 0.001$). Compared to the general population, the prevalence of a phenotypic Gilbert's syndrome (known also as benign hyperbilirubinemia) was significantly higher in both male (18.4% vs. 31.1%, $p = 0.004$) and female athletes (7.4% vs. 17.3%, $p < 0.001$). **CONCLUSIONS:** Elite athletes have significantly higher serum concentrations of bilirubin, the most potent endogenous antioxidant substance. Simultaneously, also the prevalence of Gilbert's syndrome is higher in elite athletes, suggesting that the presence of Gilbert's syndrome may predispose to better physical performance. This study was supported by grant No. SVV 260156/2019 provided by Charles University.

207 Board #23 May 27 9:30 AM - 11:00 AM
Salivary Hormone Critical Difference And Biological Variation In A Professional American Football Season

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Reported Relationships: **A.S. Wolfe:** Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..

Although a large body of research has investigated various hormonal and immunological responses to exercise, few studies have assessed the biological significance of those responses utilizing critical difference values (CDV) and biological variation (BV) in the context of monitoring biomarkers in professional athletes. **Purpose:** To assess salivary hormone changes over a professional American football season and determine if individual monitoring of these biomarkers is valuable. **Methods:** Professional American football players ($n = 24$) were recruited to provide weekly saliva samples over the course of a seven week season. Saliva samples were collected between 0600 and 0800 hours following an overnight fast and a mouth rinse with distilled water. Eight samples (two baseline and six weekly samples) were collected per player and analyzed for salivary testosterone (T), cortisol (C), uric acid (sUA), and immunoglobulin A concentration (SIgA). Player data were included for analysis if they provided samples at $\geq 70\%$ of all collection time points ($n = 17$). Data were analyzed using parametric statistics after confirmation of normality by Shapiro-Wilk and Reed's Criterion tests. The within-subject biological variation, CDV, and index of individuality (II) were calculated in accordance with the methods of Frasier and Harris. Lastly, relative percent change from baseline for each weekly collection was assessed using repeated measures one-way ANOVA. **Results:** The CDV for salivary T, C, sUA, and SIgA were 27.5%, 61.3%, 48.0%, and 59.2%; while BV was 10.8%, 26.1%, 20.5%, and 25% respectively. II was calculated as 0.93, 0.52, 0.59, and 0.65 (arbitrary units) for T, C, sUA, and SIgA, respectively. All hormones exhibited significant differences between players ($p < 0.001$), however were not significantly different between weeks ($P > 0.05$). **Conclusion:** These data suggest that individual players experience week-to-week variation in salivary hormone response over a professional American football season, however team-wide fluctuations are minimal. Furthermore, the relatively low II values may imply that these salivary biomarkers are useful in terms of monitoring meaningful individual changes across a season.

208 Board #24 May 27 9:30 AM - 11:00 AM
Validation Of The Humon Hex Lactate Threshold Estimate

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Fitness trackers track a wide range of fitness and physiological metrics, including muscle oxygen saturation and lactate threshold (LT). The Humon Hex (HH) is a low-cost wearable device that uses continuous-wave near-infrared spectroscopy (NIRS) to determine muscle oxygen saturation. The HH is unique in its ability to estimate LT based on muscle oxygen saturation during a threshold test. **Purpose:** The purpose of this study was to determine the validity and accuracy of predicting LT from continuous-wave NIRS compared to lab-based measurements. **Methods:** 15 healthy, recreational runners (6 male, 9 female, 26.1 ± 6.4 yrs, 67.9 ± 16.3 kg, 173.3 ± 9.5 cm, 31.6 ± 21.5 km/week) participated in a single threshold test on a treadmill. The protocol was dictated by the HH device ("Threshold Test" in the app) and involved increasing treadmill velocity by 0.22 m/s (0.5 mph) every 3 min until volitional exhaustion. At the end of each stage, participants would straddle the treadmill while researchers collected and analyzed the blood lactate levels using a Lactate Scout portable lactate analyzer (Lactate.com). The HH LT estimate was provided by the Humon website.

Blood lactate levels were recorded and graphed, and LT was derived by identifying the point immediately prior to where lactate levels had a greater than 1 mmol/L jump from the previous stage that also placed the total lactate concentration above 4 mmol/L. A 2-tailed, paired t-test, mean absolute percentage error (MAPE), single measures Intraclass Correlations (ICC), and Bland-Altman analysis with accompanying bias and Limits of Agreement were performed, calculated and plotted. **Results:** There was no difference between the HH estimated LT velocity compared to the lab-based methods (12.5 ± 2.0 km and 12.7 ± 1.3 km/hr, respectively). There was a MAPE of 9.00% and an ICC of 0.652 with a 95% confidence interval of -0.222 to 0.869 ($F(15,15) = 4.546$, $p = 0.004$) when comparing the variables. **Conclusion:** Although there was no difference between HH estimated LT velocity compared to laboratory testing, the MAPE was above 5% and ICC slightly below 0.7 with a significant relationship. This data suggests that the HH does not produce a completely valid estimate of LT compared to lab-based tests; however, it still may be useful in situations where laboratory testing may not be available or practical.

209 Board #25 May 27 9:30 AM - 11:00 AM
Exercise As A Tool For Evaluation Of A Novel Subcutaneous Lactate Monitor

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BACKGROUND: Lactate levels are commonly used as an indirect measure to assess metabolic stress both in exercise (e.g., anaerobic threshold and exercise intensity) and clinical conditions like sepsis. The current method for measuring blood lactate does not meet the need in clinical settings. Multiple blood draws and long processing preclude timely decision-making in clinical practice. A minimally invasive, blood free, continuous lactate monitor can improve clinical decisions and patient care.

PURPOSE: To evaluate continuous lactate measurements of a novel enzymatic, Continuous Lactate Monitor (CLM), that was developed in our laboratory, during incremental cycling exercise challenges.

METHODS: Five healthy individuals 18-45 y/o (3 males, 2 females) participated in the study. Two CLM devices were inserted subcutaneously in the lower back flank an hour before the exercise challenge. Each exercise challenge consisted of a 12-minute warm up and up to 7, 4-min incremental workload bouts separated by rest intervals. Continuous lactate measures obtained from CLM were compared with commercial lactate analyzer (Abbott iSTAT) measures taken at 12 time points from venous blood, drawn from the antecubital vein: before, during exercise, and up to 120 minutes post exercise. Area under the curve (AUC), and delay time were calculated to compare the CLM readings with blood lactate.

RESULTS: Average blood lactate increased from 1.02 to 16.21 mM/L. Ratio of AUC derived from CLM to blood lactate was 1.09 (1.01-1.22). Average difference between CLM and blood lactate, with linear interpolation between blood lactate measurement, was 1.4 mM/L (0.878-2.37). At the lower levels of lactate (baseline), CLM sensitivity was lower. Average delay time between CLM readings and blood lactate was 6.16 minutes (3.70-11.21).

CONCLUSIONS: The newly developed CLM has shown to be a promising tool to continuously measure lactate in a minimally invasive fashion. Results indicate the CLM can provide needed trends in lactate over time. Such a device may be used in the future to improve treatment in clinical conditions such as sepsis, assess the response to endurance exercise in both clinical and athletic settings, and guide exercise prescriptions. Supported by PERC Systems Biology. *N.D. and J.W. equal contribution

210 Board #26 May 27 9:30 AM - 11:00 AM
Effect Of Exercise Setting On Energy Expenditure And Enjoyment During Active Virtual Reality Gaming

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PURPOSE: Recent work by our lab (Gomez, et al., 2018) has shown that active virtual reality games (AVRGs) can elicit exercise intensities that meet American College of Sports Medicine (ACSM) recommended exercise guidelines for preventative health benefits. However, much of the work focusing on this topic has been limited to laboratory settings. The purpose of this study was to investigate differences in energy expenditure (VO_2) and enjoyment of college-aged students while playing AVRGs in different settings (i.e., lab, gym, home). **METHODS:** A repeated measures design was used with 32 participants (16 males, 16 females, Age = 22.6 ± 2.6 years), all of whom completed two 45-minute AVRG sessions in the lab and gym. A subset of 4 participants completed an additional AVRG session at home. **RESULTS:** Significant differences

in $\dot{V}O_2$ were observed among the three AVRGs ($F(1, 28) = 9.128, p = .005$; range = 13.53 - 23.04 ml/kg/min). However, there were no differences between settings in $\dot{V}O_2$ or enjoyment ($p > .05$). **CONCLUSIONS:** Different AVRGs elicit varying exercise intensities, yet the setting in which they are played does not affect $\dot{V}O_2$ or perceived enjoyment. These results suggest AVRGs can be studied reliably across multiple settings (lab, gym, and home) without having to consider environmental influences. As VR systems become more accessible and affordable, future research should continue investigating the effects of AVRGs during at-home play.

211 Board #27 May 27 9:30 AM - 11:00 AM

A Superjump® Into ACSM Guidelines

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SuperJump® (SJ) is a fitness activity combining aerobic and anaerobic exercises performed on a mini trampoline. The exercise intensity can be modified by changing countermovement depth, jump height, and frequency. Although it has been hypothesized that practicing SJ may contribute to daily physical activity recommendations, no study has quantified intensity. **PURPOSE:** To investigate heart rate (HR) and perceived exertion responses of a SJ workout. **METHODS:** Seventeen (Males: n=9; Females: n=8) young adults (age: 25.8±2.7 years; height: 1.7±0.1 m; weight: 66.2±12.1 kg) volunteered for the study. The intensity of the activity was assessed by means of HR monitors during a SJ session (30-min). At the end of each bout of exercise, session ratings of perceived exertion (sRPE) on a CR10 scale were recorded. Percentages of age-predicted maximal HR (%HRmax) were utilized to quantify intensity. %HRmax data were categorically separated according to the American College of Sports Medicine (ACSM) classes of intensity (very light: <57%HRmax; light: 57-63%HRmax; moderate: 64-76%HRmax; vigorous: 77-95%HRmax; near maximal to maximal: ≥96%HRmax). Repeated measures ANOVA was used to evaluate differences ($p < 0.05$) in relation to gender and exercise intensity. *Post hoc* analysis was applied using Bonferroni correction. **RESULTS:** No difference emerged for gender for HR and sRPE data. Frequency of occurrence of %HRmax was significantly higher ($p < 0.005$) for the moderate intensity (48.9±34.9%) with respect to very light (5.5±9.5%), light (16.5±24.4%) and vigorous (29.1±37.7%) intensities, while none of the subjects experienced near maximal to maximal values. According to sRPE values (3.1±1.2) subjects rated the SJ session as moderate. **CONCLUSION:** Findings indicate that SJ can be classified as moderate physical activity according to ACSM guidelines. Therefore, SJ may contribute to meet daily physical activity recommendations by representing an alternative form of low-impact aerobic exercise. Further studies should investigate the long-term effects of SJ training on health-related physical fitness parameters.

212 Board #28 May 27 9:30 AM - 11:00 AM

A Lower Limb Functional Screening Tool For Predicting Lower Limb Injury: A Prospective Cohort Study

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(No relevant relationships reported)

PURPOSE: The purpose of the current study was to assess the usefulness of the lower limb functional screening tool (LoLiFST) for predicting low back and lower limb injury in active athletes.

METHODS: Fifty athletes (32M,18F; mean age: 19.4 ± 2.5 yrs) from six different sports volunteered. Athlete injury history and general information were recorded. The LoLiFST is based on five lower limb movements in different movement planes, directions, modes, and at varying intensities. Both legs were assessed in a random order and each athlete was given both technique and symptom scores. Intra-rater and inter-rater reliability was evaluated. Participants were followed up for 12 months, and their exposure to sport and injuries were recorded. Independent samples t-tests were performed to determine if a significant difference existed in LoLiFST scores between those injured and non-injured athletes. Receiver operating characteristic (ROC) analysis was employed to assess the instrument's capacity to predict injury.

RESULTS: The inter-rater reliability was 0.900 and the intra-rater reliability was 0.955. Fourteen participants experienced injury within the following 12 months. Injured athletes had significant lower scores than non-injured in both technique and symptom scores of the LoLiFST ($df=48, t=4.149, P<0.05; df=16.402, t=2.979,$

$P<0.05$). When technique or symptom score alone was included in the ROC analysis, the area under the ROC curve (AUC) scores were 0.793 ($P<0.05, 95\%CI: 0.649-0.936$) and 0.761 ($P<0.05, 95\%CI: 0.599-0.923$), respectively. When technique and symptom scores combined, the AUC discrimination score was 0.835 ($P<0.05, 95\%CI: 0.709-0.962$). When injury history was added into the variable set, the AUC discrimination score was 0.860 ($P<0.05, 95\%CI: 0.746-0.974$), resulting in 86.0% of cases being correctly predicted as low back or lower limb injured/non-injured.

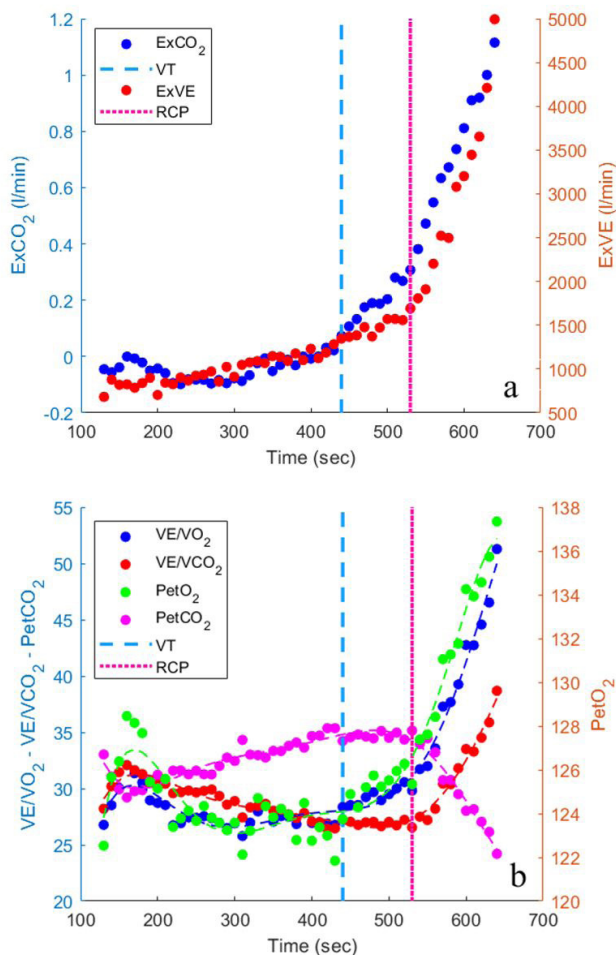
CONCLUSIONS: The new functional assessment tool LoLiFST had excellent intra-rater and inter-rater reliability. The findings from the current study suggest that the technique, reported symptoms, and injury history should be used in combination to maximize its capacity for predicting injuries. Future larger sample size research is warranted to explore the validity of the LoLiFST in predicting low back and lower limb injury in various sports.

213 Board #29 May 27 9:30 AM - 11:00 AM

An Automated Excess Minute Ventilation Method To Detect The Respiratory Compensation Point

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Ventilatory changes during incremental exercise to maximum effort are represented as two inflection points: the ventilatory threshold (VT) and the respiratory compensation point (RCP). RCP is not frequently reported and detection methods have not been well validated. **PURPOSE:** To introduce an automated excess minute ventilation (ExVE) method to detect the RCP. **METHODS:** 171 peak cycle tests were performed by 96 healthy subjects (M/F) of varying body weight and training status. Expired air was collected for metabolic gas analysis (ParvoMedics TrueOne™). We compared RCPs from the proposed ExVE and the V-slope method (Davis, et al. 1985). Novel method: We extended the excess $\dot{V}CO_2$ (Ex $\dot{V}CO_2$) concept used to detect VT (Gaskill et al. 2001) and calculated ExVE as $(\dot{V}E^2/\dot{V}CO_2) - VE$ to determine RCP. The V-slope method may not be capable of providing automatic solutions (Panteleimon et al. 2008). Thus we applied a parametric global method (Lavielle, 2005) to automatically find the first sustained rise in the Ex $\dot{V}CO_2$ and ExVE curves. **RESULTS:** The detected RCP in the ExVE curve (Figure a) was located at the point of an increase in both the $VE/\dot{V}O_2$ and $VE/\dot{V}CO_2$ and a decrease in end-tidal CO_2 (Pet CO_2) (Figure b) (Jesús et al. 2016). There were extremely strong positive correlations in both RCP Time and RCP $\dot{V}O_2$ between the ExVE and V-slope methods (0.934, 0.920). There was no significant difference between the ExVE and V-slope methods in both RCP variables (0.610 and 0.162) (Table). **CONCLUSION:** The ExVE method can determine the RCP. Our novel and automated protocol may increase the methodological consistency in both research and clinical practice.



Result of Pearson correlation and independent two sample t-test								
Variables	Pearson Corr.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% CI (lower)	95% CI (upper)
RCP Time (sec)	0.934	-0.511	348	0.610	6.959	1.181	-33.137	19.471
RCP VO ₂ (l/min)	0.920	-1.402	348	0.162	0.097	0.014	-0.228	0.038

214 Board #30 May 27 9:30 AM - 11:00 AM
Effect Of Scapular Dyskinesis On Scapular Functionality And Back Endurance In Elite Women Handball Players

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Purpose: In professional handball players, accurate scapulohumeral rhythm is crucial for the prevention of overhead shoulder injuries. Additionally low back strength and endurance transfer power to scapular and upper part of body via posterior fascia chain. The aim of this study was to investigate the difference between handball players with scapular dyskinesia and without scapular dyskinesia regarding to functionality and back endurance. **Methods:** Forty-one elite female handball players were included in the study. Sixteen women (mean age: 22.5±6.4yrs BMI: 22.5±2.7kg/m²) who has scapular dyskinesia according to lateral scapular slide test (LSST) as Group 1, 25 women (mean age: 22.5±6.4yrs, BMI:21.8±2.0kg/m²) who has no scapular dyskinesia according to LSST as Group 2 divided into groups. Davies Test and Closed Kinetic

Chain Upper Extremity Stability Test (CKCUEST) were used for the measurement of scapular functionality and Sorensen Test for the measurement of back extensor endurance. Mann-Whitney U test was used to compare the mean values between the groups. **Results:** There were no statistically significant differences in CKCUEST and Davies tests between both groups (p> 0.05). There was statistically significant difference in favor of Group 2 according to Sorensen test between both groups (p = 0.026). **Conclusion:** Endurance of the trunk extensor muscles seems to have influence in scapular dyskinesia in elite female handball players. Besides, functionality of upper extremity in scapular dyskinesia needs to future studies for handball players.

215 Board #31 May 27 9:30 AM - 11:00 AM
Fitness Readiness For Yoga Poses Scale (fryps): Development And Validation
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 (No relevant relationships reported)

Background/Purpose: While yoga is quickly becoming one of the most popular exercises, some significant yoga injuries were also reported. Lack of needed fitness for a specific yoga post is often the reason to get injured. Yet, no tool is available to assess participants' fitness readiness for yoga practice. This study was to address this need by developing a Fitness Readiness for Yoga Poses Scale (FRYPS) and collected its psychometric evidence.

Methods: After a comprehensive literature search and consulting with a number of experts, 101 healthy college students (male = 27.72%, age = 20 ± 3 yr.) were recruited for the study. Specifically, their performance of 7 common yoga poses was evaluated, including mountain pose, bend back, bend forward, riding horse, upward facing dog, downward facing dog and flowing cobra, and their fitness were tested by 6 fitness tests, including sit-up, push-up, squat, cow-face, leg-lifting, and back-up, on the same day. The fitness scores were used to create a draft of FRYPS. The participants were then categorized into 3 groups basing on their yoga performance (poor, fair, good). Using stepwise regression, FRYPS' scores as the independent variable, the yoga pose rating as the dependent variable, the relationship between FRYPS and yoga pose performance level was established. Additional analysis, such as receiver operation curve (ROC), were performed to help setting cutoffs for FRYPS.

Results: The results of regression analysis indicated that a 7-level FRYPS can be used to evaluate the fitness readiness for yoga posture practice, including mountain standing, standing back bend, standing forward bend, riding type, snake strike type and upper dog type.

Conclusion: Consisting of six fitness tests (sit-ups, push-ups, squats, shoulder-flexibility tests, active knee-lifting and back-ups), a yoga fitness readiness scale called FRYPS was developed and its psychometric evidences were collected and confirmed.

216 Board #32 May 27 9:30 AM - 11:00 AM
Novel Surface Mechanomyography Sensor Assessment Of Hamstrings Contraction During A Neuromuscular Control Screening Task

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 Reported Relationships: S.E. Linderman: Salary; Figur8, Inc.

PURPOSE: Hamstring strain is a common injury among athletes. Asymmetries in muscle balance and activation are potential injury risk factors. Surface mechanomyography (sMMG) sensors are wearable devices that when applied across a muscle group provide a novel measurement of physical muscle output during a contraction. The purpose of this study is to assess 1) the relationship of sMMG's muscle bulk displacement measurement to force generation and 2) sMMG detection of hamstrings contraction timing compared to the clinical standard method of electromyography (EMG).

METHODS: Healthy, active individuals (mean age= 30.0 ±10.77 y, n=9, 6 males, 3 females) underwent hamstrings neuromuscular control assessment with simultaneous recording of EMG and sMMG by sensors applied to the right hamstrings. Subjects performed a series of 3 resisted "make-test" isometric hamstring curls against a hand-held dynamometer (HHD). Raw sMMG data and 6th order Butterworth filter and TKEO processed EMG data were used in timing analyses. Paired T-tests and a Pearson correlation assessed relationships between measurement modalities.

RESULTS: Peak hamstrings muscle bulk displacement detected by sMMG (mean= 4.02 ±1.04 mm) positively correlated with HHD maximum force generation (mean= 28.84 ±12.13 lb), r²= 0.850. There was no significant difference in the timing duration of muscle contraction between EMG (mean= 4.443 ±0.573 s) and sMMG (mean= 4.469 ±0.623 s), p= 0.279.

CONCLUSIONS: Results are consistent with physiologic expectations that increased physical muscle bulk displacement during a contraction is associated with greater force. Similarity in time signatures with EMG support findings of successful sMMG

detection of hamstrings contraction (Figure 1). The sMMG sensor may be helpful for assessing hamstrings muscle performance of both force output and timing as part of neuromuscular control screening for injury prevention, rehabilitation monitoring, or return-to-sport readiness.

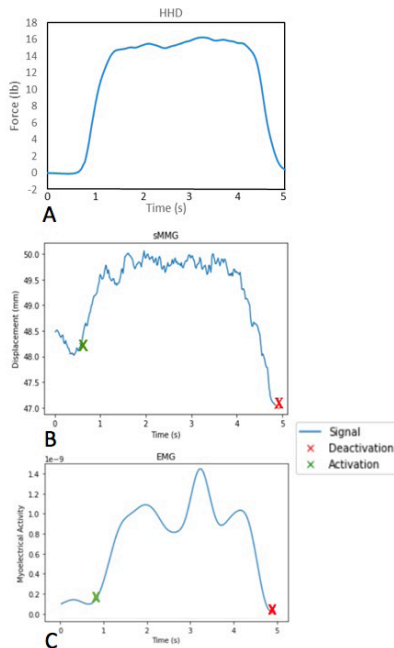


Figure 1. Example comparison of surface mechanomyography (sMMG) sensor output to hand-held dynamometry (HHD) and electromyography (EMG) during a resisted isometric hamstrings curl. Raw sMMG hamstrings muscle displacement (B) aligns with HHD force output (A) and processed EMG data (C) for muscle contraction duration. The timing activation threshold was set at 3 times above the standard deviation of a resting trial for each modality (Solonik et al., 2010).

218 Board #34 May 27 9:30 AM - 11:00 AM

THE WINFIGHT TEST: PROPOSAL OF A PUNCHING FATIGUE AND ANAEROBIC TEST FOR COMBAT SPORTS ATHLETES

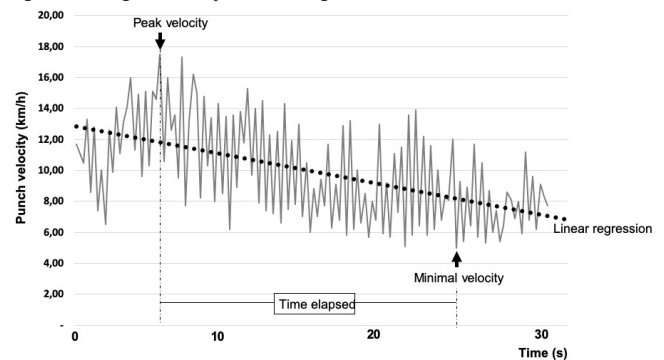
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PURPOSE: The principle of specificity states that training and testing should be relevant and appropriate to the sport in order to achieve better performance. The Wingate test measures anaerobic power and fatigue in a 30-seconds bout of all-out cycling. Despite the importance of anaerobic power analysis for performance in combat sports, there is no specific test for its evaluation in fighters. We propose the Winfight test, for analysis of fatigue and anaerobic capacity in professional combat sports athletes.

METHODS: 10 professional combat sports athletes (6 males; age: 28±6 years) performed a 30-seconds bout of all-out exercise, punching a heavy bag, while wearing punch trackers (Hykso, USA). Velocity of each punch was recorded and plotted against time (Figure). Linear regression analysis was performed, and punch velocity x time slope was calculated. Peak (PeakVel) and minimal (MinVel) punch velocity were used to calculate velocity drop-off (VDO). Fatigue index (FI = VDO/time elapsed between peakV and minV) were calculated. Data presented as mean ± standard error.

RESULTS: Peak V (27,5±7,9 km/h) was achieved at 4±3 s. MinV (5,5±1,3 km/h) was achieved at 23±4s. VDO was 22,08±7,5 km/h, a drop of 78,7±7,7%. When time was considered, FI = 1,2±0,4 km/h/s; %FI=4,4±1,2%/s. Punch velocity x time slope = -0,08±0,04. **CONCLUSIONS:** Due to the predominance of anaerobic metabolism, professional combat sports athletes cannot keep very high punching velocity for more than a few seconds. The Winfight test enabled the analysis of punching fatigue. This data can be used for training and tactics during fight camps. Studies are currently being done to evaluate Winfight test's results reproducibility and correlation to performance.

Figure 1. Winfight test of a professional fighter



217 Board #33 May 27 9:30 AM - 11:00 AM

Reliability Of A Submaximal Cycle Ergometer Verification Phase To Confirm VO_{2max}

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Purpose: To test the reliability of a submaximal cycle ergometer VO_{2max} test with a 90% power output verification phase (VP) test in active male and female participants. **Methods:** 20 active (BMI = 22.7±2.9 kg/m²; age = 25.5±4) men (n = 10) and women (n = 10) completed 3 ramp VO_{2max} graded exercise tests (GXT) on a cycle ergometer followed by 10 minutes of active recovery, then performed a constant-load verification phase test at 90% of maximum power output achieved on the ramp VO_{2max} tests to verify attainment of a 'true' VO_{2max}. **Results:** Maximum attained VO₂ did not differ between the two verification phase tests (verification phase test 2: 3.01±0.69 L/min, verification phase test 3: 3.04±0.69 L/min; P=0.55). Likewise, VO_{2max} achieved on the verification phase was similar to the ramp VO_{2max} test (verification phase test 2: 3.01±0.69 L/min, verification phase test 3: 3.04±0.69 L/min; GXT 2 = 3.03±0.71 L/min, GXT 3 = 3.04±0.69 L/min; P > 0.05). ICCs and CVs for the group showed excellent consistency for VP VO_{2max} (ICC = 0.991; CV = 2.68 ±2.52%). ICC and CV for female participants VP VO_{2max} demonstrated excellent consistency (ICC = 0.987; CV = 2.5%). Male participants VP VO_{2max} displayed excellent consistency (ICC = 0.941; CV = 2.2%). Bland-Altman Plots showed no bias between VO_{2max}. **Conclusions:** The verification phase proved to be reliable with low variability and showed no bias based on VO_{2max} value. A 90% submaximal verification phase is a reliable test to confirm a 'true' VO_{2max}.

219 Board #35 May 27 9:30 AM - 11:00 AM

Comparison Of The Wingate Anaerobic Test And The New Power Bike Test On Anaerobic Power

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Anaerobic power (AP) is the one of the most important factors influencing athletic performance in many sports. Although the Wingate anaerobic test (WAT) has been the most representative measurement for assessing AP, exhaustive testing procedure limits its use in the lab. Recently, the New Power Bike test (NPT) was developed and can measure anaerobic power with maximal pedaling for only four seconds without load. **PURPOSE:** The purpose of this study was to 1) compare the power output between the WAT and the NPT and 2) examine relationships among WAT, NPT, and vertical jump test (VJT). **METHODS:** Thirty-seven participants (age, 26.65±4.16 years; height, 169.2±9.56 cm; weight, 84.49±20.10 kg) went through AP measurements using the WAT, NPT, and VJT. The participant conducted VJT and either WAT or NPT randomly on the first visit. Participants then performed either WAT or NPT via a counterbalanced design on second visit with one-week interval. The Pearson correlation coefficient were computed among the WAT, NPT, and VJT scores and the effect size was evaluated with Cohen's d. Variance between the variables was calculated with the coefficient of determination (r²). The statistical significance was set at 0.05. **RESULTS:** There were

significant positive correlations between the WAT and NPT in the mean of peak power (MPP) ($r = 0.727, p < 0.001$) and mean of relative peak power (MRPP) ($r = 0.388, p = 0.018$), respectively. The MPP (976.18 ± 344.17 W) and MRPP (11.47 ± 2.60 W/kg) of the NPT were significantly higher than the MPP (705.67 ± 249.30 W) and MRPP (8.34 ± 2.55 W/kg) of WAT. There were positive correlations in MPP between NPT and VJT ($r = 0.620, p < 0.001$) between the WAT and VJT ($r = 0.399, p = 0.015$). Also, there were significant correlation ($r(35) = .25, p = .014, d = 5.1$) in MRPP between WAT and VJT, with shared variance between the variables at 0.6%. **CONCLUSION:** There were significant positive correlations between the WAT and NPT in MPP and MRPP. The NPT also showed greater correlation with field test (VJT). So, the NPT can be a good alternative measurement with lesser efforts for assessing anaerobic power and predict athletic performance in the field.

220 Board #36 May 27 9:30 AM - 11:00 AM

Can Cognitive Training During Exercise Improve Performance On A Time To Exhaustion (TTE) Test?

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(No relevant relationships reported)

Mental fatigue can negatively affect our drive to continue exercise. A recent study showed that a training intervention combining exercise and a cognitive task was able to improve performance on a time to exhaustion (TTE) test, which is a challenging task where individuals are required to exercise at a set workload for as long as possible. The duration of the training needed to improve TTE is unknown. **PURPOSE:** To determine if an 8-week cognitive training intervention can improve TTE performance by delaying mental fatigue. **METHODS:** Subjects were 28 recreationally active individuals, with a mean \pm SD age of 22.1 ± 2.6 years. They were randomly assigned to one of three intervention groups: a control group (CON) that was asked to exercise normally at home, and two groups that exercised in the laboratory either once (1X) or twice (2X) per week. Groups were designed to have nearly equal men and women. All subjects were asked to complete a graded exercise test (GXT) to exhaustion and a TTE before and after an 8-week intervention. All tests were completed on a cycle ergometer. The GXT consisted of cycling at a beginning workload of 70-85W and the workload increased every minute by 25-55W, depending on sex and training status. The TTE included a set workload corresponding to 75% VO_{2max} . Training sessions included 1hr of cycling at 65% VO_{2max} while continuously performing the AX-CPT task on a laptop computer. One-way ANOVAs were used to determine the effect of intervention group on change in TTE and VO_{2max} values. **RESULTS:** CON had no change in VO_{2max} (-0.8 ± 4.5 ml·kg⁻¹·min⁻¹) and the experimental groups both had a small increase (1X: 2.8 ± 5.4 , 2X: 2.5 ± 5.9 ml·kg⁻¹·min⁻¹); however, none of these were significant. There was not a difference between groups in VO_{2max} change ($p = 0.313$) or change in TTE (CON: -1.5 ± 9.0 , 1X: -1.8 ± 15.8 , 2X: 6.3 ± 12.2 min; $p = 0.257$). **CONCLUSION:** Although the 2X group saw an increase in TTE it was not significantly different from the other groups. This method has promise, however, as four individuals in the 2X group improved TTE compared to only two subjects in 1X, and one subject in CON. Some individuals may be non-responders to this type of intervention; this would explain the large variability. Alternatively, the lack of significant findings may suggest that the intervention should be longer or include more sessions each week.

221 Board #37 May 27 9:30 AM - 11:00 AM

Reliability Of Cycling Time Trials Performed At Maximal And Submaximal Intensities

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Maximal time trial efforts provide reliable assessments of exercise performance, yet are exhaustive in nature and thus must be used judiciously. **Purpose:** To determine whether a time trial performed at a submaximal, non-exhaustive pace, akin to a "tempo" workout, could provide an equally reliable index of exercise performance. **Methods:** Twenty-two volunteers (14 male, 8 female; age 29 ± 8 years) completed three submaximal (TT_{SUB} ; $n = 14$) or three maximal (TT_{MAX} ; $n = 8$) 250kJ time trials on a cycle ergometer over a period of four weeks. TT_{SUB} was completed at a self-selected work rate to maintain Rating of Perceived Exertion (RPE) between 13 and 17 (Somewhat Hard to Very Hard) throughout the trial. TT_{MAX} was completed as fast as possible to simulate a race effort. Reliability across trials was assessed using the Intraclass Correlation Coefficient (ICC) and the coefficient of variation (CV), calculated as the quotient of standard deviation and mean time to completion of each individual's trials. Independent t-tests were used to assess mean differences between TT_{SUB} and TT_{MAX} . Fisher r-to-z transformation was used to compare ICCs ($\alpha = 0.05$). **Results:** Time to complete 250kJ at submaximal effort (RPE 15.2 ± 0.5 vs. 16.5 ± 0.7 ; $P < 0.001$) was longer than for maximal effort (1961 ± 558 vs. 1463 ± 607 s; $P = 0.035$). However, there were no differences in TT_{SUB} and TT_{MAX} reliability as assessed by ICC

(0.92 vs. $0.97, P = 0.352$) or CV of time to completion (7.3 ± 5.3 vs. $6.7 \pm 4.0, P = 0.807$). **Conclusion:** This study supports the concept that a tempo-style workout may be used as a reliable index of exercise performance. Future studies will be completed to evaluate the sensitivity of the non-exhaustive time trial to changes in aerobic capacity.

222 Board #38 May 27 9:30 AM - 11:00 AM

Differences Between Pointe Shoe And Barefoot Jumping In A Professional Ballet Dancer: A Case Study

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(No relevant relationships reported)

Ballet is an art form that requires highly trained athletes to perform specialized movements specific to their field. Some of the most unique aspects of ballet training that sets it apart from other athletics are the use of pointe shoes, the emphasis on bilateral training, and the full body aesthetic requirements of every movement. **PURPOSE:** To determine how wearing pointe shoes alters full body kinematics during ballet temps levé jumps on both the preferred stance leg and the non-preferred stance leg, to compare the left and right side to determine the effectiveness of bilateral ballet training, and to observe the contribution of upper extremity movement to jump execution. **METHODS:** One professional female ballet dancer (23 yrs) with 17 years of ballet training performed various jumps in two footwear conditions. She was instrumented with 39 reflective markers, and a 10-camera motion capture system was used to collect three dimensional marker position data at 250 Hz. Sagittal plane upper and lower extremity angles were calculated and compared between conditions as well as between left and right sides. **RESULTS:** During single leg jumps, ankle range of motion (ROM) was slightly larger *en pointe* ($79.1^\circ \pm 1.31^\circ$) than barefoot ($56.4^\circ \pm 0.68^\circ$) due to an increase in plantarflexion, regardless of preferred takeoff leg. Conversely, knee ROM was slightly smaller due to a decrease in knee flexion *en pointe* ($45.8^\circ \pm 2.43^\circ$) than barefoot ($56.1^\circ \pm 6.33^\circ$) for single leg jumps, regardless of preferred takeoff leg. A bilateral jump revealed no distinct differences between left and right sides. Upper extremity angles did not show clear trends between left and right sides or between footwear conditions, however, the ipsilateral shoulder ($114.7^\circ \pm 6.69^\circ$) had slightly greater ROM than the contralateral shoulder ($103.4^\circ \pm 8.49^\circ$) during single leg jumps. **CONCLUSIONS:** Wearing pointe shoes causes alterations to lower limb angles during single leg jumps, altering the demand on the dancer's body during these movements. The increase in ipsilateral shoulder ROM implies ballet dancers utilize the upper extremity to accurately execute single leg jumps. The lack of obvious differences between left and right side joint angles indicates that bilateral ballet training is effective at the professional level.

223 Board #39 May 27 9:30 AM - 11:00 AM

DECREASE IN PHYSICAL FITNESS IN SOUTH CHINA COLLEGE STUDENTS FROM 2015 TO 2018

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Physical fitness (PF) is important for human health and movement throughout the lifespan. **PURPOSE:** The aim of this study was to explore changes in physical fitness in college students from the first year of college to the third year of college. **METHODS:** 3606 Chinese college students aged from 16 to 23 years old (1810 males) were recruited from Shenzhen University in China. The subjects participated in PF tests in 2015 and 2018. Physical characteristics and PF tests included body weight (BW), body height (BH), body mass index (BMI), vital capacity, 50-meter running, long distance jumping, sitting body flexion, 800-meter running (only for females), 1000-meter running (only for males), sit-up (only for females) and pull-up (only for males). All students were tested by facilities TSN200 (produced by Physical Fitness Science and Technology Company). Dependent T-tests were used to compare variables responses and a two-way ANCOVA was used to examine gender by time at post-test with pre-test scores serving as a covariate ($p < 0.05$). **RESULTS:** In females, significant differences were noted for BH, VC, 50-meter running, long distance jumping, sitting body flexion, 800-meter running, and sit-ups. In males, significant differences were found for BW, BMI, VC, 50-meter running, long distance jumping, sitting body flexion, and 1000-meter running. **CONCLUSION:** The results indicated that many PF performance tests decreased over the time frame noted. Moreover, it appears that limited performance time was dedicated to PF. Therefore, we suggest that strategies should be enacted by the University or government to improve the condition of PF for college students in China.

224 Board #40 May 27 9:30 AM - 11:00 AM
A Comparison Of Step Tests To Predict Maximal Oxygen Consumption
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Introduction: Of the many methods to estimate maximal oxygen consumption (VO_{2max}), step tests provide a quick estimation of VO_{2max} without expensive equipment. Few studies have investigated varied step height and cadence speed across a broad sample population. The purpose of this study was to generate and validate models to predict VO_{2max} using three different step tests. **Methods:** A sample of 162 adults, aged 18-79 years, completed a graded exercise test to assess VO_{2max} . All three step tests were completed on a later day. The step tests differed in duration, number of stages, and step height. Test 1 (T1) was a two-stage, six-minute test, and had a six-inch step height, Test 2 (T2) was a three-stage, nine-minute test, and had a six-inch step height, and Test 3 (T3) was a three-stage, nine-minute test, and had an eight-inch step height. Stepping cadence increased with each stage and was prescribed based on age group (<40 years, 40-60 years, and >60 years). Recovery heart rate (HR_{rec}) was measured every 30-seconds for two-minutes after each test. Model equations were obtained using hierarchical multiple regression analysis. Covariates for each model included age, sex, body mass, stepping cadence, and HR_{rec} at all measured time intervals. The baseline model for each test consisted of age, sex, and body mass. Stepping cadence was entered in step two but was only significant for T3. Thirty-second HR_{rec} was entered in the final step and was significant for all three tests. Validity was assessed using a Jackknife cross-validation method, allowing for root mean square error (RMSE) and percent bias to be calculated. **Results:** The baseline model accounted for ~72% of the variance for predicting VO_{2max} . Each model accounted for ~83% of VO_{2max} variance and had an error ~4.15 ml $kg^{-1}min^{-1}$. The results of the jackknife analysis found that bias for all three tests was minimal (<0.001%) and the resulting bias-adjusted R^2 was 0.825, 0.826, and 0.834 for T1, T2, and T3, respectively. Adjusted RMSE was 4.259, 4.223, and 4.102 ml $kg^{-1}min^{-1}$ for T1, T2, and T3, respectively. **Discussion:** All three step tests account for ~83% of the variance of VO_{2max} with an error around 4.2 ml $kg^{-1}min^{-1}$. As there is a minimal difference between tests, there is flexibility in the utilization of these step tests based on the need of the administrator and ability of the client.

225 Board #41 May 27 9:30 AM - 11:00 AM
Biomechanical Analysis Of The Closed Kinetic Chain Upper Extremity Stability Test
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PURPOSE: The closed kinetic chain upper extremity stability test (CKCUEST) involves counting alternate touches of each hand to the contralateral hand while maintaining a push-up position. The purpose of this study was to compare kinematic and ground reaction force (GRF) patterns between the dominant (DOM) and nondominant (NDOM) limbs. **METHODS:** Healthy college-aged males (n=16) and females (n=16) completed three 15s trials of the CKCUEST test with 45s rest between trials. DOM and NDOM GRF and hand kinematics were captured using an electromagnetic tracking system and two forceplates. Contact and flight times were computed separately for each limb. For both the medial-lateral (ML) and 3-dimensional (3D) composite vectors, the average hand travel distance, hand velocity, and peak and average GRF per touch were computed and statistically compared between limbs. **RESULTS:** There were no significant limb differences for contact (DOM=.97±.28s, NDOM=.98±.28s, P=.679) and flight (DOM=.69±.19s, NDOM=.69±.19s, P=.305) times. ML distance was statistically equal (P=.866) between the NDOM (1.38±.13m) limb compared to DOM (1.38±.14m), as well as the 3D distance (DOM=1.36±.14m, NDOM=1.34±.13m, P=.189). There were no significant differences for ML (DOM=2.08±.44m/s, NDOM=2.08±.45m/s, P=.728) and 3D (DOM=2.30±.50m/s, NDOM=2.30±.49m/s, P=.734) velocities. Peak ML GRF was significantly (P<.001) greater for the NDOM (186.7±77.2N) limb compared to DOM (166.6±65.7N). Average ML GRF was significantly (P<.001) greater for NDOM (130.3±51.1N) limb compared to DOM (112.6±44.5N). There were no significant limb differences for either peak 3D GRF (DOM=475.6±163.6N, NDOM=474.7±163.8N, P=.840) or average 3D GRF (DOM=362.1±121.1N, NDOM=362.0±121.7N, P=.974). **CONCLUSIONS:** Although there were significant findings with ML GRF, the differences may not be clinically meaningful. Future research will consider patients with shoulder pathologies being assessed during rehabilitation progression and at discharge.

226 Board #42 May 27 9:30 AM - 11:00 AM
Validity And Reliability Of Small Respiratory Chamber To Assess Exercise Energy Expenditure
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The recently created small respiratory chambers (FLEX rooms) permit a more affordable solution and faster response time than the larger traditional whole room respiratory chambers. Despite the potential for FLEX to be employed to assess acute energy expenditure (EE), it has never been validated for submaximal exercise. **PURPOSE:** To perform concurrent validation and reliability analysis of indirect calorimetry of FLEX against metabolic carts (Cart) during submaximal cycling. **METHODS:** Ten healthy participants were included in this study (41.5±15.2 years; BMI=25.8±3.3 kg/m²). Energy expenditure was evaluated on FLEX and mixing chamber Cart, simultaneously. FLEX is an 11,000-liter room operated by a push-pull system and mass flow controllers. Participants performed two submaximal exercise bouts of 30-minutes the same day with a 30-minute resting period between bouts, each bout had a light and a moderate load; they repeated the same protocol after two days. Oxygen uptake (VO_2) and CO_2 production (VCO_2) were derived with the same equation. EE, Net EE, gross efficiency (GE) and net efficiency (NetEF) were calculated for each load (L1 & L2). FLEX within and between-day reliability was calculated by the standard deviation of the differences in kcal/min and %. Repeated measures analysis was utilized to explore differences between Cart and FLEX. **RESULTS:** EE and NetEE were not significantly different between cart and FLEX technologies (EE_{L1} , FLEX= 4.29 vs. Cart= 4.13 kcal/min, EE_{L2} , FLEX= 6.2 vs. Cart=6.0 kcal/min, P>0.05 for both; $NetEE_{L1}$, FLEX= 2.7 vs. Cart=2.7 kcal/min, EE_{L2} , FLEX= 4.63 vs. Cart=4.57 kcal/min, P>0.05 for both). GE and NetEF were similar between both systems for all loads (GE_{L1} , FLEX= 11.8% vs. Cart= 12.3%, GE_{L2} , FLEX= 16.3% vs. Cart= 18.9%, P>0.05 for both; $NetEF_{L1}$, FLEX= 18.8% vs. Cart=18.9%, $NetEF_{L2}$, FLEX= 22.0% vs. Cart= 22.4%, P>0.05 for both). FLEX assessments of EE were highly reliable within-day (L1= 0.11 kcal/min (2.5%) and L2= 0.07 kcal/min (1.1%)) and between-days (L1= 0.10 kcal/min (2.4%) and L2= 0.14 kcal/min (2.2%)). **CONCLUSION:** FLEX is a valid and reliable technique to assess energy metabolism during exercise without the cumbersome mouthpiece or mask required by metabolic carts.

227 Board #43 May 27 9:30 AM - 11:00 AM
A Comparison Of Predictive Equations Versus Measured Resting Metabolic Rate In Healthy Individuals
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Established prediction equations, such as the Mifflin-St. Jeor (MSJ), Harris-Benedict (HB), World Health Organization (WHO), and Nelson provide an estimate of resting metabolic rate (RMR). However, these prediction equations should be reinvestigated to determine if an update is needed. **PURPOSE:** To examine several well-known RMR prediction equations ($RMR_{predict}$) against measured (RMR_{meas}) values in healthy adults. **METHODS:** Twenty-four participants (35.2 ± 15.4 yrs, 171.8±3.9 cm, and 71.5±33.2kg) participated in this study. Each participant followed standard pre-test guidelines and underwent a single RMR assessment (RMR_{meas}) using a metabolic cart calibrated before each test. Each participant laid motionless in a supine position under a ventilated canopy for 25-30 minutes. The most stable 5 minutes of resting data within ≤5% of coefficient of variation was defined as the measured resting metabolic rate. A two-factor mixed methods ANOVA was used to compare the measured RMR against other prediction equations (HB, WHO, and MSJ) by sex. Additionally, sex-adjusted Bland Altman Limits of Agreement (LA) were reported as frequency of subjects outside of agreement compared to RMR_{meas} . For significant differences, Cohen's d effects sizes were reported. All results are expressed as M ± SD with significance set at p ≤ 0.05. **RESULTS:** On average males had 498±137kcal/d higher RMR than females (p≤0.001). The HB (1609.7 ± 300.5 kcal/d) and WHO (1620 ± 302.8 kcal/d) prediction equations did not differ from the RMR_{meas} (1703.5 ± 349.5 kcal/d) (p > 0.05). However, significant differences were observed for MSJ (1529.4 ± 284.5 kcal/d; d = 0.92) and Nelson (1515.7 ± 352.9 kcal/d; d = 1.05) prediction equations when compared to RMR_{meas} (1703.5 ± 349.5 kcal/d). The Mifflin-St. Jeor and Nelson significantly underestimated RMR when compared to RMR_{meas} by 9.3 ± 10.5% and 10.9 ± 9.8%, respectively. MSJ and Nelson had the largest frequencies outside of the LA at 20% and 36% under-predicted for females, respectively. **CONCLUSIONS:** Preliminary data shows that MSJ and Nelson RMR equations

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may need to be interpreted with caution, especially for female populations. Since no significant differences were observed between HB and WHO compared to RMRmeas, their continued use in estimating RMR in a healthy population of adults is supported.

228 Board #44 May 27 9:30 AM - 11:00 AM
INTRATER RELIABILITY OF ASSESSING THE 1-MINUTE PUSH-UP TEST

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Many law enforcement agencies, fire departments and military branches often require members to complete a muscular strength and endurance physical fitness test for entry or as a yearly test to assess their ability to perform essential job duties. Push-ups are common components of a muscular fitness assessment, especially in tactical settings. These tests require a certain level of muscular strength, however, the level of strength needed to be successful in essential job duties is widely debated. Because multiple raters are used to test large groups, scoring inconsistencies can occur due to a lack of proper movement standard knowledge between raters. **PURPOSE:** The primary purpose of this study was to evaluate interrater reliability of the 1-minute push-up test using video motion capture application across a group of fitness professionals and health science students. **METHODS:** Data collected from 28 video raters (males, n = 10; females, n = 18, age: 24.8 ± 5.5) was analyzed to determine the interrater reliability for the 1-minute push-up test. Raters were recruited from health science courses at the university where this study was conducted. Raters were shown 10 different video recordings of individuals performing the 1-minute push-up tests as a group in a classroom. Raters were instructed to score the performance of each video participants based on the testing procedures and criteria that were provided. **RESULTS:** A Cronbach's alpha reliability analysis of the entire sample revealed a high degree of interrater reliability for the push-up test. ($\alpha = .987$). **CONCLUSION:** Based on the results of this investigation, it appears that the push-up test can be assessed by different raters with a high degree of reliability. These findings are significant for populations, such as military, fire and police, that frequently perform these assessments as part of their yearly evaluations.

229 Board #45 May 27 9:30 AM - 11:00 AM
Can Lateral Weight Shift Be Reliably Observed During The Functional Movement Screen Deep Squat?

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Bilateral asymmetries of lower extremity strength have been reported in the literature and their existence may influence performance and increase injury risk. Although functional movement screen (FMS) deep squat (DS) scoring criteria does not include lateral weight shift, previous reports have demonstrated weight distribution asymmetry in both adolescent soccer players and active, adult participants. Lateral weight shifts are often observed in FMS DS, however, no previous report has determined the ability to validly and reliably observe this characteristic.

PURPOSE: To determine if lateral weight shift could be reliably rated when compared to bilateral vertical ground reaction forces (vGRF) during FMS DS.

METHODS: Thirty-seven active subjects (19 F, 18 M, 20.8 ± 1.4 yrs) granted informed consent and performed three FMS DS trials on two force plates (1200 Hz) while video (30 Hz) captured frontal, sagittal plane views. A Matlab script processed vGRF data with a lowpass filter and computed limb symmetry index (LSI) during the descent phase and full squat position. Two sports medicine professionals independently viewed videos and rated asymmetry using a novel, web-based sliding scale scoring rubric. Raters scored trials from 0-100 in interval increments of 1 with 50 representing a symmetric DS. Scores were averaged across trials and intraclass correlations (ICCs) were performed to determine inter-rater reliability. Receiver operator characteristics (ROC) curves determined cut-off scores that maximized sensitivity and specificity of determining substantial weight shifts (>10%, >15%).

RESULTS: Subjects demonstrated average LSI of 9.8 ± 6.9% with eighteen subjects demonstrating LSI > 10%. Raters were able to determine correct shift direction (L, R) in 57.7% of all subjects and 68.1% for those with average LSI > 10%. Inter-rater reliability was poor (ICC=0.41, 95% CI=-0.07, 0.69). All ROC curve areas were < 0.61 indicating the scoring rubric failed to accurately diagnose LSI > 10% or >15%.

CONCLUSIONS: Although active, adult subjects demonstrated lateral weight shift during FMS DS, raters weren't able to reliably observe this shift even in severe cases. Clinicians should demonstrate caution when prescribing interventions based on visual observance of lateral weight shift during the FMS DS.

230 Board #46 May 27 9:30 AM - 11:00 AM
Body Mass Scaling Of Metabolic Rate During Submaximal Steady-state Motorized Treadmill Climbing

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Avid rock climbers and the research literature commonly agree that body mass (M_B , kg) is the primary determinant of the energy cost of climbing. Given that gravitational resistance is the primary external force being worked against when climbing, it is presumed that the energy cost, as measured by steady-state oxygen uptake ($\dot{V}O_2$, l/min), should be proportional to both *body mass* (M_B , kg) and the *total mass* of a climber and their gear (M_T , kg) - i.e., $\dot{V}O_2 \propto M_B^b \alpha M_T^c$, where b is the theoretical mass exponent value of +1.0. The research literature, however, has never formally addressed the issue of mass exponents for climbing energy expenditure. **PURPOSE:** To begin understanding the relationship between mass and steady-state climbing $\dot{V}O_2$, this study determined M_B and M_T scaling exponents for energy cost during motorized treadmill climbing. It was hypothesized that both mass exponents would scale to the +1.0 power. **METHODS:** Data for 16 men and 4 women (Mean±SD: 25±4 yrs age; 22.7±1.5 kg/m² BMI) from a previously published study (Heil IJPEFS 2019) were used for these analyses. Each climber performed five mins of steady-state climbing at six combinations of "slow" and "fast" climbing speeds (4.6-9.1 m/min) across three treadmill grades: vertical (0°), overhang or negative incline (-5 to -10°), positive inclines (+5 to +10°). Steady-state $\dot{V}O_2$ data collected with a portable indirect calorimetry system were analyzed using standard log-linear multiple regression analyses using treadmill speed and grade, a dummy-coded gender term, and either M_B or M_T as independent variables ($\alpha=0.05$). Derived mass exponents were then compared to the theoretical value of +1.0 using 95% CIs. **RESULTS:** Without the gender term in the regression model, mass exponents for both M_B (b ; 95%CI: 1.28; 1.11-1.45) and M_T (+1.32; 1.14-1.49) were significantly higher than +1.0 (model $P<0.001$; $R^2 = 0.79$). With the gender term, however, mass exponents for neither M_B (1.05; 0.85-1.25) nor M_T (1.09; 0.89-1.29) differed from +1.0 (model $P<0.001$; $R^2 = 0.82$). **CONCLUSIONS:** The mass exponents for both M_B and M_T did not differ from the theoretical +1.0 value attributed to gravitational resistance when accounting for gender. The reason for the need to include the gender term, however, is not clear and may be an artifact of the imbalance between men (n=16) and women (n=4) in this study.

231 Board #47 May 27 9:30 AM - 11:00 AM
Evaluation Of Longitudinal Combine Performance Assessments In Ncaa Division Two Football Athletes

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INTRODUCTION: Combine style assessments provide information regarding athlete's strengths, weaknesses and ability. Values allow strength and conditioning professionals to assess training objectives and method of operation. **PURPOSE:** To evaluate longitudinal combine performance assessments in NCAA Division II football athletes. **METHODS:** One hundred fifty-four football athletes participated in combine style assessments over three years using six time points (16WI, 16SU, 17WI, 18WI, 18SU, 19SU). Tests included vertical jump via Vertec, broad jump via meter tape, electronically timed 40-yard dash, stopwatch or electronically timed pro-agility run, and maximal power clean, back squats, and bench press. For data analysis, positions were condensed into categories of Bigs (offensive and defensive lineman) Skill (wide receivers, running backs, defensive backs) and Big Skill (quarterbacks, tight ends, linebackers). Descriptive statistics and comparative analysis, mixed methods regressions, were performed using SPSS (version 24.0) with significance set at $p \leq 0.05$. **RESULTS:** Athletes displayed significant increases in back squat ($F=4.965$, $p<0.0005$), power clean ($F=3.164$, $p=0.008$), and bench press ($F=4.329$, $p=0.001$) as they participated in subsequent assessments. Athletes displayed significant decreases related to subsequent assessment in broad jump ($F=3.889$, $p=0.002$), vertical jump ($F=3.146$, $p=0.009$), pro-agility right ($F=2.555$, $p=0.028$) and left ($F=2.797$, $p=0.017$). Squat ($F=4.931$, $p<0.0005$), power clean ($F=2.806$, $p=0.017$), 40-yard dash ($F=4.369$, $p=0.001$), pro-agility left ($F=4.509$, $p=0.001$), and right ($F=4.329$, $p=0.001$) performance improved with subsequent assessments and was significantly related to position category (Skill<Big Skill<Bigs). Bench press ($F=4.827$, $p<0.0005$) performance was significantly related to subsequent assessments and position category (Skill<Big Skill<Bigs). Broad jump ($F=4.415$, $p=0.001$) and vertical jump ($F=3.707$, $p=0.003$) performance were significantly related to subsequent assessments and position category (Skill>Big Skill>Bigs). **CONCLUSION:** Subsequent assessment had an impact on combine performance results. Further, position categories have differing attributes that will impact combine performance values.

232 Board #48 May 27 9:30 AM - 11:00 AM

Stressful Exercise Reveals Hidden Correlations Between Anthropometric Measurements And Cardiovascular Parameters

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Camera-based girth measures paired with multi-spectrum bioelectrical impedance spectroscopy can aid in bodily measurements helpful for assessing composition. Fit3D is a relatively new technology for the determination of anthropometric circumferences. There are known relationships between abdominal obesity and blood pressure, but there are fewer investigations exploring the relationship between peripheral circumferences and cardiovascular parameters. **PURPOSE:** To evaluate relationships between anthropometric measurements calculated by the Fit3D to pre- and post-exercise blood pressure values. **METHODS:** 17 subjects (7 female, 10 male) underwent laboratory testing beginning with a body composition assessment by the Fit3D (Fit3D, Inc., USA). Subjects then had resting heart rate and blood pressure recorded, followed by a treadmill $\dot{V}O_2$ max assessment during which ventilatory threshold was identified using the V-slope method. This value was used to determine work rate in a subsequent 60-minute exercise session. Immediately after exercise, subjects were retested on the Fit3D and had post-exercise values of heart rate and blood pressure collected. Descriptive statistics characterized the study sample; simple linear regressions tested the relationships between anthropometric assessments and cardiovascular parameters. **RESULTS:** Subjects were 20.5 ± 1.7 years old, weighed 73.8 ± 15.4 kg, had a body fat of $24.2 \pm 6.6\%$, resting heart rate (HR) of 78.1 ± 14.9 bpm, systolic blood pressure (SBP) of 122.8 ± 4.6 mmHg, and diastolic pressure of 74.6 ± 4.9 mmHg. Fit3D-calculated "Body Shape Rating" was unrelated to HR at baseline ($p=0.297$) but a higher value predicted a lower post-exercise HR ($\beta=-0.691$, $p=0.033$). Resting forearm circumference was unrelated to SBP ($p=0.978$) and DBP ($p=0.539$), but post-exercise forearm circumference predicted both SBP ($\beta=1.336$, $p=0.031$) and DBP ($\beta=1.823$, $p=0.038$). Calf circumference was unrelated to SBP, but demonstrated trends with DBP at rest ($\beta=0.942$, $p=0.033$) and post-exercise ($\beta=1.403$, $p=0.080$). Upper arm and upper leg circumferences were unrelated. **CONCLUSION:** In a condensed age group, stressful exercise seemed to reveal otherwise-hidden correlations between peripheral anthropometric measurements and cardiovascular assessments.

233 Board #49 May 27 9:30 AM - 11:00 AM

A Simulated Climbing Test Is Correlated With Total Work From The Wingate Anaerobic Test

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(No relevant relationships reported)

INTRODUCTION: The Wingate Anaerobic Test (WANt) is a popular test for measuring lower-body anaerobic capacity and related variables. However, it may be beneficial for athletes in activities where the whole body is utilized to perform an anaerobic test that includes both the upper and lower body. Simulated climbing machines may provide comparable anaerobic capacity test results to that of the WANt. **PURPOSE:** To determine if a distance climbed 30-s maximal-effort test on a simulated climbing machine correlates with WANt variables, specifically total work (anaerobic capacity). **METHODS:** 32 participants were recruited from the local university population and reported to the lab five times. Day 1 included reading and signing the IRB approved informed consent, recording of anthropometric data, and practicing the protocol on both the cycle ergometer (Monark 598E) and simulated climbing machine (Versaclimber SM Sport). On days 2-5, participants performed the anaerobic test protocol on each machine twice using a random order. The WANt protocol used a 7.5% body mass resistance with a 3-5-minute warm-up followed by 30-sec of maximal effort cycling. The climbing protocol included a 3-5-minute warm-up with no resistance followed by a 30-sec maximal effort climb with the lowest resistance possible on the machine. Each protocol was performed twice on two separate days. Intraclass correlation coefficient (ICC_{3,1}) were calculated between two trials of the WANt total work (J), between the two trials of the climber for distance climbed. Bivariate correlations were calculated for total work on the WANt and distance on the climber. **RESULTS:** Fifteen males (24.8 ± 6.5 yrs; 176.2 ± 5.4 cm; 77.0 ± 13.5 kg) and fifteen females (23.1 ± 4.1 yrs; 159.4 ± 6.4 cm; 69.2 ± 13.8 kg) completed the study. A high degree of test-retest reliability was found for WANt total work (ICC = .99 [98-.99], $p < 0.001$) and climbing distance (ICC = .94 [93-.99], $p < 0.001$). WANt total work and climbing distance were significantly correlated, $r = .81$, $p < .001$.

CONCLUSIONS: Simulated climbing machines may be a reliable method for performing anaerobic capacity testing. Athletes involved in activities involving both the upper and lower body may have a greater benefit using a simulated climbing machine over the traditional cycle ergometer.

234 Board #50 May 27 9:30 AM - 11:00 AM

Methods For Estimating Anaerobic Glycolytic Capacity (vLa_{Max}) In Trained Cyclists

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PURPOSE: The maximum rate of lactate production (vLa_{Max}) can be used to estimate the maximum anaerobic energy contribution, which can be used to optimize endurance training. The aim of this study was to examine the reliability of a 20-sec vLa_{Max} estimate using either a variable or standardized alactic time interval (t_{alac}). **METHODS:** 16 trained male cyclists and triathletes (35.3 ± 8.9 yo, 1.80 ± 0.05 m, and 73.3 ± 11.2 kg, average 30-sec Wingate power of 9.0 ± 1.6 Wkg⁻¹) were recruited. Subjects completed two familiarization trials on their own before completing two 20-sec maximal sprints on their own bikes which were attached to a Wahoo Kickr trainer. Each session began with a 10-min warm-up at 100 W before each sprint and were then followed by 12-min passive rest. A lactate (HLA) sample was taken from the finger at the end of the sprint and then every 2-min after that until HLA dropped ≥ 1 mM. vLa_{Max} was then calculated using (HLA post - pre)/(20-sec - alactic time), where t_{alac} was either time 0-sec to time where power drops 3.5%, or was set at 5-sec. **RESULTS:** Individual sprint sessions data were analyzed and no significant differences ($p > 0.05$) nor were noted between session 1 and 2 data; all data were pooled and then vLa_{Max} calculated using methods described above. Mean 20-sec sprint power was 9.8 ± 1.0 Wkg⁻¹ (~109% of Wingate) and a total work of 14.5 ± 2.7 . The t_{alac} was calculated to be 4.0 ± 2.3 -sec. There was no significant difference ($p > 0.05$) between the calculated vLa_{Max} 0.51 ± 0.18 mL·L⁻¹·sec⁻¹ and vLa_{Max} using the a standard 5-sec value, 0.54 ± 0.15 mL·L⁻¹·sec⁻¹. Neither vLa_{Max} value appears to be associated ($r^2 < 0.10$, $p > 0.05$) with absolute sprint performance. **CONCLUSIONS:** These results indicate that using a standard t_{alac} of 5-sec produced similar results as calculating it using a 3.5% drop in power. While vLa_{Max} may ultimately influence HLA testing curves (i.e., lactate threshold) and endurance performance, it does not appear to be associated with actual sprint power output.

235 Board #51 May 27 9:30 AM - 11:00 AM

Comparisons Of Functional Movement Screen Values In Different Weight Populations

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(No relevant relationships reported)

PURPOSE: In this study, we explored the mechanism of overweight and obesity on functional exercise ability through correlating functional movement screen (FMS) with BMI, and comparing FMS values among different weight groups. **METHODS:** FMS was performed in 481 adults (male 209, female 272) aged 20 to 69. The FMS consists of 7 modes of action: deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability push up and rotary stability. The total score of FMS is 21 points. The BMI grading criteria of Chinese people was used. **RESULTS:** (1) BMI was negatively correlated with the total score of FMS, and the correlation coefficient was -0.309 ($P < 0.01$). The correlation coefficients of BMI with shoulder mobility and rotary stability were -0.404 and -0.311 ($P < 0.01$), respectively. (2) If BMI exceeded 26 kg/m², the total score showed a downward trend. The decline was most obvious when exceeded 31 kg/m². (3) The total FMS score of obese group was significantly lower than that of normal weight and overweight group ($P < 0.01$), and that of overweight group was significantly lower than that of normal weight group ($P < 0.01$). (4) The scores of shoulder mobility and rotary stability of obese people were significantly lower than those of normal weight and overweight people ($P < 0.01$). The scores of active straight leg raise in obese group were significantly lower than normal weight group ($P < 0.01$). (5) There was significant difference in the score distribution of in-line lunge ($\chi^2 = 13.097$, $P = 0.011$), the proportion of 1 point is the highest in obese people, and the proportion of 3 points from high to low is normal weight, overweight and obese people. The scores of shoulder mobility and active straight leg raise were significantly different among the three groups ($\chi^2 = 61.661$, $P = 0.000$; $\chi^2 = 14.852$, $P = 0.005$), the proportion of 3 points from high to low was normal weight, overweight and obese people. There was also a significant difference in the distribution of rotary stability scores ($\chi^2 = 34.388$, $P = 0.000$). **CONCLUSION:** BMI was negatively correlated with FMS performance, and the order of FMS performance from good to bad was normal weight, overweight and obese people. Among the three groups, the most obvious differences were shoulder mobility, rotary stability and active straight leg raise.

236 Board #52 May 27 9:30 AM - 11:00 AM
Examining A Method For The Comprehensive Assessment Of Instantaneous Force Using Directional Continuous Jump Motion Test

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(No relevant relationships reported)

PURPOSE: To develop a directional continuous jump motion test and conduct a comprehensive assessment and comparison of basketball players under the conventional measurement method (vertical jump, standing long jumps [forward, back]) and the directional continuous jump measurement method (vertical, forward, backward). **METHODS:** Subjects included the following two groups; general students (10 male students) and basketball students (10 male students). The conventional single jump (vertical jump, standing long jumps [forward, back]) and the directional continuous jump (vertical, forward, backward) were measured using Kinect2. For the directional continuous jumps, subjects were instructed to perform the first vertical jump to the best of their ability and then to move to the next motion as quickly as possible after landing. Overall scores were calculated for jump height/distance using the conventional measurement method and the directional continuous jump measurement method. Then, the standard score (T-score) for the basketball group was calculated on the basis of the mean for the general male student group. The difference between the means of the standard score (T-score) on the conventional single measurements and on the directional continuous jumping measurement were tested. The level of significance was set at 5%. **RESULTS:** Significant differences was not found in the means of the overall standard scores (T-Scores) for conventional single measurements and directional continuous jump measurements. The individual results indicated that six subjects had an overall standard score (T-score) that was higher than the average (50) under the conventional measurement method, and eight subjects had higher than average scores under the directional continuous jump measurement method. It show that even a player who scored below the mean for general students on the conventional measurement (single jumps) scored higher than the mean for all directions in the directional continuous jump measurement. **CONCLUSION:** When studying athletes, overall instantaneous force can be assessed and gauged efficiently using the directional continuous jump measurement method.

237 Board #53 May 27 9:30 AM - 11:00 AM
The Accuracy Of Prediction Equations For Estimating 1rm In The Press And The Deadlift

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(No relevant relationships reported)

Many of the equations used to predict the one-repetition maximum (1RM) from the number of repetitions performed to fatigue with a submaximal load have been derived from the squat and bench press exercises in which the eccentric portion precedes the concentric portion of the repetition. In the press and deadlift, the concentric phase precedes the eccentric phase which may affect performance in the number of repetitions performed to fatigue and, thus, the accuracy of existing 1RM prediction equations for these exercises.

PURPOSE: To compare the actual 1RM to the predicted 1RM from seven existing prediction equations for the press and deadlift. **METHODS:** 30 resistance trained individuals (23±3 yrs) completed a 1RM protocol for the press and deadlift. Participants then returned to the lab on two separate occasions and completed one set of each exercise to fatigue at either 70% or 90% of their 1RM in a randomized order. The actual 1RM was compared to the predicted 1RM from seven 1RM prediction equations for each exercise at each load. A one-way repeated measures (1x8) ANOVA was used followed by Bonferroni post-hoc tests to determine pairwise differences between the actual and predicted 1RM values. **RESULTS:** For the press, the predicted 1RM from 70% 1RM lifted to fatigue was significantly ($p<0.002$) lower than the actual 1RM from three of the seven equations (mean differences of 3.1±0.7, 5.7±0.7, and 6.2±0.7 kgs) and the predicted 1RM from 90% 1RM lifted to fatigue was significantly ($p<0.012$) greater than the actual 1RM from four of the seven equations (mean differences of 3.0±0.7, 3.2±0.7, 3.5±0.6, and 4.7±0.7 kgs). For the deadlift, the predicted 1RM from 70% 1RM lifted to fatigue was significantly ($p<0.001$) lower than the actual 1RM from three of the seven equations (mean differences of 13.7±2.7, 20.1±2.3, and 20.3±3.2 kgs) whereas the predicted 1RM from 90% 1RM lifted to fatigue was significantly ($p<0.012$) greater than the actual 1RM from one of the seven equations (mean differences of 7.1±1.0 kg). **CONCLUSIONS:** Lower loads (70% 1RM) used to predict the 1RM may underestimate the actual 1RM whereas higher loads (90% 1RM) may overestimate the

1RM for the press and deadlift. The use of higher loads for 1RM prediction increases the accuracy of the 1RM prediction for the deadlift in most equations but still may lead to an overestimation of the 1RM.

238 Board #54 May 27 9:30 AM - 11:00 AM
Use Of Hr_{index} To Predict Oxygen Uptake: A Validation Study

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Heart rate index (HR_{index}), expressed as an activity HR divided by resting HR (HR_{rest}), has been proposed to estimate oxygen uptake (VO₂) of physical activity and aerobic capacity (VO₂max). Recently, a prediction equation (e.g., METs=6×HR_{index}-5) that used HR_{index} to predict VO₂ in MET was developed retrospectively from aggregate data of 60 published studies. However, it is unclear whether this predictive model is accurate when applied among individuals. **Purpose:** To examine the predictive validity of the HR_{index} equation by comparing submaximal and maximal VO₂ predicted by the HR_{index} equation (VO₂-Pred) with that measured by indirect calorimetry (VO₂-Meas). **Methods:** 60 healthy adults (21±2 yrs.; 28 males and 32 females) participated in this study. Each subject underwent a VO₂max test and an experimental session on two separate days. The experimental session consisted of a 15-min resting period and three successive 10-min treadmill exercise bouts performed at 40%, 60% and 80% of VO₂max. VO₂ and HR were recorded continuously during both the VO₂max test and the experimental session and these data were used to obtain VO₂-Pred and VO₂-Meas for each level of intensity and for VO₂max. Validation was carried out by Pearson product-moment correlation analysis, paired t-test, Bland-Altman plots, and by assessment of mean absolute errors. **Results:** A significant ($p<0.05$) correlation coefficient was found between VO₂-Pred and VO₂-Meas at 40% ($r=0.56$), 60% ($r=0.60$), and 80% of VO₂max ($r=0.55$) and at VO₂max ($r=0.51$). VO₂-Pred differed significantly ($p<0.05$) from VO₂-Meas at 40% (5.7±1.4 vs. 4.9±1.0 METs), 60% (8.5±2.0 vs. 7.5±1.4 METs), and 80% of VO₂max (10.5±2.4 vs. 9.6±1.8 METs) and at VO₂max (11.8±2.7 vs. 12.6±2.3 METs). Prediction biases were +0.74, +1.06, +0.82, and -0.83 METs, while mean absolute errors of prediction were 22.1%, 21.6%, 19.1% and 16.1% at 40%, 60%, and 80% of VO₂max and at VO₂max, respectively. **Conclusion:** It appears that the prediction equation involving HR_{index} overestimates VO₂ at submaximal intensities and underestimates VO₂max in healthy adults. These results suggest that further investigation aimed to establish the accuracy of using HR_{index} to predict VO₂ is warranted.

239 Board #55 May 27 9:30 AM - 11:00 AM
A Novel Device To Assess Eccentric Grip Strength

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(No relevant relationships reported)

PURPOSE: To determine normative values for eccentric grip strength derived from an original device in general Japanese populations and to investigate the relationship between isometric grip strength and eccentric grip strength. **METHODS:** In the present study, 102 subjects (32 men: age 61.5±11.0 years, height 170.6±6.7 cm, weight 68.2±9.8 kg; 70 women: age 60.7±14.9 years, height 156.0±7.4 cm, weight 52.4±7.2 kg) participated. Isometric grip strength was assessed using a dynamometer (Takei, Co., Ltd, Tokyo, Japan). The peak force of eccentric grip strength was assessed using an original device. The device utilized an AC servo motor (60 W class) to generate eccentric force to unclench the subject's hand at a constant speed of 32.67 mm/s. Intra-class correlation coefficients (ICCs) and coefficients of variation (CVs) were calculated for the variables of interest.

RESULTS: The isometric grip strength was 39.2±7.8 kg and 25.6±4.7 kg in men and women, respectively. The peak eccentric grip strength was 50.0±12.1 kg and 30.9±7.2 kg in men and women, respectively. The CV tended to be higher in the eccentric grip strength (26-26.6%) than in the isometric grip strength group (18.7-20.0%). The ICC of eccentric grip strength was 0.944-0.953 for both groups.

CONCLUSIONS: Based on these findings, it is suggested that the eccentric grip strength device shows good test-retest reliability. In addition, the eccentric grip strength is 20.7-27.5% higher than the isometric grip strength in the general population.

240 Board #56 May 27 9:30 AM - 11:00 AM
Abstract Withdrawn

241 Board #57 May 27 9:30 AM - 11:00 AM
Does Heart Rate Response Confirm The Attainment Of Maximal Oxygen Uptake In Adults 45 Years And Older?

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Heart rate plateau (HR_{plat}) is an effective indicator for confirming $\dot{V}O_{2max}$ attainment. However, it is unknown if this criterion holds for older populations. **PURPOSE:** Test the efficacy of HR_{plat} for confirming $\dot{V}O_{2max}$ in older individuals. **METHODS:** Twelve males and twelve females (60±8 years, N=24) completed individualized ramp and staged protocols to volitional fatigue on the cycle ergometer (CE) and treadmill (TM), respectively. Participants then performed verification protocols at 105% of their peak workload from each $\dot{V}O_{2max}$ test. $\dot{V}O_{2max}$ was confirmed using a plateau in $\dot{V}O_2$ ($\dot{V}O_{2plat}$ = largest $\dot{V}O_2$ value - closest neighboring point ≤150 ml/min), a $\dot{V}O_{2max}$ verification criterion of a $\dot{V}O_2$ not greater than 2% higher than the incremental phase, and two different criteria for HR_{plat} (≤2 bpm or ≤4 bpm). Secondary criteria for establishing maximal effort were $RER_{max} \geq 1.10$, $HR_{max} \pm 10$ bpm of $APHR_{max}$, $RPE \geq 17$, and $[BLa] \geq 8$ mM. **RESULTS:** Data are presented (Table 1) as sex-specific percentages. All attained $\dot{V}O_{2plat}$ on both modalities. The verification criterion was met by ≥ 67% of females and ≥ 92% of males in our sample regardless of modality. HR_{plat} (≤2 bpm) was met by ≤ 67% of females and ≤ 44% of males in our sample regardless of modality. Males more frequently attained HR_{plat} (≤4 bpm) than did females; females attained HR_{plat} (≤4 bpm) more frequently on TM as compared to CE. **CONCLUSION:** A verification bout is reliable for confirming $\dot{V}O_{2max}$ in older males on both modalities and for females on the TM. HR_{plat} (≤4 bpm) may serve as a standalone criterion for TM $\dot{V}O_{2max}$ attainment for males and females. $\dot{V}O_{2plat}$ was the most robust method for confirming $\dot{V}O_{2max}$ attainment in older adults. Due to wide variability in the literature regarding $\dot{V}O_{2plat}$ criteria and indirect calorimetry processing methods, agreement on a standardized definition for $\dot{V}O_{2plat}$ and clear data processing procedures are needed. Table 1. $\dot{V}O_{2max}$ attainment criteria for all tests across sex and modality (N=24)

Criterion	Treadmill (%)		Cycle Ergometer (%)	
	Males	Females	Males	Females
$\dot{V}O_{2plat}$ (≤150ml/min)	100	100	100	100
HR_{plat} (≤2 bpm)	44	67	25	18
HR_{plat} (≤4 bpm)	100	83	75	64
$[BLa]$ (≥8mM)	25	8	50	25
HR_{max} (± 10 bpm $APHR_{max}$)	90	92	92	75
RER_{max} (≥ 1.10)	83	75	92	100
RPE (≥17)	92	100	100	100
$\dot{V}O_{2verif}$ (≤2% higher than $\dot{V}O_{2max}$)	92	83	92	67

$\dot{V}O_{2plat}$ = plateau in oxygen consumption. HR_{plat} = plateau in heart rate. $[BLa]$ = maximal blood lactate concentration. $APHR_{max}$ = age-predicted heart rate max (220-age). RER_{max} = maximal respiratory exchange ratio, RPE = maximal rating of perceived exertion. $\dot{V}O_{2verif}$ = $\dot{V}O_{2max}$ of the verification trial.

242 Board #58 May 27 9:30 AM - 11:00 AM
SEX DIFFERENCES IN MAXIMAL OXYGEN UPTAKE: WHAT ARE THE BIGGEST CONTRIBUTORS?

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 (No relevant relationships reported)

Previous investigations in maximal aerobic capacity ($\dot{V}O_{2max}$) have attributed sex differences to anatomical and physiological parameters. **PURPOSE:** To determine the main factor affecting $\dot{V}O_{2max}$ in a sample of physically active young adults. **METHODS:** Sixteen college-aged students (18-25 years, 8 males and 8 females) participated in one laboratory visit including body composition, hematocrit (HCT), and $\dot{V}O_{2max}$ assessment. Lean body mass (LBM) and fat mass (FM) were obtained from a whole-body DEXA scan. Hematocrit (HCT) was determined using a finger prick blood sample and validated by measures of urine specific gravity (USG) to control for hydration status. A graded exercise test was performed on the cycle ergometer using 25 watt (W) per minute and 20 W per minute incremental protocols for men and women respectively. $\dot{V}O_{2max}$, cardiac output max (Qmax) and stroke volume max (SVmax) were recorded using the COSMED Quark CPET metabolic cart. Cardiac output was

determined using the Fick principle. Test measure means were grouped by sex and analyzed for significance using a one-way ANOVA. A Pearson's R correlation was performed to determine the association between variables of HCT, LBM, SVmax, Qmax, absolute $\dot{V}O_{2max}$.

RESULTS: Males showed significantly greater measures of height (177.94 cm ± 5.74 cm vs. 166.6 cm ± 3.1 cm; p<0.01), LBM (63.70 kg ± 7.51 kg vs. 43.85 kg ± 1.90 kg; p<0.01), HCT (46.9% ± 3.5% vs. 42.2% ± 3.0%; p<0.05), absolute $\dot{V}O_{2max}$ (3.377 L/min ± 0.464L/min vs. 2.439 L/min ± 0.300 L/min; p<0.05), Qmax (20.4 L/min ± 2.3 L/min vs. 14.84 L/min ± 1.80 L/min; p<0.01) and SVmax (110.1 mL ± 13.5 mL vs. 78.24 mL ± 7.47 mL; p<0.01) compared to females. Pearson's R correlation analysis showed that absolute $\dot{V}O_{2max}$ (L/min) was positively correlated with Qmax (R= 0.989), SVmax (R= 0.958) and LBM (R= 0.777).

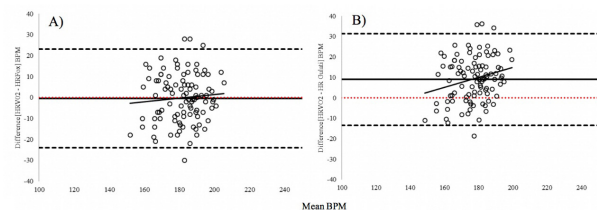
CONCLUSIONS: Sex differences in maximal aerobic capacity should be understood predominantly as a consequence of maximal cardiac output and sex-related differences in body size and lean mass.

243 Board #59 May 27 9:30 AM - 11:00 AM
Accuracy Of Age-predicted Maximal Heart Rate In The General Population

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Age-predicted maximal heart rate (APMHR) is an essential measure for health care professionals in determining cardiovascular response to exercise testing, exertion during exercise, and exercise prescription. Although multiple prediction equations have been validated for specific populations, the criterion validity of each for use in a general population requires testing. **PURPOSE:** To evaluate the agreement between measured max heart rate (HR_{max}) with APMHR equations in the general population. **METHODS:** HR_{max} from 99 graded treadmill exercise tests (GXT) at a sports performance clinic were attained (age: 38.2±12.4, BMI: 25.6±3.9, $\dot{V}O_{2max}$: 46.5±10.3). GXTs was terminated once volitional fatigue was achieved and were only included for analysis if RER exceeded 1.10. Five previously established equations were used to predict HR_{max} : Fox (220-age), Tanaka (208 - 0.7*age), Gellish (207-0.7*age), Gulati (206-0.88*age), and Arena (209.3-0.72*age). Bland-Altman plots were used to establish the level of agreement. Univariate ANOVA with pairwise comparisons was performed to assess if differences existed between measured and predicted HR_{max} . **RESULTS:** Figure 1 depicts agreement between measured and predicted HR_{max} . A significant main effect was found for HR_{max} between measures ($F_{5,588} = 12.094$, p<0.001). The Gulati equation was significantly different from GXT HR_{max} (p<.001). Analysis of Bland-Altman plots revealed minimal bias with similar levels of agreement in all prediction equations with the exception of Gulati (mean difference: 9.3). Slope of the plots show that prediction equations underestimate HR_{max} in individuals with lower measured HR_{max} and vice versa, with the exception of the Fox equation. **CONCLUSION:** All prediction equations aside from Gulati may be suitable to predict HR_{max} in a general population. The Fox equation may be superior as it is less likely to under or overestimate based on individual HR_{max} .

Figure 1. Bland-Altman plots showing levels of agreement between HR_{max} during GXT and the Fox (A) and Gulati (B) prediction equations



244 Board #60 May 27 9:30 AM - 11:00 AM
A Validation Study Of A Treadmill Speed Incline Conversion Chart

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PURPOSE: To investigate the accuracy of the Hillrunner.com treadmill speed/incline conversion chart using ventilatory data, heart rate, subjective perceived effort, and blood lactate. **METHODS:** Two groups of experienced runners, divided based on their self-reported easy run pace, ran at 6 different speed/incline combinations for 5 minutes each. All stages were equivalent according to the HillRunner.com chart, and 1 minute standing rest was given between stages. Group 1 (n=11) ran at inclines up to 4%, while Group 2 (n=22) ran at inclines up to 10%. Oxygen consumption ($\dot{V}O_2$),

respiratory exchange ratio (RER), heart rate (HR), blood lactate (BL), overall rate of perceived exertion (RPE), and leg RPE (LRPE) were measured for each stage. $\dot{V}O_2$ was compared against the $\dot{V}O_2$ predicted by the ACSM equation (ACSM. $\dot{V}O_2$). Stage order was randomized, and repeated-measures ANOVA was used to detect differences between stages and inclines. **RESULTS:** Measures of exercise intensity did not change as incline rose from 0% to 4% in Group 1 ($p > .05$). Increases in $\dot{V}O_2$ (42.2 ± 3.6 to 45.9 ± 4.0 mL.kg⁻¹.min⁻¹; $p < .05$), HR (146 ± 12 to 151 ± 12 bpm; $p < .05$), BL (1.4 ± 0.9 to 1.9 ± 1.2 mM; $p < .05$) and LRPE (10 ± 2 to 12 ± 2 ; $p < .05$) were found as incline increased from 0% to 10% in Group 2. When compared with $\dot{V}O_2$, ACSM. $\dot{V}O_2$ underestimated oxygen consumption at all inclines up to 8% ($p < .05$). ACSM. $\dot{V}O_2$ was similar to $\dot{V}O_2$ at an incline of 10% in Group 2 (45.9 ± 4.0 vs. 46.7 ± 2.4 mL.kg⁻¹.min⁻¹; $p > .05$). Within subjects, pooled results show moderate correlations between HR and BL at 0% and 2% ($R = 0.478$, $R = 0.587$; $p < .01$) but not at 4% ($R = 0.309$; $p > .05$). Statistically significant correlations were also found between HR and BL at 6%, 8%, and 10% ($R = 0.601$, $R = 0.560$, $R = 0.600$; $p < .01$) in the Group 2 participants. **CONCLUSIONS:** The HillRunner.com chart appears valid at relatively low inclines. However, at higher inclines, the decreases in speed may not prevent increases in exercise intensity as measured with $\dot{V}O_2$, HR, BL, and LRPE. The ACSM $\dot{V}O_2$ prediction equation underestimates oxygen consumption in a trained population at inclines up to 8%.

245 Board #61 May 27 9:30 AM - 11:00 AM
Development And Reliability Of A Comprehensive Test Battery For Performance Diagnostic In Team Sports
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 (No relevant relationships reported)

Team sports are characterized by complex coordinative and conditional abilities that are prerequisites for optimal performance and injury prevention of the athletes. To assess these abilities, comprehensive and reliable tests are needed. **Purpose:** The aim of this study was to determine the test-retest reliability of team-sports specific performance tests and to optimize test execution with respect to test quality. **Methods:** Single-limb standing balance (SB_left, SB_right), straight-line sprint over 10 m (SLS_10), foot tapping test over 3 and 15 s (FTT_3 and FTT_15), Countermovement Jump (CMJ) and Drop Jump (DJ) were evaluated. 16 healthy students (8 males, 8 females) participated in the study, which was conducted in two waves with $n = 8$ each. From the findings of study 1 (s1), test execution modifications for 3 of 6 tests were defined in study 2 (s2). Therefore SLS_10, FTT_3 and FTT_15 were analyzed with $n = 16$. Results of SB, CMJ and DJ refer separately to s1 and s2. Test-retest was assessed on two occasions within 1 week. Reliability was analyzed by use of intraclass correlation coefficient (ICC) and 95%-limits of agreement (LoA). Classification of reliability was based on the following ICC values: < 0.5 : poor, $0.5 < 0.75$: moderate, $0.75 < 0.90$: good, > 0.90 excellent. **Results:** The overall ICC indicate an excellent reliability for SLS_10 (ICC 0.93; LoA -0.1 to 0.1 s). FTT_15 and FTT_3 show moderate to good reliability (FTT_15: ICC 0.74; LoA -1.4 to 0.8 Hz; FTT_3: ICC 0.77; LoA -1.4 to 0.9 Hz). CMJ demonstrate an excellent reliability for both studies with ICC 0.92 (s1) vs. 0.93 (s2) and LoA -2.5 to 6.2 cm (s1) vs. -1.2 to 4.5 cm (s2). SB_left (s1: ICC 0.66; LoA -139.2 to 199.1 mm; s2: ICC 0.68; LoA -97.6 to 83.8 mm) and SB_right (s1: ICC 0.61; LoA -70.8 to 200.7 mm; s2: ICC 0.67; LoA -81.9 to 111.4 mm) indicate a moderate reliability and DJ a good reliability (s1: ICC 0.77; LoA -5.6 to 7.4 cm; s2: ICC 0.81; LoA -5.2 to 5.4 cm) in both study groups. **Conclusion:** Except for tests of standing balance, all other tests revealed a good to excellent test-retest reliability by use of ICC with SLS_10 and CMJ as the outstanding tests. Test modifications towards s2 led to slight improvements in reliability. However LoA reveal remarkable intra-individual variations between s1 and s2 which should be kept in mind when testing and rating an athlete's performance.

246 Board #62 May 27 9:30 AM - 11:00 AM
Comparison Of Portable Metabolic Analyzers During Walking, Running, And Jogging
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 (No relevant relationships reported)

Portable devices that accurately detect the composition of expired gases open new possibilities in research and accessibility of energy expenditure and aerobic capacity measurements.

PURPOSE: The purpose of this study was to compare the O_2 uptake measurements of the $\dot{V}O_2$ Master Pro (VM) to the Cosmed K5 (K5) during walking, jogging, and running in field and lab conditions.

METHODS: Twelve proficient runners, with a current 10k pace of 5:19 min/km, performed 3 matched intervals at 3 different speeds (4.82, 8.05, 11.27 kph) on a treadmill and on an outdoor track, while expired gasses were measured. During walking intervals, the VM did not report data for the majority of participants, and were, therefore, excluded from analysis. Jogging and running measurements were analyzed

using a repeated measures ANOVA. In addition to the human subject measures, a device airflow test was performed using a 3L calibration syringe timed to a metronome at 15, 25, and 35 bpm to simulate different respiratory frequencies (RF).

RESULTS: The indoor analysis revealed significant differences in $\dot{V}O_2$ (2284 vs. 1320 ml/min at jogging pace; 3,016 vs. 1,880 ml/min at running pace), $\dot{V}e$ (51.1 vs. 40.7 ml/min at jogging pace; 71.02 vs. 57.11 ml/min at running pace), and HR (130 vs. 128 bpm at jogging pace; 157 vs. 155 bpm at running pace) between the K5 and VM respectively ($p < .05$). Outdoor running analysis revealed a significant difference in $\dot{V}O_2$ (2359 vs. 1354 ml/min at jogging pace; 3295 vs. 1969 ml/min at running pace) and $\dot{V}e$ (53.4 vs. 40 ml/min at jogging pace; 81.77 vs. 63.01 ml/min at running pace) between the K5 and VM respectively ($p < .05$). Notably, the outdoor analysis did not show a significant difference in HR or speed ($p > .05$). For the airflow test, a 2-tailed, paired t-test revealed a significant difference in $\dot{V}e$ (46.0 vs. 42.7 ml/min at 15 bpm; 77.2 vs. 69.3 ml/min at 25 bpm; 107.9 vs. 96.2 ml/min at 35 bpm) and TV (3.05 vs. 2.85 L/breath at 15 bpm; 3.07 vs. 2.77 L/breath at 25 bpm; 3.08 vs. 2.75 L/breath at 35 bpm) at all Rf ($p < .001$).

CONCLUSIONS: These findings indicate that there are significant discrepancies between the VM and the K5.

247 Board #63 May 27 9:30 AM - 11:00 AM
Evaluation Of Maximal Oxygen Uptake Using Verification Phases Of Different Intensities Across Fitness Levels
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 (No relevant relationships reported)

Confirmation of maximal oxygen consumption ($\dot{V}O_{2max}$) has relevance in both clinical and exercise settings. Though there are criteria in place to confirm $\dot{V}O_{2max}$ has been attained, they are inconsistently achieved. For example, a plateau in $\dot{V}O_2$ with a corresponding increase in workload is often absent, and other criteria such as a respiratory exchange ratio (RER) ≥ 1.15 or heart rate (HR) within 10 beats per min (bpm) of age predicted maximum can result in an inaccurate estimate of $\dot{V}O_{2max}$. Due to these shortcomings, some researchers have suggested the use of a verification phase (VP) to confirm the attainment of $\dot{V}O_{2max}$. **PURPOSE:** Therefore, this study aimed to provide further evidence for the need to use a VP with $\dot{V}O_{2max}$ testing protocols in populations of different fitness levels. **METHODS:** 49 participants (M: 27, F: 22; 21.9 ± 2.6 y, 24.3 ± 2.8 kg·m²) had their $\dot{V}O_2$ and HR measured during three maximal graded treadmill tests with each test followed by a VP of differing intensity (85%, 95%, 105% final workload). Participants were divided into groups based on their $\dot{V}O_{2max}$ using norms adapted from American College of Sports Medicine (ACSM) $\dot{V}O_{2max}$ guidelines (poor, fair, good, excellent) resulting in 7, 19, 18, and 5 participants respectively. $\dot{V}O_{2max}$ from the graded treadmill test was confirmed with the VP and/or an additional test if the highest $\dot{V}O_2$ value achieved was no more than 2 x typical error (TE: 1.9 to 3.7 mL·kg⁻¹·min⁻¹ across groups). **RESULTS:** Plateau was achieved on 43/147 tests (29%), RER ≥ 1.15 was achieved on 104/147 tests (71%), HR within 10 bpm of age-predicted max was achieved on 83/147 tests (56%), and volitional fatigue was reached on 147/147 tests (100%). The highest $\dot{V}O_2$ value attained on the initial $\dot{V}O_{2max}$ test was not different than either value attained following the VP at 95 or 105% of final $\dot{V}O_{2max}$ test workload or a second repeat test on a separate day ($P > 0.211$). The 85% VP $\dot{V}O_2$ value was lower than the initial $\dot{V}O_{2max}$ test value ($P < 0.001$). **CONCLUSION:** While traditional criteria to confirm the attainment of $\dot{V}O_{2max}$ were inconsistently achieved, the use of a VP (at 95 or 105%) or a subsequent repeat test on a separate day were able to confirm the $\dot{V}O_{2max}$ value attained. Our data also suggests exercise studies employing only a single $\dot{V}O_{2max}$ test should consider these inconsistencies across a range of fitness levels.

248 Board #64 May 27 9:30 AM - 11:00 AM
DOES LOWER EXTREMITY FMS PERFORMANCE PREDICT VERTICAL JUMP HEIGHT IN FEMALE NCAA DIVISION III FOOTBALLERS
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 (No relevant relationships reported)

BACKGROUND: Functional Movement Screening (FMS) is typically used as a pre- and post-sports participation tool that examines the athlete's ability to maintain balance, core strength, range of motion, flexibility and stability, which are all components of optimal sports performance. In FMS, higher scores indicate a greater ability to perform one of seven movement patterns. This study aimed to identify which lower extremity FMS movement patterns (deep squat, hurdle step, in-line lunge, and active straight leg raise) would predict vertical jump height. **METHODS:** Twenty-four members of a NCAA Division III women's soccer team (mean \pm SD): (age=19 \pm 1 yrs.; height=1.7 \pm 0.1 m; BMI=23.6 \pm 2.5 kg·m²; body fat=29.1 \pm 4.3%) volunteered for FMS screening in addition to performance testing including vertical jump. All testing was conducted pre-season. **RESULTS:** This study suggests a relationship between deep squat FMS scores and vertical jump height. Stepwise multiple regressions ($p \leq 0.05$) indicated that there is a direct relationship between vertical jump

height and the deep squat ($r = 0.416$, $F = (1, 22) = 4.611$, $p = .043$) but not amongst the other lower extremity FMS tests (in-line lunge, hurdle step, active straight leg raise, p 's = 0.82, 0.78, 0.27 respectively). **CONCLUSIONS:** While there is no one perfect screening tool to assess optimal performance, individual tests within the FMS battery can be useful in identifying performance in NCAA Division III female athletes. The use of individual FMS testing can be an additional predictor for performance variables, particularly those involved with power motion such as the vertical jump.

249 Board #65 May 27 9:30 AM - 11:00 AM
ESTIMATION OF THE VENTILATORY THRESHOLD USING WIRELESS NEAR-INFRARED SPECTROSCOPY AND DISTANCE MAXIMUM ANALYSIS

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(No relevant relationships reported)

The ventilatory threshold (VT) separates moderate intensity (<VT) and heavy intensity (>VT) domains and can be determined using a pulmonary gas exchange system in a laboratory setting. Knowledge of an exercise workload (i.e., velocity during running) in which the VT occurs is useful when prescribing individualized cardiorespiratory exercise. If wireless near-infrared spectroscopy (NIRS) systems could estimate the VT, more environment specific testing results could be obtained. **PURPOSE:** To investigate if the VT can be estimated via wireless NIRS responses from the medial gastrocnemius (G) or vastus lateralis (VL) during a running graded exercise test (GXT). **METHODS:** 17 healthy, recreationally active adults (age = 21 ± 4 years, height = 1.68 ± 0.11 m, weight = 66.3 ± 16.8 kg) completed a GXT on a treadmill to volitional fatigue. Every three minutes the velocity was increased by +1 km/hr (starting velocity = 5 km/hr) while the incline remained at 1%. Pulmonary gas exchange and NIRS (G, VL) data were continuously collected. The pulmonary gas exchange data was visually inspected (V-Slope, end-tidal pressures, and ventilatory equivalents) to identify the velocity at which the VT occurred (vVT). The last 15 seconds of NIRS data (G, VL) for each stage were averaged and the velocity at each NIRS threshold (vNIRS-G, vNIRS-VL) were determined by the distance maximum (Dmax) analysis. Concurrent validity of the NIRS thresholds (vNIRS-G, vNIRS-VL) were assessed against the VT (vVT) using Pearson correlation coefficients (r) and standard error of estimate (SEE). Statistical significance was established *a priori* at $p < 0.05$. **RESULTS:** vNIRS-G was not significantly related to vVT (vNIRS-G = 8.6 ± 1.2 km/hr, vVT = 8.1 ± 1.1 km/hr, $r = -0.08$, $p = 0.769$) and had an SEE of 1.2 km/hr. vNIRS-VL also was not significantly related to vVT (vNIRS-VL = 9.1 ± 1.6 km/hr, $r = 0.313$, $p = 0.221$) and had an SEE of 1.1 km/hr. **CONCLUSION:** The present results demonstrate poor concurrent validity between the NIRS thresholds and the VT during running exercise. Based upon the present results, it is suggested that the NIRS threshold not be determined by Dmax analysis during running GXT.

250 Board #66 May 27 9:30 AM - 11:00 AM
Maximal Oxygen Consumption Differences Between A Treadmill And A Combined Arm And Leg Ergometer Protocol

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There are different modes of exercise and equipment to measure maximal oxygen consumption (VO_{2max}). The equipment used may elicit different values depending on the amount of muscle mass recruited, the participant's activity history, and if the participant is sitting (bike) or weight-bearing (treadmill). Using a simultaneous arm and leg protocol may serve as an additional testing mode for accurate assessment of cardiorespiratory capacity. **Purpose:** The purpose of this study is to compare the relative VO_{2max} elicited from a common treadmill protocol (TM) to a simultaneous arm and leg ergometer protocol (AL). **Methods:** Participants completed two VO_{2max} trials, separated by 7-14 days, with the order of the trials randomized. The TM trial assessed VO_{2max} using the Bruce protocol. For the AL trial, participants used an arm and leg ergometer at the same time throughout the duration of the test. Resistance started at 50 watts on the electromagnetically-braked bike ergometer and increased by 30 watts for each two minute stage. The arm ergometer resistance started at 24.5 watts and increased 4.9 watts for each two minute stage. Cadence on the arm ergometer was set at 50 rpm while the leg rpm was self-selected. **Results:** Thirteen apparently healthy college-aged participants completed both TM and AL assessment trials (21 ± 1.68, female n = 9). There was a difference ($p < .05$) between TM and AL in VO_{2max} (ml/kg/min) (45.0 ± 7.3 vs. 42.1 ± 6.7, respectively), RER (1.18 ± .08 vs. 1.13 ± .06 min, respectively), and completion time (10.9 ± 1.3 vs. 7.5 ± 2.2 min, respectively), with AL values at 93.6 ± 5.7% (range = 78.8-100.7%) of TM. Peak heart rate was not different between TM and AL (185.7 ± 8.3 vs. 188.3 ± 10.5 min, respectively). **Conclusion:** A standard treadmill protocol elicited a higher VO_{2max} , RER, and completion time than

a novel simultaneous arm and leg ergometer protocol. However, AL values were a high percentage of the TM values. Therefore, a simultaneous arm and leg protocol may serve as an additional option in the assessment of cardiorespiratory capacity.

251 Board #67 May 27 9:30 AM - 11:00 AM
Temporal Trends In Handgrip Strength For Adults

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PURPOSE: To estimate national and international temporal trends in handgrip strength for adults.

METHODS: Data were obtained from a systematic search of studies reporting temporal trends in handgrip strength for adults aged 20-89 years, and by examining national fitness datasets. Sample-weighted temporal trends were estimated using best-fitting regression models relating the year of testing to mean handgrip strength. International and national trends were estimated by a post-stratified population-weighting procedure. **RESULTS:** Trend data from nine studies/datasets representing 2,550,360 adults from five high- and two upper-middle-income countries between 1967 and 2017, collectively showed a negligible decline in mean handgrip strength of -2.6% (95%CI: -2.8 to -2.4) or -0.08 standard deviations (95%CI: -0.09 to -0.07). Internationally, trends were curvilinear over time, with the rate of change (per decade) in handgrip strength steady from 1967 to 2000 at 0.3% (95%CI: 0.0 to 0.6), before declining at -3.5% (95%CI: -3.3 to -3.7) from 2000 onwards. National trends ranged from a decline of -6.3% (95%CI: -7.2 to -5.4) per decade in England (50-89-year-olds between 2004 and 2013) to an improvement of 3.3% (95%CI: 2.8 to 3.8) per decade in Mexico (20-69-year-olds between 1978 and 2000). **CONCLUSIONS:** Despite a negligible improvement from 1967 to 2000, handgrip strength has declined among adults over the past two decades, which is suggestive of a modern decline in overall strength capacity. Temporal handgrip strength data from low- and lower-middle-income countries are needed to better track trends in population health and fitness and to guide healthy public policy.

252 Board #68 May 27 9:30 AM - 11:00 AM
Metabolic Equations To Estimate VO_{2max} Of Healthy Active Canadian Men Aged 18-34 Years-old: Preliminary Results

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(No relevant relationships reported)

VO_{2max} is simply defined by the body's ability to use oxygen during physical exercise and is widely used as an indicator of cardiorespiratory fitness. Lower VO_{2max} is associated with higher risk of morbidity and mortality as well as low physical performance while higher VO_{2max} levels predict good performance in aerobic sports. Direct measurement of VO_{2max} is still considered as the gold standard. However, it is costly, required sophisticated equipment, and less accessible. Therefore, several metabolic equations have been developed to estimate VO_{2max} using indirect calculation in sub maximal tests. The most commonly used equations are those developed by the American College of Sport Medicine (ACSM) and the research group of Fitness Registry and the Importance of Exercise National Database (FRIEND). **PURPOSE:** This study aims to evaluate the accuracy of these two equations to estimate VO_{2max} comparatively to direct O_2 consumption measurement. **METHODS:** 30 healthy active men aged between 18-34 years old (BMI: 23.9±2.9 kg/m²) who are avid runners performed a maximal treadmill test with direct VO_2 measures (mlO₂/kg/min) using a metabolic cart (Vyntus CPX). VO_{2max} estimation was calculated using ACSM and FRIEND running metabolic equations. Direct and indirect results were compared with repeated measures T-test. These preliminary results are part of a larger study which includes 180 men and women of all age group (18-34, 35-54, and ≥ 55y.o.). **RESULTS:** Indirect VO_{2max} obtained from ACSM and FRIEND equations showed very large ($d = 2.01$) and moderate ($d = 0.6$) effect size, and were significantly different when compared to direct measures (ACSM: 66.4±7.0; FRIEND: 56.5±5.9; Vyntus: 53.0±6.3; $p < 0.001$). The mean ACSM overestimation was 13.4 mlO₂/kg/min while FRIEND equation was only 3.5 mlO₂/kg/min. **CONCLUSION:** The VO_{2max} calculated with ACSM and FRIEND equations for running showed overestimate values in our male sample. However, the average difference between direct and indirect measurement is smaller when using the FRIEND equation suggesting better accuracy. More research is needed to evaluate the accuracy in different populations and different fitness levels to optimize the VO_{2max} estimation formula.

523 Board #69 May 27 9:30 AM - 11:00 AM
Self-selected Music Effects Perceived Exertion But Not Metabolic Indices During VO₂Max Testing In Women

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 (No relevant relationships reported)

VO₂max testing for research is often conducted in a highly controlled environment with only "encouragement" from testers to help ensure maximal effort is given. It has been hypothesized that music can have an ergogenic effect by either increasing the state of readiness to perform the exercise or create a state of disassociation from the task being performed to increase performance. For this reason, music is often discouraged during athletic testing. While there is a myriad of hypotheses and research on exercise with music, little research exists on the effect of music on optimal VO₂max testing conditions.

Purpose: This study seeks to determine the effects of self-selected music during a VO₂max test on measures of metabolic indices and perceived exertion.

Methods: Twenty-two women (19.95±0.79y and 65.41±9.96kg) volunteered to participate in this study. Individuals were asked to perform a modified Bruce protocol incremental treadmill test to exhaustion on two occasions separated by at least 24 hours, once with no music, and once listening to self-selected music. Time at volitional fatigue (TTE) was also recorded. During the test, expired gases were recorded to analyze maximal VO₂ and VO₂ at VT. RPE during each stage using the Borg scale and then averaged for each individual throughout the test. Following each test, participants were asked to rate their overall feeling of exertion on a visual analog scale (VAS). Paired samples t-tests were conducted to determine any differences between each condition.

Results: Paired samples t-tests showed no significant difference for TTE (\bar{x} music = 684.18±86.07s; \bar{x} no music = 668.1±81.25s; $p=0.12$), VO₂max (\bar{x} music = 44.45±5.82ml/kg/min; \bar{x} no music = 43.9±7.27ml/kg/min; $p=0.36$), or VT (\bar{x} music = 27.29±6.52ml/kg/min; \bar{x} no music = 26.93±7.03ml/kg/min; $p=0.32$). However, paired samples t-tests revealed significant difference for RPE (\bar{x} music = 13.1±1.58; \bar{x} no music = 14.13±1.48; $p<0.05$) and VAS (\bar{x} music = 10.85±2.29cm; \bar{x} no music = 9.37±2.72cm; $p<0.05$).

Conclusions: The findings of this study supports previous research demonstrating a connection between music and a decrease in perceived exertion during exercise. However, the addition of self-selected music during a testing session did not have a significant effect on all physiological variables measured.

524 Board #70 May 27 9:30 AM - 11:00 AM
Comparison Of Novel Hop Testing Method To Identify Decreased Performance And Asymmetries

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Hop testing is used to evaluate athletes that are returning to sport. Evaluating alternative tools that use less repetitive impact could put these vulnerable populations at lower risk for injury during testing. Limited research examines various plyometric tests and traditional hop testing at identifying decreased performance and asymmetries.

Purpose: To examine the association between alternative and traditional hop tests in physically active adults.

Methods: Participants performed a series of seven hop tests in a randomized order including both single and double leg takeoffs for a single, double, and triple jump, and 2-1-2 bound. Three successful trials were performed for each jump. Left and right limbs were combined for all analyses. Spearman's Rho correlations were performed to investigate the relationship between jump tests.

Results: Twenty physically active individuals (age 18 - 32; 11 female, 9 male) participated. There were large associations between single leg single, double, and triple jumps ($r = 0.854-0.960$, $p<0.001$). There were large association between double leg single, double, and triple jumps ($r = 0.908-0.923$, $p<0.001$). There were large associations between single leg single jump and double leg single jump ($r = 0.939$, $p<0.0001$), single leg double jump and double leg double jump ($r = 0.886$, $p<0.0001$), and single leg triple jump and double leg triple jump ($r = 0.851$, $p<0.001$). There were large associations between single leg single jump and 2-1-2 jump ($r = 0.853$, $p<0.001$), single leg double jump and 2-1-2 jump ($r = 0.900$, $p<0.0001$) and single leg triple jump and 2-1-2 jump ($r = 0.904$, $p<0.001$). There were large associations between double leg single jump and 2-1-2 jump ($r = 0.929$, $p<0.001$), double leg double jump and 2-1-2 jump ($r = 0.905$, $p<0.0001$), and double leg triple jump and 2-1-2 jump ($r = 0.832$, $p<0.001$). **Conclusion:** There was a high positive correlation between all single leg jumps tested and the 2-1-2 jump as well as all double leg jumps and the 2-1-2 jump. These results indicate that utilization of double leg 2-1-2 jump may be a safer precursor to examining performance before initiating single leg jumps. These results

demonstrate that the 2-1-2 jump and double leg jumps may be utilized without the increased load of repetitive landing impact on a unilateral limb as seen in traditional hop testing.

255 Board #71 May 27 9:30 AM - 11:00 AM
ACSM And FRIEND Running Equations, Are They Valid For Healthy Active Women?: Preliminary Results

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VO₂max is simply defined by the body's ability to use oxygen during physical exercise and is widely used as an indicator of cardiorespiratory fitness. Lower VO₂max is associated with higher risk of morbidity and mortality as well as low performance while higher VO₂max predict good performance in aerobic sports. Direct measurement of VO₂max is still the gold standard, however this method presents high cost and required sophisticated equipment. Therefore, several metabolic equations have been developed to estimate VO₂max using indirect calculation. The most commonly used equations are those developed by the American College of Sport Medicine (ACSM) and the research group of Fitness Registry and the Importance of Exercise National Database (FRIEND).

Purpose: The aim of this study is to evaluate the accuracy of these two equations to estimate VO₂max comparatively to direct O₂ consumption measurement.

Methods: 21 healthy active women aged between 22-50y.o. (mean: 37,1±7,4) (BMI: 23,0±2,5kg/m²) performed a maximal treadmill test using a metabolic cart (Vyntus CPX) to measure direct VO₂max (mlO₂/kg/min). VO₂max estimation was then calculated using ACSM and FRIEND running metabolic equations. Results were compared using repeated measures T-test. These preliminary results are part of a larger study which includes 180 men and women of all age group and fitness level (18-34, 35-54 and ≥ 55y.o.).

Results: When compared to the direct measurement (Vyntus: 44,9±4,9), only the ACSM equation showed significantly higher results 53,0±6,6(mean difference: 8,1; $p<0,01$). The FRIEND equation did not significantly differ from the metabolic cart result (45,5±4,7)(mean difference: 0,56; $p=0,5$). In the same direction, ACSM showed a large effect size (Hedge's $g = 1,29$) while Friend only showed a small effect size ($g = 0,11$).

Conclusion: The VO₂max calculated with the ACSM equation for running showed overestimated values in our female sample. The average difference between direct and indirect measurement when using the FRIEND equation suggests a better accuracy. More research is needed to evaluate the accuracy in different populations and different fitness level to optimize the VO₂ estimation formula.

256 Board #72 May 27 9:30 AM - 11:00 AM
Comparison Of Peak Lactate Levels Between A Wingate Test And Dune Climb

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The Wingate cycle test has been a widely accepted and utilized laboratory test to assess anaerobic power. Blood lactate levels measured during tests of maximal exertion, such as the Wingate, provide useful information regarding energy production pathways that are beneficial to training. Research has indicated that blood lactate levels measured during a cycling test may be lower than those measured during a treadmill test.

However, we were unable to find research that compared peak blood lactate during a laboratory based Wingate cycle test to peak values immediately following a dune climb sprint. **Purpose:** The purpose of this study was to compare maximum blood lactate levels measured directly following a laboratory based Wingate test v. a sprint dune climb in healthy college subjects. **Methods:** 11 participants (5 male, 6 female, mean age 201 years) that were enrolled in a cycling spring term course at Alma College voluntarily completed a sprint dune climb (approximately 70 feet uphill at 5% incline) and a Wingate test. Tests were performed 7 days apart to minimize effects of muscle fatigue. Blood lactate levels were measured immediately following cessation of exercise. **Results:** There was no significant difference in maximum blood lactate level achieved between the two tests (w: 7.4±2.13 mg/dL v. dc: 6.35±4.19, $p = .235$). **Conclusion:** Peak blood lactate levels achieved following maximal anaerobic exercise does not appear to be altered by mode or environment (laboratory v. field based) in this study.

257 Board #73 May 27 9:30 AM - 11:00 AM

A Comparison Of Female Only Predictive Equations Versus Measured Resting Metabolic Rate

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Established prediction equations, such as Dore, Garrow and Weber (GW), and Cunningham (CH) were developed to predict resting metabolic rate (RMR) in females. However, these female prediction equations should be reexamined to determine if an update is required. **PURPOSE:** To examine several well-known female only RMR prediction equations (RMR_{predict}) against measured (RMR_{meas}) values in healthy females. **METHODS:** Fourteen female participants (36.5 ± 16.2 yrs, 166.8 ± 3.6 cm, and 62.7 ± 33.2 kg) participated in this study. Each participant followed standard pre-test guidelines and underwent a single RMR assessment using a metabolic cart calibrated before each test. Each participant laid motionless in a supine position under a ventilated canopy for 25-30 minutes. The most stable 5 minutes of resting data within $\leq 5\%$ of coefficient of variation was defined as the measured resting metabolic rate. A one-way repeated measures ANOVA was used to compare the RMR_{meas} against RMR_{predict} (Dore, GW, and CH). Additionally, Bland Altman Limits of Agreement (LA) were reported as frequency of subjects outside of agreement compared to RMR_{meas} . For significant differences, Cohen's *d* effects sizes were reported. All results are expressed as $M \pm SD$ with significance set at $p \leq 0.05$. **RESULTS:** The GW (1408.3 ± 149.3 kcal/day) and CH (1497 ± 135.8 kcal/day) prediction equations did not differ from the RMR_{meas} (1485.4 ± 247.2 kcal/day) ($p > 0.05$). However, significant differences were observed for Dore (1104.5 ± 89.3 kcal/day; $d = 2.71$) prediction equation when compared to RMR_{meas} . Dore under-predicted 100% of cases under the LA and the Garrow had the highest variability over-predicting and under-predicting 50% and 21.4%, respectively. The Dore equation significantly underestimated RMR when compared to RMR_{meas} by $23.8 \pm 9.3\%$. **CONCLUSION:** Our preliminary data shows that the use of the Dore prediction equation underestimated RMR by 380.9 ± 157.9 kcal/day. Therefore, using this equation to estimate calories in females should be interpreted with caution. Although not statistically different from the RMRmeas, the GW equation had the largest variability of RMR estimates. Our data supports the continued use of the CH prediction equation, as no significant differences were observed compared to RMRmeas in a healthy population of females.

258 Board #74 May 27 9:30 AM - 11:00 AM

Validation Of A Novel $VO_{2\text{max}}$ Protocol

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The Bruce treadmill protocol is commonly utilized when assessing maximal oxygen consumption ($VO_{2\text{max}}$). As the Bruce was developed originally for cardiac patients, and its initial stages are very slow coupled with a steep grade, it may not be an appropriate protocol for young or trained individuals with higher levels of cardiorespiratory fitness. Additionally, the steep grade used in the Bruce protocol elicits significant local muscular fatigue, which may cause participants to end the test prior to reaching their true $VO_{2\text{max}}$. Secondly, the Astrand protocol also utilizes a steep grade and the speed of the first two stages is relatively slow, which may not elicit a significant cardiovascular response in healthy individuals. The apparent flaws of these two validated tests may present limitations that can induce measurement error and underestimation of $VO_{2\text{max}}$ in healthy or well-trained populations.

PURPOSE: The purpose of this study is to validate a novel $VO_{2\text{max}}$ protocol that may be better suited for healthy or well-trained populations. **METHODS:** Ten participants performed the Bruce, Astrand, and Novel protocols in a randomized and counterbalanced order with the following maximal values being recorded from each protocol: $VO_{2\text{max}}$, minute ventilation (V_e), respiratory exchange ratio (RER), heart rate (HR), rating of perceived exertion (RPE), and time to exhaustion (TTE). **RESULTS:** Paired samples t-tests revealed no differences in $VO_{2\text{max}}$ when comparing the Novel versus both the Bruce ($p = .151$) and Astrand protocols ($p = .503$). Results from the Bland-Altman Analysis revealed that the Novel protocol exhibited a low degree of bias with tight limits of agreement when compared to the Bruce (mean bias $\pm 95\%$ LOA = 1.102 ± 4.357) and Astrand protocols (mean bias $\pm 95\%$ LOA = -0.440 ± 3.920). Additionally, the Novel protocol resulted in significantly lower TTE when compared to the Bruce ($p < .001$) and Astrand protocols ($p = .001$). **CONCLUSION:** The Novel protocol produces similar $VO_{2\text{max}}$ values to that of the Bruce and Astrand protocols with lower TTE, or test duration, making it a quicker and more effective protocol for this population.

259 Board #75 May 27 9:30 AM - 11:00 AM

Swim Or Run? Comparison Of Flume And Treadmill Maximal Aerobic Capacities In Trained Swimmers

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PURPOSE: Treadmill testing and cycle ergometry are the most common modes of exercise testing for assessing maximal aerobic capacity ($VO_{2\text{max}}$). Most sedentary subjects and trained runners have higher $VO_{2\text{max}}$ measurements during treadmill testing compared to cycle testing, suggesting mode of exercise affects $VO_{2\text{max}}$. However, trained cyclists attain higher $VO_{2\text{max}}$ values on cycle ergometry than treadmill testing due to the specific adaptations of cycle training. Front-crawl swimming is a dynamic exercise involving both upper and lower limbs. The purpose of this study was to determine if trained swimmers have higher $VO_{2\text{max}}$ values when swimming compared to running. **METHODS:** Eight trained swimmers (3 M, 5 F; 21.6 ± 2.9 years) performed $VO_{2\text{max}}$ testing on a treadmill and in a swim flume. For the flume test, subjects breathed through a 2-way non-rebreathing snorkel that collected their expired breath for analysis. For the treadmill test, subjects used a mouthpiece, nose clip, and 2-way non-rebreathing valve. For both modes of exercise, the subjects' expired air was collected into a mixing chamber and analyzed by a metabolic cart. The subjects exercised at increasing intensities until volitional fatigue on both tests. Blood lactate was assessed before and after each test. Metabolic measurements and heart rates (HR) were measured continuously and reported as 10-s averages. **RESULTS:** The subjects had higher $VO_{2\text{max}}$ values on the treadmill than in the swim flume (56.2 ± 7.8 vs. 50.6 ± 11.5 ml $\text{kg}^{-1} \text{min}^{-1}$, $p = 0.034$). At $VO_{2\text{max}}$, minute ventilation, tidal volume, and respiratory frequency were all higher on the treadmill than in the flume. Respiratory exchange ratio and HR were significantly higher following the treadmill test and post-run lactate tended to be higher on the treadmill test ($p = 0.055$). However, oxygen pulse (VO_2/HR), an index of cardiac stroke volume, did not differ between tests, as both VO_2 and HR were lower while swimming. **CONCLUSIONS:** Results from the study suggest that running elicits a greater cardiovascular demand than swimming even in trained swimmers. This may be due to greater involvement of the larger leg muscles in running than in swimming. Future studies should examine the other three competitive swimming strokes, as they are less efficient than the front crawl and more reliant on the lower body for propulsion.

260 Board #76 May 27 9:30 AM - 11:00 AM

 $VO_{2\text{max}}$ And Ventilatory Threshold Comparison Between Boxing And Arm-crank Exercise Tests

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PURPOSE: Maximum oxygen uptake ($VO_{2\text{max}}$) and ventilatory thresholds (VT) obtained from an exercise test are indicators of functional capacity. Additionally, they can be employed to prescribe exercise and to evaluate the evolution of an exercise program. For upper-body exercise, the arm-crank exercise test is considered the gold standard to estimate $VO_{2\text{max}}$. Recently, boxing training has been employed as an upper-body physical activity modality in cardiovascular disease populations to improve health outcomes, such as cardiorespiratory fitness. However, according to the specificity principle of exercise training, changes on physical fitness are better reflected if the same modality of exercise is being used during its assessment. Therefore, the purpose of this study was to compare $VO_{2\text{max}}$ and VT estimations between boxing and arm-crank exercise test.

METHODS: Twelve subjects (8 males, 4 females) performed a boxing exercise test by repeatedly executing the boxing combination of right hook and left hook. A metronome set a tempo for participants to follow throughout the exercise protocol; for males, the metronome started at 140 Beats Per Minute (BPM) and increased by 30 BPM after every stage until exhaustion; for females, the tempo was set to 125 BPM and increased 30 BPM after every 2-minute stage until exhaustion. When performing the arm-crank exercise test, participants pedaled at a range of 50 to 60 revolutions per minute. Male subjects start pedaling at 50 Watts (W) resistance and would increase 15 W at the end of each 2-min stage until exhaustion. Female subjects pedaled at 40 W resistance and would increase by 10 W at the end of each stage until exhaustion. Throughout both exercise tests, VO_2 was constantly recorded. Statistical analysis included Bland-Altman analysis for agreement and Pearson correlation for strength of association. **RESULTS:** Although $VO_{2\text{max}}$ and ventilatory threshold showed statistical agreement between both exercise modalities ($VO_{2\text{max}}$ 95% CI [-7.6 to 6.7], VT 95% CI [-29.1 to 21.4]), clinical agreement was not obtained. Additionally, there was a strong association for $VO_{2\text{max}}$ ($r: 0.7$, $p < 0.05$) and a weak correlation for VT ($r: 0.2$, $p < 0.05$). **CONCLUSIONS:** Exercise tests should be specific for the exercise modality that is being used for training.

261 Board #77 May 27 9:30 AM - 11:00 AM
Contrasting Product Claims With Actual Physiological Measurements Of Popular "Exercise" Equipment

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People around the world are increasingly aware of their need to exercise regularly. Many of them are turning to simple, attractive solutions they see on television, but not all countries have equally strict regulations for assessment of product claims, and the criteria for scientific support appear to be lax for exercise equipment. It would be unfortunate for people to purchase useless equipment and give up exercise because of a lack of positive results. **PURPOSE:** to measure the acute physiological response to using a popular piece of equipment, commercially available in Costa Rica. **METHODS:** 1) VO_2 was tested at rest and using the equipment with a Jeager MasterScreen CPX metabolic cart (CareFusion Corporation, San Diego, CA). Energy expenditure was calculated simultaneously from heart rate (Polar FT7, Kempele, Finland) (HRM), accelerometry (Actigraph wGT 3x-BT, Pensacola, FL) (ACC), and a pedometer (3DActive PDA-100, London, UK) (PED). 27 young, apparently healthy students (15F, 12M) rested in a supine position for 10 min while measuring oxygen consumption. They proceeded to use the exercise machine according to manufacturer's instructions, in the highest setting, for 10 min (EXER). **RESULTS:** All data are Mean \pm SD. Subjects were 19.1 \pm 1.0 y.o., 1.647 \pm 0.073 m tall, and weighed 63.09 \pm 10.13 kg; resting $\text{VO}_2 = 3.2 \pm 0.7 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$. During EXER, calculated energy expenditure was highest with PED (63.3 \pm 7.6 kcal, gross), registering 2099.1 \pm 250.5 "steps"; HRM recorded 24.7 \pm 7.9 kcal (gross), while ACC recorded 0.8 \pm 1.2 kcal (net) during those 10 min. Exercise intensity was measured from VO_2 at 1.54 \pm 0.23 METs, corresponding to 5.6 \pm 2.2 kcal of net (16.8 \pm 2.8 kcal gross) 10-min energy expenditure. **CONCLUSION:** Not even the least accurate, most generous measurement using PED was close to the infomercial claim of 277 kcal in 10 min for a lean, small female runner. The actual net energy expenditure while using this equipment, as carefully measured in this study with indirect calorimetry, will result in an insignificant amount of body fat loss, even if used for a full hour every day. Users are advised to save their money and buy two or three good pairs of walking shoes instead. Funded by the University of Costa Rica, project VI-838-B6-766.

262 Board #78 May 27 9:30 AM - 11:00 AM
Constructing A Tool To Assess Orienteer'S Competence

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Components to determine orienteering performance consists of orienteering map reading ability and physical conditioning. Orienteers are typically trained in a well-designed course with pre-determined locations of start, controls and finish. The winner expends the least time. In addition, athletes always train themselves in varied outdoor settings or even on a treadmill. However, there had been no a tool to assess orienteering map reading ability and physical conditioning respectively. **PURPOSE:** To develop a systematic approach to assess individual map-reading ability and physical conditioning with considering physiological characteristics. **METHODS:** Twelve orienteers (9 males and 4 females, training experience: 3.6 \pm 1.7 yrs., BMI: 21.8 \pm 1.8 kg/m²) were recruited to participate the study. Participants were asked to have 2 runs in the same test course wearing device of Garmin Forerunner® 935/HRM-Tri. The first run mimicked the real competition, which was followed by a second run after enough rest and reviewing the map in detail. Anaerobic threshold (AT: 10.0 \pm 2.0 km/hr) and critical velocity (CV: 11.4 \pm 2.0 km/hr) were measured in lab using a standardized protocol on treadmill. The map-reading ability is defined by the difference between the first run velocity and the second run velocity. Repeated measures of one-way ANOVA was used to exam the mean difference among the first run velocity, the second run velocity, AT and CV. Statistical significant difference is set at $p < .05$. **RESULTS:** The first run velocity was significantly lower than the second run velocity, AT and CV (8.5 \pm 1.2 km/hr vs. 9.5 \pm 1.5 km/hr, 10.0 \pm 2.0 km/hr, 11.4 \pm 2.0 km/hr). However, the second run velocity did not differ from AT. The %HR_{max} of the first run was also significantly lower than that of the second run (85.7 \pm 4.3% vs. 89.8 \pm 2.6%). To further assess individual map-reading ability and physical conditioning, we constructed a four-quadrant analysis tool to interpret the current state and future training direction. Two of participants showed excellent map-reading ability and good physical conditioning, which matched their achievements in formal competition. **CONCLUSION:** A tool for assessing orienteer's competence was developed. It may be helpful for a coach to prescribe individual training plan or select some talent athletes.

263 Board #79 May 27 9:30 AM - 11:00 AM
Physical Performance Testing For Entry-level Undergraduate Turkish Physical Education Students

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Background: Physical performance testing is required in Turkey on entry to undergraduate study in physical education (PE). However, there is no standard test battery across academic institutions. **Purpose:** This investigation compared a laboratory cardiorespiratory (CR) fitness evaluation with field testing in a convenient group of first year students at an accredited undergraduate PE program. **Methods:** Twelve apparently healthy athletic male undergraduate PE students (mean age=19.5, SD=1.5) individually performed laboratory cardiopulmonary exercise testing (CPET), the Cooper 12-minute Run (C12RT) and the Shuttle Run (SRT) field tests one week apart. Body composition including detailed segmental analysis was also assessed with a Full Body BIA Analyzer. **Results:** The mean CPET VO_2 max was 64.21 ml/kg/min (SD=7.3) with a superior age-gender fitness classification (>55 ml/kg/min; >95th percentile). Both the C12RT (Mean=59.54 ml/kg/min, SD=7.1) and SRT (Mean=60.67 ml/kg/min, SD=3.8) correlated with CPET ($p < 0.05$). The mean Mass of Body Fat and Body Fat% was 10.9, SD=2.4, and 16%, SD= 2.8 respectively. The mean Lean Body Mass was 56.76 kg, SD=6.8. **Conclusions:** The field tests were valid and practical methods of measuring CR fitness in this sample group. **Future Directions:** PE teachers can positively influence students by modeling an active lifestyle to promote physical fitness. The identification of an approved comprehensive physical performance test battery for PE programs in Turkey may provide an opportunity for benchmarking across academic institutions.

264 Board #80 May 27 9:30 AM - 11:00 AM
Effects Of A Race Timer On The 3 Minute All-out Test For Critical Power

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The Critical Power (CP) model provides a valuable insight into the physiological capacities of an individual to perform work by profiling both aerobic and anaerobic capacities. The 3 Minute All-Out Test for Critical Power (3MT) was developed as a time conscious method for obtaining CP as well as providing insights into the amount of work done above CP (WEP). Concerns about pacing during the test lead researchers to develop a protocol which blinds participants to time during the 3MT. Due to the role that knowledge of time plays in anticipation, pacing, and decision-making during exercise, this protocol may lead to inaccurate results obtained from the 3MT. **PURPOSE:** To investigate the effects of incorporating a race timer in the 3MT. **METHODS:** Twelve healthy active males (Age: 24.9 \pm 2.2 yrs; Height: 180.4 \pm 7.5 cm; Weight 78.1 \pm 6.6 kg; VO_2 peak 53.9 \pm 6.1 ml.kg.min) completed one VO_2 peak test and one 3MT familiarization trial before completing one standard 3MT and one 3MT with the presence of a countdown race timer in a randomized and counterbalanced order. Paired T-tests were used to compare CP, WEP, PPO, Mean Power, Total Work, VO_2 peak, & HRmax. **RESULTS:** CP was significantly higher in the timer condition (Timer: 276.7 \pm 49.6 Watts vs. Standard: 267.51 \pm 44.54 Watts, $p = 0.02$) while WEP was significantly lower in the timer condition (Timer: 12.47 \pm 4.01 kJ vs. Standard: 13.71 \pm 4.34 kJ, $p = 0.004$). No significant differences were observed in PPO, Mean Power, Total Work, VO_2 peak, & HRmax between trials. **CONCLUSION:** These results suggest that the knowledge of time (elapsed or remaining) may have a significant impact on CP and WEP in the 3MT. This impact may be due in part to the role that knowledge of time plays in pacing and decision making, and fits within the framework of the Affordances Competition Hypothesis. These findings warrant further investigation in more experienced cyclists in order to better understand what role knowledge of time plays in the 3MT.

265 Board #81 May 27 9:30 AM - 11:00 AM
Shuttle Run And Performance In Aerobic And Anaerobic Capacities.

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 (No relevant relationships reported)

Field hockey is a physiologically demanding sport with intermittent bouts of aerobic and anaerobic performance. The ability to assess player condition is vital to coaching success. In place of VO_2 , the 20-meter shuttle run test (SRT) is a common alternative for on field determination of a player's aerobic fitness. Limited data supports the

relationship between shuttle run and anaerobic fitness in this population. **PURPOSE:** To determine the accuracy of a shuttle run test (SRT) as a predictor of field hockey performance. **METHODS:** We enrolled 19 D1 field hockey players (18-22 years old) in an 11-week prospective study. Goalies and injured players were excluded from the study. A 6-week program prior to the study consisted of a 20m shuttle run during practice. Speed was gradually increased by 0.5 km/h at a time, each increase in running speed was coded as a change in level. A Polar Pro GPS/heart rate recorder (Polar Electro Inc. Bethpage, NY) recorded effort parameters during 43 practices. Data included time in heart rate (HR) zone 4 (80-89%) (sec), time in HR zone 5 (90-100%) (sec), percentage of HR max (%) total distance covered (m), distance/min (m/min), maximum speed (km/h), number of sprints (acceleration >1.9 m/s²), and distance in speed zone 5 (>19.00 km/h) (m). Bivariate correlations and linear regressions tested relationships between SRT and on-field performance. **RESULTS:** SRT was significantly related to total distance covered ($r=0.090, p=0.022$), distance per minute ($r=0.112, p=0.004$), maximum speed ($r=0.097, p=0.013$), distance in speed zone 5 ($r=0.119, p=0.002$), and number of sprints ($r=0.188, p<0.001$). No other relationships were detected. Better performance on the SRT corresponded to more (and more frequent) in-practice sprinting. **CONCLUSION:** Although the SRT may not provide a valid estimate of VO₂ max, it is a valid predictor for many components of on-field performance. It associates with total distance, distance per minute, maximum speed, distance in speed zone 5, and number of sprints in collegiate field hockey players.

266 Board #82 May 27 9:30 AM - 11:00 AM
Stroboscopic Vision-induced Sensory Reweighting During Postural Control
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 (No relevant relationships reported)

Human postural control is achieved by dynamic reweighting of sensory inputs among visual, vestibular, and somatosensory systems in accordance with an external environment. However, due to experimental limits, little is known how partially disrupted visual inputs affect postural control. **PURPOSE:** The purpose of this study was to explore the effects of stroboscopic glasses on postural control. **METHOD:** 24 healthy people (M: 12, F:12, Height: 172.1±7.8, weight: 67.5±10.4) performed balance tests (jump landing balance and single leg balance) with 3 sets of 10 second, respectively. While the jump landing test has three conditions (eyes-open (EO), and high and low strobe vision (HSV, and LSV) respectively), the single-leg balance has four conditions (EO, HSV, LSV, and eyes-closed (EC)). These two balance tests will be implemented on a firm surface and a foam surface. Main outcome measure were dynamic postural stability index (DPSI) and the center of pressure (COP) excursion with 2 directions (anterior-posterior (A/P) and medial-lateral (M/L)). For the surface conditions, student-t test was used. For DPSI and COP excursion, an analysis of variance with repeated measures was performed to determine difference in balance performance between these visual conditions. **RESULT:** In the jump landing balance, DPSI was greater on the foam than the firm ($p = .0474$). Likewise, in the single leg balance, CoP excursion was greater in both A/P and M/L on the foam than the firm ($p < .0001$). For the vision conditions, in the jump landing balance, DPSI was greater in HSV and LSV than EO ($p = .0100$ and $p = .0013$, respectively). In the single leg balance, CoP excursion was greater in EC, HSV, and LSV than EO ($p < .0001$). Additionally, CoP excursion in EC was greater than HSV and LSV ($p = .0012$ and $p = .0093$, respectively). In the single leg balance, both HSV and LSV showed greater interaction with foam in both A/P and M/L than the firm (6% up to 22%). **CONCLUSION:** The effects of stroboscopic glasses on postural control were less than the effects of eye-close. The subjects seemed to rely more on visual inputs to stabilize posture in an unstable condition. The stroboscopic glasses, that can adjust visual inputs, may be used to measure the reliance of visual inputs in those who have reduced or altered somatosensory function.

267 Board #83 May 27 9:30 AM - 11:00 AM
Anaerobic Power Measurement Tests In Athletes
 Rodrigo D. Pandelo¹, Braulio H M Branco², Emilson Colantonio³, Romeu Candido, Jr¹, Domingos R. Pandelo, Jr¹.
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PURPOSE: The aim of the present study is to verify if Countermovement Jump (CMJ) and Countermovement Jump with arm swing (CMJA) can be used as an alternative for anaerobic power measurement in athletes, due to the higher physical and psychological demand demands required by the Wingate test (WAnT). **METHODS:** Thirteen individuals were selected, all males and physically active. All participants had reported any known cardiovascular, orthopedic or neuromuscular problems. A protocol familiarization session was held before each test in order to

participants had the opportunity to learn about each protocol. WAnT was performed with 7.5% of the participants' body mass. For all tests data were collected for analysis of Peak Power (PP), Average Power (AP) and Fatigue Index (FI). **RESULTS:** The results were as expected as the PP and AP indicators were higher in CMJA compared to CMJ. This was to be expected due to the increased power transfer rate through the use of the arms. The highest power measurements were found in the WAnT test, which was also expected. However, when analyzing FI, WAnT also has the highest index (6.33% in CMJ, 4.89% in CMJA, and 17.08% in WAnT). Comparing the AP (in watts) of the 3 tests, based on measurement of effect size (Hedge's g), the following values were reached: 1.67 for WAnTxCMJ, 1.17 for WAnTxCMJA, and 0.42 for CMJxCMJA. So, can be said that there is large difference, in practical terms, in the first 2 cases, and moderate in the third case **CONCLUSIONS:** This study showed that there are significant differences between the 3 anaerobic lower limb power assessments tested (WAnT, CMJ and CMJA). Therefore the WAnT test should not be replaced by the CMJ and CMJA tests when we are evaluating anaerobic power of the lower limbs, since the existence of significant differences between them, as showed in the effect size analysis (Hedge's g). Remarks can be done in sports that have specific characteristics that recommend the adoption of one or another test, depending on the motor skill and other specific demands

268 Board #84 May 27 9:30 AM - 11:00 AM
Establishing Prediction Equations For "the Big 3": Bench Press, Squat, And Deadlift
 Amanda Aileen Wheeler Gryffin, Brian Church, Lance Bryant, Greg Allen. *Arkansas State University, State University, AR.*
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 (No relevant relationships reported)

The bench press (BP), squat (SQ), and deadlift (DL), often referred to as "the big 3", are three exercises implemented into programs to improve muscular strength, power, and hypertrophy. Many times athletes are limited by injury to perform only one or two of these lifts. Identifying a relationship that would allow prediction of the 1RM for one of these lifts based on the other two would help clinicians, coaches, and other fitness professionals in these situations. **PURPOSE:** The purpose of this study was to use the 1RM bench press, squat, and deadlift for top ranked power lifters and Division I football athletes to establish prediction equations for "the big 3". **METHODS:** Upon University IRB approval, one hundred seventy-four (88 power lifters; 86 Division I football athletes) experienced participants' bench press, squat, and deadlift 1RM scores were collected via the International Powerlifting Federation website and the local university strength and conditioning coaches. Multiple regression was used to determine variability within each set of scores as well as to determine strong predictors. **RESULTS:** Multiple regression analysis demonstrated 86% of variance in 1RM DL is explained by BP and SQ [$F(2, 169)=511.861; p<.001$] with SQ ($\beta=.670$) being the stronger predictor. Eighty-three percent of variance in 1RM SQ is explained by DL and BP [$F(2, 169)=415.904; p<.001$] with DL ($\beta=.798$) being the stronger predictor. And 71% of variance in 1RM BP is explained by DL and SQ [$F(2, 169)=201.718; p<.001$] with DL ($\beta=.624$) showing as the stronger predictor. **CONCLUSION:** When taken together, scores from two of the three lifts may predict the score of the third lift. This allows regression equations to be developed for each of the lifts. The following equations were developed to predict scores for DL, SQ, and BP, respectively, and where DL = 1RM for DL, SQ = 1RM for SQ, and BP = 1RM for BP.
 $DL = 40.511 + (.632)SQ + (.382)BP$
 $SQ = -18.829 + (.847)DL + (.179)BP$
 $BP = 7.855 + (.489)DL + (.171)SQ$
 Clinicians, coaches, and other fitness professionals may use these equations to estimate 1RM scores of power lifters and football athletes in instances where a new 1RM is being established, a return to play decision is being made, or any lift may not be completed for other reasons.

WEDNESDAY, MAY 27, 2020

A-42 Free Communication/Poster - Youth Fitness and Sport

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

- 269** Board #85 May 27 9:30 AM - 11:00 AM
Relationship Between Academic Ability And Physical Fitness In Elementary And Middle School Students
Kosho KASUGA¹, Takahiro NAKANO², Syunsuke YAMAJI³, Kazuo OGURI⁴, Tamotsu KITABAYASHI⁵, Tomoaki SAKAI⁶.
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(No relevant relationships reported)

PURPOSE: The purpose of this study was to clarify the relationship between physical fitness and academic ability of Japanese children. **METHODS:** The participants were 2,417 elementary school 6th graders and middle school 2nd graders. The overall physical fitness assessment determined from eight physical fitness tests was used as the evaluation value (A: Excellent, B: Slightly excellent, C: Standard, D: Slightly inferior, E: Very inferior). For evaluation of academic ability we used the number of correct answers for basic and applied questions in national language and mathematics, national language (basic and applied), mathematics (basic and applied), basic academic ability (national language and math), applied academic ability (national language and math), and the total number of correct answers for all tests were calculated and analyzed. An independence test was applied to verify the relationship between academic ability and physical fitness. **RESULTS:** As a result of the analysis, significant ($p < 0.01$) associations were found between all items of academic ability and the overall physical fitness assessments for elementary and middle school students. Significant χ^2 values were also found for all academic ability items in total number of correct answers by physical fitness evaluations. Residual analysis indicated that the rate of low correct answers was significantly lower, and the rate of high correct answers was significantly higher in children with higher levels of physical fitness. In other words, important evidence has emerged showing that children who have increased physical fitness owing to outdoor play and sports tend to have higher levels of academic ability. **CONCLUSIONS:** Elementary school students tended to have higher academic ability as their overall physical strength was higher. This tendency appears as a remarkable difference in applied academic ability. On the other hand, in middle school students, the academic ability levels of groups A, B, and C were similar. However, the level of academic ability in groups D and E was remarkably low, and it seems that students in the low physical fitness group lacked a positive approach to study.

- 270** Board #86 May 27 9:30 AM - 11:00 AM
Relationship Between Parental Granting Mobility License And After-school Physical Activity In Children
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(No relevant relationships reported)

Independent mobility refers to the freedom of children to play or travel without adult supervision. Parents play an important role in influencing their children's physical activity (PA). However, how parental granting mobility license may influence children's after-school PA has seldom been investigated. **PURPOSE:** To investigate the relationship between parental granting mobility license and objectively measured after-school PA among children in Hong Kong. **METHODS:** One hundred twenty-seven children aged 8-12 years were recruited from 3 primary schools. Their parents responded to an 11-item scale to measure parental granting mobility license in four domains: travel to/from school, travel to sport-related destinations, travel to other destinations, and active play. Children wore an ActiGraph accelerometer for 8 consecutive days to assess PA accumulated in after-school period during school days. Univariate and stepwise multiple regression analyses were performed to examine the associations between parental granting mobility license (in both overall score and the four domains) and after-school PA. **RESULTS:** Ninety-five children (9.1 ± 0.7 years, 53.7% boys) provided valid ActiGraph data for at least 3 days and their parents completed the questionnaire. On average, the after-school period lasted for 292.3 ± 100.7 minutes, of which 31.3% was accumulated in light-intensity PA (LPA) and 7.3% in moderate-to-vigorous PA (MVPA). After adjusting for gender, age and body mass index, the overall score of parental granting mobility license was positively associated with after-school MVPA ($B = 0.211$, 95% confidence interval [CI]: 0.033 to 0.389). Two domains of the parental license, i.e., travel to sport-related destinations ($B = 1.112$, 95% CI: 0.322 to 1.901) and active play ($B = 1.633$, 95% CI: 0.473 to 2.792), showed significant associations

with after-school MVPA. However, only active play remained significant in the stepwise multiple regression models. Neither the overall score nor the 4 domains of parental granting mobility license was related with after-school LPA. **CONCLUSIONS:** Higher level of parental granting mobility license, especially the freedom of children to play without adult's supervision, was associated with more after-school MVPA in children.

- 271** Board #87 May 27 9:30 AM - 11:00 AM
Exercise Capacity Vs. Mobile And Screen Time In Healthy Pediatric Population
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Background: Exercise capacity is related to morbidity and mortality in the general population. Screen time is related to sedentary behavior and physical inactivity in children and adults. There is a paucity of data on screen time vs. exercise capacity using cardiopulmonary exercise test (CPET) in children and adolescents. Our aim was to evaluate and compare exercise capacity using CPET and screen time in healthy pediatric population. **Methods:** Cross-sectional retrospective study assessing daily screen time (questionnaire) and CPET (cycle ergometer). Screen time was analyzed as "total screen time", "mobile devices" (smartphones and tablets) and "sedentary devices" (computer and television). **Results:** Seventy-two healthy non-obese children (mean age 13.6 ± 3.4 y/o, 47% Female, BMI₅₀ 50 ± 30.3) were evaluated. Peak oxygen uptake (peak $\dot{V}O_2$, %predicted) was preserved (mean peak $\dot{V}O_2$, %pred $98.8 \pm 19.2\%$). A negative correlation was found between peak $\dot{V}O_2$ and "total screen time" ($r = -0.32$, $p < 0.007$) and peak $\dot{V}O_2$ and "mobile devices" ($r = -0.33$, $p < 0.004$) while no correlation was found for "sedentary devices". **Conclusions:** "Mobile devices" and "total screen time" were negatively correlated with exercise capacity in pediatric healthy population. Children and adolescents should be encouraged to decrease daily screen time and highlight mobile technology. Larger longitudinal studies are needed to better study the impact of screen time on morbidity in children.

- 272** Board #88 May 27 9:30 AM - 11:00 AM
Comparing $\dot{V}O_{2max}$ Assessed By The 20-m Shuttle-run And Maximal Treadmill Test In Adolescents With Obesity
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Cardiorespiratory fitness (CrF) is a strong predictor of health. The 20-m shuttle-run test is widely used to estimate CrF in children. However, it is not clear if it provides reliable data in adolescents with obesity. **PURPOSE:** To compare CrF assessed by the 20-m shuttle-run test and a maximal graded exercise test (GXT) in adolescents with obesity. **METHODS:** Thirty-seven adolescents (16 boys: 15 ± 2 y, 32.5 ± 2.9 kg·m⁻² and 41.9 ± 6.6 % fat and 21 girls: 15 ± 2 y, 34.6 ± 3.3 kg·m⁻² and 48.5 ± 8.5 % fat) underwent two CrF assessments on different days (7-days wash-out between). For the 20-m shuttle-run test, adolescents were instructed to run between two points separated by 20 meters at a predetermined pace that started at 8.5 km·h⁻¹ and increased by 0.5 km·h⁻¹ until the participant failed twice to keep up with an auditory signal or reached exhaustion. Maximum oxygen uptake ($\dot{V}O_{2max}$) was estimated using Barnett and colleague's equation. For the GXT, participants exercised on a treadmill with a speed that started at 3.0 km·h⁻¹ and increased by 1.0 km·h⁻¹ each minute until failure. During the GXT, $\dot{V}O_2$ was measured using open circuit spirometry. **RESULTS:** Estimated $\dot{V}O_{2max}$ was higher in the shuttle-run test (33.4 ± 4.6 ml·kg⁻¹·min⁻¹) compared to the GXT (24.6 ± 6.7 ml·kg⁻¹·min⁻¹, $p < 0.01$). Estimated $\dot{V}O_{2max}$ obtained in the shuttle-run test was not related to $\dot{V}O_{2max}$ obtained in the GXT ($\rho = -0.03$; $p = 0.85$). However, the $\dot{V}O_{2max}$ obtained in GXT was associated with final speed ($\rho = 0.58$; $p < 0.01$) and number of completed stages ($\rho = 0.59$; $p < 0.01$) on the shuttle-run test. **CONCLUSIONS:** Performance indicators from the 20-m shuttle-run test are significantly associated with directly measured $\dot{V}O_{2max}$. However, the predictive equation to estimate $\dot{V}O_{2max}$ based on 20-m shuttle run test is not adequate for adolescents with obesity.

273 Board #89 May 27 9:30 AM - 11:00 AM
Pilot Study Of A 12 Week Intervention (AERIAL©) To Teach Youth To Head The Ball Safely

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Reported Relationships: S.P. Chrisman: Receipt of Intellectual Property Rights/Patent Holder; The AERIAL program was co-developed by The Sports Institute at UW Medicine and VICIS and both hold ownership. No fees are associated with this program.

PURPOSE: To assess feasibility and acceptability of AERIAL©, a 12-week heading training program developed by VICIS© in collaboration with the University of Washington (UW). **METHODS:** We conducted a longitudinal cohort study with n=21 youth (9 male, 12 female) from 2 premier level U12 soccer teams in the Seattle area. Coaches were trained regarding the AERIAL© program, instructing youth to perform the drills each week while correcting form. Drills focused on active core strength, spatial awareness, and heading progression and took approximately 20 minutes per week. Data were collected at three time points (baseline, 6 weeks and 12 weeks) with a primary outcome of feasibility and acceptability, secondary outcome of heading confidence, and an exploratory outcome of heading safety behaviors (assessed via standardized video at the same three time points). **RESULTS:** Feasibility and acceptability were high for all stakeholders (mean/total, standard deviation): youth (4.60/5, SD 0.28), parents (4.52/5, SD 0.86), and coaches (3.83/5, SD 0.55). Heading confidence significantly improved in females in both games and practice from baseline to 6 weeks (Wilcoxon matched-pairs signed rank, p=0.0033 games and p=0.032 practice), and remained stable at 12 weeks. Males reported a high level of heading confidence at baseline and had no significant increases during the study. Video coding indicated a number of safety behaviors were present at baseline in nearly all athletes (eyes open, core and neck as one, contact with front of head, squared shoulders), while other safety behaviors increased during the training period, though not significant with this small sample size: 1) legs staggered 2) knees bent 3) arms up and 4) palms open. **CONCLUSION:** The AERIAL© program appears to be a feasible and acceptable means for introducing youth to heading and aerial maneuvers, and preliminary data suggests potential efficacy for improving safety and performance.

274 Board #90 May 27 9:30 AM - 11:00 AM
Effects Of Athletic Performance Training On Injury Prevention And Psychosocial Health In Female Adolescent Athletes

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Two major health concerns with female adolescent athletes are psychosocial wellness and sports-related injuries. It is also known that these health concerns are much greater for minority students who attend high school in economically depressed cities.

PURPOSE: To complete a pilot study on urban underrepresented minority and suburban female high school athletes, to determine the feasibility and utility of using Functional movement screening (FMS) to assess injury risk and Patient-Reported Outcomes Measurement Information System (PROMIS) to assess psychosocial health in this population during 10-weeks of athletic training.

METHODS: In this feasibility pilot study, female student-athletes from an urban minority high school (n=10) and suburban high schools (n=10) were recruited into a 10-week athletic training study. The primary goals of this study were to: 1) recruit and retain the human subjects throughout the study period, 2) evaluate global health (depression, anxiety, pain, peer relationships and physical function) and physical performance, and 3) assess injury risk. Self-reported data from the subjects were collected at each session, and FMS and performance data were collected at pre- and post-intervention. Statistical analyses to assess changes after the 10-weeks of athletic training were performed using paired t-test.

RESULTS: Fifteen students completed the 10-week training, and no adverse events of the training or study were reported. Anxiety (45.8±7.4 vs. 41.4±7.0, p=0.006), peer relationships (51.5±6.8 vs. 54.1±6.5, p=0.02), pain interference (47.0±6.4 vs. 44.1±7.8, p=0.02), were significantly improved, while depression (47.0±7.9 vs. 44.1±6.8, p=0.08) trended towards significance. Bench Press (70.2±10.7 vs. 82.0±13.9, p=0.0009), Pro Agility (5.8±0.5 vs. 5.4±0.4, p=0.005), and Total FMS (20.3±4.6 vs. 30.4±4.5, p<0.0001) were all significantly improved. Surprisingly, 10 students (67%) were in peril of sports-related injury (FMS<14) at the start of the program, and all but 1 (90%) eliminated this serious risk factor.

CONCLUSION: PROMIS and FMS are effective outcome measures to quantify changes in psychosocial wellness and sport-related injury risk in high school female athletes. In addition, exercise improves mood and overall health. Supported by William & Sheila Konar Foundation

275 Board #91 May 27 9:30 AM - 11:00 AM
An Investigation Of Factors Predicting Injury Among Adolescent Softball Players

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Upper extremity (UE) injury risk is a concern among adolescent softball players. Previous studies have found injury rates among adolescent softball players to be between 0.95 to 5.6/1000 athlete exposures. Few studies exist that investigate that seek to predict injury in adolescent softball players via musculoskeletal characteristics (MSC) or outcome measures. Understanding factors that can predict injury is important to clinicians for mitigating injury risk. **PURPOSE:** To investigate which MSC and outcome measures can predict injury in adolescent softball athletes. **METHODS:** 67 adolescent softball athletes participated (Age: 15.8±3.3 years). MSC and outcome measures were assessed prior to the start of the high school season, and each athlete was interviewed at the mid-season (8 weeks) and end of season (16 weeks) time points to update injury status. For MSC, the dominant side throwing UE and ipsilateral hip were established. ROM assessments included internal (IR), external rotation (ER), and total range of motion (TROM) of glenohumeral and hip joints. Strength included IR and ER of glenohumeral and hip joint, and hip abduction. Flexibility assessments included pectoralis minor length, and posterior shoulder tightness. Postural measurements included forward head posture and forward shoulder posture. Outcome measures included the QuickDASH with Sport Module, the Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow questionnaire (KJOC), and the Functional Arm Scale for Throwers. A ROC curve analysis was performed to assess all aforementioned variables and outcome measures ability to predict injury. **RESULTS:** 27 participants experienced an injury from the mid-season to end-season. The QuickDASH Sport Module displayed fair accuracy to predict injury (Area under curve = 0.721). All other measurements had either poor accuracy or failed to predict injury altogether (Area under curve < 0.7). **CONCLUSION:** The QuickDash Sport Module may be used prior to the start of the season as a tool to identify those at a greater risk of injury with caution. Further research is needed to investigate predictors of injury among the softball adolescent population with increased sample size and considering differences among those who play year around, specialize in softball, or amongst different positions.

276 Board #92 May 27 9:30 AM - 11:00 AM
Does The Mixed Relay Triathlon Affect Respiratory Function In Healthy Junior Triathletes?

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Exercise-induced bronchoconstriction (EIB) is a transient narrowing of the airway that can be attributed to heavy ventilation associated with sustained high intensity exercise greater than 8 min. High aerobic and ventilatory training demands can exacerbate the EIB response and lead to prevalence of EIB in endurance athletes like triathletes. The mixed relay triathlon, due to its high intensity and short duration format, will induce heavy ventilation that could lead to EIB. However, no research at present has determined the influence of a mixed relay on respiratory function and baseline spirometry measures which influence EIB.

PURPOSE: To determine severity and prevalence of EIB in healthy triathletes competing in a mixed relay and understand if baseline spirometry is predictive of the EIB response and race performance. **METHODS:** Seven males (17.7 ± 0.4 years, 183.7 ± 3.0 cm) and 5 females (17.6 ± 0.6 years, 171.1 ± 2.7 cm) competed in the Canadian Championships (300m swim, 6km bike, 1.6km run). Spirometry measures of Forced Expiratory Volume in 1 sec (FEV1), Forced Vital Capacity (FVC), FEV1/FVC (%), Forced Expiratory Flow at 50% FVC (FEF50), FEF 25-75% and Peak Expiratory Flow (PEF) was performed before warm up and 5 min post-race. Measures were calculated as % delta change (for EIB determination) and in raw units to determine pre-post differences in measures via paired sample t-tests. **RESULTS:** Mean race time was 22.4 ± 1.5 min including transitions (swim 4.5 ± 0.5 min, bike 10.4 ± 0.7 min, run 6.1 ± 0.6 min). No spirometry measure was significantly decreased post-race. One athlete had mild EIB (% decrease in FEV1 between 10 and 25%) and 2 athletes had a baseline FEV1/FVC ratio <0.7. Percent delta change in PEF and FEF 25-75% were

correlated to finish time ($r=-0.78, r=-0.83, p<0.05$ respectively). **CONCLUSION:** An all-out 20 min ultra-short triathlon does not negatively affect respiratory function in young healthy junior triathletes. It maybe that the decrease in PEF and FEF 25-75 affected finish time due to reduced airway function affecting exercise intensity. The low prevalence of EIB compared to older endurance athletes supports the late onset of EIB in endurance athletes (> 25 years) although the 2 athletes with <0.7 resting FEV1/ FVC ratios show signs of underlying airway obstruction.

277 Board #93 May 27 9:30 AM - 11:00 AM

Dynamic Warm-up Effects On Maximal Treadmill Exercise Performance In Children: A Pilot Study

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Dynamic warm-up protocols (DWP) consisting of moderate- and high-intensity exercise movements have been found to enhance strength and power performance in youth; however, the effects of DWP on maximal treadmill exercise performance in children are unclear. Prior to pediatric exercise testing participants typically perform low-intensity treadmill walking (TW). **PURPOSE:** To compare the effects of a DWP with a TW warm-up protocol on maximal exercise performance in children. **METHODS:** 11 healthy children (10.8 ± 1.5 yrs) were tested for peak oxygen uptake (VO₂ peak) on 2 nonconsecutive days following different 6 min warm-up protocols performed in random order. DWP consisted of 9 progressive body weight movements including dynamic stretches, lunges, hip bridges, and jumps whereas the TW protocol consisted of walking on a motor-driven treadmill at 2.2 mph and 0% grade. Comparisons between trials were made with a paired t-test. **RESULTS:** VO₂ peak was significantly higher ($p=0.04$) following DWP than TW (56.9 ± 9.1 vs 52.7 ± 9.4 ml/kg/min) and a trend ($p=0.08$) towards greater maximal heart rate was noted following DWP vs TW (192.5 ± 7.5 vs 190.9 ± 7.1 bpm, respectively). No significant differences between DWP and TW trials were observed for maximal minute ventilation (70.7 ± 17.5 vs 64.0 ± 10.4 L/min, respectively), maximal respiratory exchange ratio (1.08 ± 0.05 vs 1.08 ± 0.07, respectively) and total exercise test time (640.9 ± 77.8 vs 638.0 ± 97.4 sec, respectively). No order effects between test day 1 and test day 2 were observed for any variable. **CONCLUSIONS:** These findings indicate that the design of the warm-up protocol can influence the cardiopulmonary responses to maximal treadmill exercise and that a DWP can result in a higher VO₂ peak than a low intensity TW protocol in healthy children.

278 Board #94 May 27 9:30 AM - 11:00 AM

Differences Of Children's Physical Fitness Between Villages And Cities In Middle China

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PURPOSE: Physical fitness during childhood is an important indicator of current and future health. School-based physical activity (PA) outcomes may be mediated by physical self-concept. Low physical self-concept may negatively impact PA engagement, compromising childhood and adolescent physical fitness, which may translate into adulthood. To establish the physical fitness of children in middle China, and examine differences between boys and girls for physical self-concept, and engagement in school-based and extra-curricular PA. **METHODS:** 456 (girls =223) healthy primary school participants were chosen, and the average age is 7.1±0.3y. Demographics questionnaires and fitness assessment were performed to identify the differences of physical fitness between the villages and city children in the middle of China. Physical self-description questionnaire were asked to answer 'yes' or 'no' to whether they participated in school-based and extra-curricular PA. **RESULTS:** The results showed in table 1 Table 1 The physical fitness differences between villages

Variables	Girls		Boys	
	Villages	Cities	Villages	Cities
Standing long jump (cm)	95.1±18.2	91.2±21.3	104.6±13.8	106.1±17.0
Tennis ball throwing (m)	6.2±2.2	6.4±2.4	9.4±2.7*	7.3±2.4
Sit-and-reach (cm)	8.7±4.4	8.2±4.6	8.1±3.8*	6.3±4.4
Turn back to run (s)	7.1±0.7	6.9±1.1	6.7±0.9	6.6±1.1
Walking on the balance beam (s)	7.7±5.6	8±4.4	5.8±4.5	5.9±2.1
Continuous foot jump (s)	6.9±2	6.6±1.4	5.9±1.8	6.1±1.2

CONCLUSIONS: The data suggests that there was no significant difficulty between villages and cities girls, but the country boys' physical fitness was better than cities boys'. All the students must improve physical fitness through increased PA, especial the girls.

279 Board #95 May 27 9:30 AM - 11:00 AM

Sprint Speed And Musculoskeletal Fitness Test Performance In Youth

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(Sponsor: Dr. Dale Brown, FACSM)
(No relevant relationships reported)

Sprint speed is a common focus of adult strength and conditioning programming and research. However, the links between sprint speed and other tests of musculoskeletal fitness (MSF) have not been extensively studied in youth. **PURPOSE:** To investigate the relationship between sprint speed and tests of jumping performance, muscular strength/endurance, agility, and anaerobic capacity in children and adolescents. **METHODS:** The analysis included 402 boys and 148 girls (ages 7 to 18 years) participating in a baseline MSF evaluation. Sprint speed was assessed via a 10-yard and 20-yard sprint. Agility and anaerobic capacity were assessed via the pro-agility and 200-yard shuttle run, respectively. Muscular strength and endurance were assessed by maximal number of chin-ups and jumping performance was assessed via the vertical jump, broad jump, and 5-hop jump tests. Pearson correlations were used to determine the associations between each fitness test relative to the 10- and 20-yard sprints, controlling for age and sex. **RESULTS:** Correlations were generally larger between 20-yard dash and other MSF tests than for the 10-yard dash. For example, the strongest correlation with both sprints was the pro-agility test, with $r = 0.755 (p < 0.001)$ for the 20-yard sprint and $r = 0.655 (p < 0.001)$ for the 10-yard sprint. Similar associations were found between the sprints and the 200-yard shuttle run, with correlations of $r = 0.758 (p < 0.001)$ and $r = 0.640 (p < 0.001)$ for the 20-yard and 10-yard dashes, respectively. While similar, the broad jump ($r = -0.657 [p < 0.001]$) had a slightly better correlation with the 20-yard sprint than either the vertical jump ($r = -0.633 [p < 0.001]$) or 5-hop test ($r = -0.629 [p < 0.001]$). The chin-up test had the smallest correlation with 20-yard sprint speed out of the MSF battery ($r = -0.414 [p < 0.001]$). **CONCLUSIONS:** Stronger relationships to the 10- and 20-yard sprints were found for the agility and anaerobic capacity tests compared to all MSF tests; however, all the MSF tests had greater associations to the 20-yard sprint overall. All three jumping tests were similarly associated with sprint speed. Future research is needed to determine if interventions targeting these MSF tests would lead to proportional alterations in the sprinting speed of youth.

280 Board #96 May 27 9:30 AM - 11:00 AM

Measurement Properties Of Agility And Movement Skill Assessment In Children: A Rasch Analysis

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(No relevant relationships reported)

PURPOSE: To investigate the measurement properties (including rating scale performance, unidimensionality, and differential item functioning) of the motor quotient scale of Chinese version of Agility and Movement Skill Assessment (AMSA) in children, by using the Rasch analysis. **METHODS:** A total of 1116 children (aged 7 to 9 years, 51.3% boys) were recruited in China for this prospective study. Each child was evaluated with the AMSA that consists of 28-item motor scale. Construct validity of the Chinese version of AMSA was investigated using Rasch analysis, whereas inter-rater and test-retest reliabilities were evaluated using Kappa coefficients (n=12). **RESULTS:** The result indicated that the Kappa coefficients for the interrater and test-retest reliabilities were 0.81 (ranging from 0.76 to 0.99) and 0.87 (ranging from 0.80 to 0.99), respectively. No ceiling or floor effects were observed and only one item exhibited misfit to the Rasch model expectations. Item 24 "Dribbling2" exhibited marginal misfit (outfit =1.38), but it did not affect the unidimensionality of the scale. **CONCLUSIONS:** The Chinese version of the AMSA demonstrated satisfactory measurement properties. It showed good indicators of validity and reliability to be used for the assessment of motor quotient of children for 7-9 years old. (This study was supported by NPOPSS Grant 15CTY011)

item	M	Dif	Infit	Outfit
CMS1:Jumping1	0.94	-3.25	1.01	0.88
CMS2:Jumping2	0.94	-3.32	1.00	0.88
CMS3:Sliding1	0.87	-2.11	1.00	0.97
CMS4:Sliding2	0.92	-2.92	1.02	0.83
CMS5:Catching1	0.62	-0.62	1.00	0.99
CMS6:Throwing1	0.39	0.58	1.00	0.97
CMS7:Hopping1	0.65	-0.88	1.01	1.00
CMS8:Hopping2	0.78	-2.00	1.00	0.94
CMS9:Climbing1	0.64	-0.65	1.00	1.00
CMS10:Climbing2	0.87	-2.40	0.99	1.07
CMS11:Skipping1	0.72	-1.03	1.00	0.99
CMS12:Skipping2	0.88	-2.20	0.99	1.04
CMS13:Balancing1	0.83	-1.83	0.98	1.06
CMS14:Balancing2	0.66	-0.74	1.00	1.02
CMS15:Moving1	0.76	-1.30	0.99	1.01
CMS16:Moving2	0.68	-0.95	1.00	1.00
CMS17:Catching2	0.53	-0.18	0.99	1.01
CMS18:Throwing2	0.47	0.15	0.99	1.05
CMS19:Controlling1	0.33	0.89	1.01	0.96
CMS20:Controlling2	0.61	-0.60	1.01	1.01
CMS21:Rolling1	0.55	-0.21	1.00	1.00
CMS22:Rolling2	0.77	-1.33	1.00	1.01
CMS23:Dribbling1	0.66	-0.75	1.00	1.02
CMS24:Dribbling2	0.89	-2.85	0.94	1.38
CMS25:Rolling3	0.73	-1.14	1.01	0.96
CMS26:Rolling4	0.88	-2.27	0.97	1.15
CMS27:Kicking1	0.48	0.11	1.00	1.01
CMS28:Kicking2	0.44	0.30	1.00	1.01

281 Board #97 May 27 9:30 AM - 11:00 AM

The Influencing Factor Of Chinese Adolescents' Scientific Fitness Literacy

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(No relevant relationships reported)

Scientific fitness literacy (SFL) is based on scientific theories and methods to guide the body's ability to exercise. It includes five main contents: knowledge, skills, behavior, attitude, and cognition of scientific fitness. **PURPOSE:** To investigate the main factors affecting Chinese adolescents' scientific fitness and provide countermeasures for Chinese adolescents' health promotion. **METHODS:** A total of 4663 healthy adolescents (age: 22.56 ± 5.81yrs, female: 54.5%) were investigated from 33 provinces. Divided into three groups according to age: juvenile (12-17yrs), pre-youth (18-28yrs), and late youth (29-40yrs); divided into three regions based on the administrative districts: Eastern Region (ER, 13 provinces), Central Region (CR, 8 provinces) and Western Region (WR, 12 provinces). **RESULTS:** We used the "China Adolescents' Fitness Literacy Questionnaire (CAFLQ)". The CAFLQ consists of two parts: (1) Knowledge and Skills (RRC 0.91), and (2) Cognitive, Attitude and Behavior (ICC 0.97, RRC 0.93). The content validity of the questionnaire was assessed by 11 experts. The structural validity was evaluated by the factor analyses. The results indicate that there are differences in the scientific and fitness literacy of adolescents in the following aspects. (1) Gender differences ($F_{(1,4661)}=80.224, P=0.000<0.05$), females (28.60±3.69) were higher than males (27.58±4.07); (2) Age differences ($F_{(2,4660)}=30.332, P=0.000<0.05$), pre-youth (28.32±3.81)>late youth (28.21±3.77)>juvenile (26.94±4.40); (3) Differences of education ($F_{(2,4660)}=63.10, P=0.000<0.05$), Postgraduate (28.54±3.50)>University (28.41±3.76)>Middle school students (26.75±4.43); (4) Region differences ($F_{(2,4660)}=11.165, P=0.000<0.05$), CR (28.63±3.84)>WR (28.15±3.76)>ER(27.85±4.13); (5) Differences of exercise patterns ($F_{(3,4659)}=205.194, P=0.000<0.05$), regular exercise (30.09±3.96)>less regular exercise (28.70±3.51)>occasional exercise (27.92±3.42)>no exercise (25.94±4.00). **CONCLUSIONS:** Age, gender, education, region and exercise patterns are the main factors affecting the Chinese adolescents SFL. Female's SFL is higher than males, pre-youth than juveniles, and CR and WR are higher than ER. The higher education levels, SFL can; the more regular the exercise, SFL can. (#3 is corresponding author)

282 Board #98 May 27 9:30 AM - 11:00 AM

Exercise Type, Physical Activity Level And Bmi: Association With Cardiorespiratory Fitness In Adolescents

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PURPOSE: To verify the association between type of exercise, physical activity level and body mass index (BMI) with cardiorespiratory fitness in Brazilian adolescents. **METHODS:** Descriptive correlational study, conducted with 350 adolescents (16.26 ± 0.66 years old), from Curitiba, Brazil. Gender, age, type of exercise (sport practice, other type of exercise practice, or not engaged in any type of physical exercise) and physical activity level (at least 420 minutes a week) were evaluated through self-reported questionnaires. The BMI was calculated using kg/m² equation. The pacer physical test was applied to evaluate the cardiorespiratory fitness (VO_{2max}). Poisson regressions, with robust variance, adjusted for gender and age, were calculated to verify the variables associated with VO_{2max} adopting p<0.05. **RESULTS:** Adolescents who practiced sports had a 2.04 times higher prevalence of having VO_{2max} in the healthy zone (PR: 2.04; 95% CI: 1.21-3.44) than those who did not exercise. The VO_{2max} of adolescents that practice another type of physical exercise did not differ from those not engaged in any type of physical exercise. Adolescents classified as sufficiently active had a 1.56 times higher prevalence of being in the healthy zone for VO_{2max} (PR: 1.56; 95% CI: 1.02-2.41) than those who were classified as insufficiently active. BMI showed no significant associations with VO_{2max}. **CONCLUSION:** Adolescents practicing sports had better levels of cardiorespiratory fitness than those who practiced other types of physical exercise and those who did not exercise at all. Additionally, adolescents who achieved adequate levels of physical activity had better levels of cardiorespiratory fitness.

283 Board #99 May 27 9:30 AM - 11:00 AM

Lower Limb Force And Power Production And Its Relation To Body Composition In 14- To 15-year-old Adolescents

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PURPOSE: To determine the influence of under- or overweight and obesity on force and power production as well as on lower limb asymmetry. **METHODS:** A cross-sectional study including 14- to 15-year-old adolescents was performed. Anthropometric measures and 20-m sprint time were measured and countermovement jump (CMJ) was measured. Force and power production were determined using a portable force plate. **RESULTS:** CMJ and 20-m sprint performances were significantly influenced by BMI categories (both, p<0.001), with obese subjects performing worse than their normal weight counterparts. Peak force and peak power were significantly higher (p < 0.001), especially in obese adolescents, whereas relative peak power was worse in overweight and obese adolescents (p<0.001). Multiple regression analysis revealed that 66.3% of the variance in CMJ and 70.0% of the variance in 20-m sprint may be predicted by gender, body fat percentage, peak force and power. In 13.6% of the participants, limb asymmetries above 15% were detected when limb symmetry index (LSI) was calculated using peak force as underlying factor, whereas only 4.5% had asymmetries in power production between left and right leg. LSI_{power} was higher in obese when compared to underweight children (p = 0.040). **CONCLUSIONS:** Findings of variations in peak force and power between body composition categories, with obese subjects having lowest performance scores, particularly when results are expressed in relation to body mass. Most importantly, a slightly higher LSI was detected among obese adolescents adding to the deleterious effects of childhood obesity on health.

WEDNESDAY, MAY 27, 2020

- 284** Board #100 May 27 9:30 AM - 11:00 AM
Physical Fitness In Relation With Attention Capacity In Latin-american Youth With Overweight And Obesity
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 (No relevant relationships reported)

Purpose: There is an increased interest in exploring the association between fitness components with cognitive development in youth in recent years. However, most of the studies so far have focused on healthy weight young people with little evidence with excessive fat accumulation population. To examine the association of health-related physical fitness with attention capacity in Latin-American children and adolescents and to examine whether body fat is moderator of the association between them.
Study design: A cross-sectional study involving 201 children and adolescents with overweight and obesity (12.1 ± 2.1 years old; 34.3% girls) from Chile (The Active-Start study) and Colombia (HEPAFIT study). We assessed physical fitness components (i.e., muscular strength, speed-agility, and cardiorespiratory fitness) using the ALPHA and FUPRECOL batteries. Attention capacity was measured by the d2 test. Lineal regression and moderation analyses were conducted.
Results: Linear regression analysis adjusted for potential confounders (age, sex, body fat, peak height velocity, mother education and study [i.e., Active-Start or HEPFIT]) revealed association between speed agility ($\beta = -7.7$; $p = 0.030$) and cardiorespiratory fitness ($\beta = 4.5$; $p < 0.001$) with attention capacity. The Johnson-Neyman technique revealed a significant relationship between cardiorespiratory fitness and muscular strength and attention capacity when body fat was below, but not above, 34.8% (20% of sample) and 29.5% (48% of sample), respectively.
Conclusions: Cardiorespiratory fitness and speed-agility are associated with higher attention capacity in youth with overweight and obesity, but body fat seems to moderate these relationships. Randomized controlled trials in this population would help to better understand whether improvements in different components of physical fitness leads to better attention capacity by a reduction in their body fat.

- 285** Board #101 May 27 9:30 AM - 11:00 AM
Impact Of School Fitness Environment On Children's Fitness: A Mixed Method Study
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 (No relevant relationships reported)

OBJECTIVE: While school fitness environment is known to have a significant impact on children's physical activity and fitness, no quick, easy, yet accurate tool is available to assess school fitness environment. The purpose of this study was to develop such a tool and validate it using a contracting-group method.

METHOD: After a comprehensive search on the literature, a check list of school fitness environment, including items in sports facilities, role of PE teachers, training methods by PE teachers, perceived values by principals and teachers and students' reported PE participation etc., was developed. An evaluation team consisting of one researcher and two graduate students was formed and trained. The team then went to two schools, A and B, in Jiujiang city, China, to interview the principals, PE teachers, students in each school, went over the school sport facility, as well as tested a group of Grade 9 students' aerobic fitness (1000-M run for boys and 800-M run for girls).

RESULTS: A total 219 students (106 boys, 113 girls) in School A and 235 students (125 boys, 110 girls) in School B were tested and their aerobic fitness level were evaluated using the 2018 high school entrance exam (HSEE) criterion. After comparing with their rating and some discussions, School A was rated having a better school fitness environment and students' fitness performance (running time in seconds) and corresponding t-test comparison further supported the observation:

	School A	School B	P
Boys (1000-M in s)			
Total	234.0 ± 28.4	242.5 ± 30.8	< .05
HSEE Good & Above	221.4 ± 14.5	227.1 ± 11.8	< .05
Girls (800-M in s)			
Total	216.1 ± 22.6	231.0 ± 27.8	< .05
HSEE Good & Above	211.3 ± 14.4	215.6 ± 13.1	< .05

CONCLUSIONS: With a combination of qualitative and quantitative methods, a simple school fitness environment tool was developed, and by comparing students' aerobic fitness from two schools, its initial validity evidence was collected and confirmed.

- 286** Board #102 May 27 9:30 AM - 11:00 AM
Physical Activity, Physical Fitness And Body Mass Index Among Elementary School Children In The Arctic Area
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 (No relevant relationships reported)

The World Health Organization recommends that children accumulate at least 60 minutes of moderate-to-vigorous-intensity physical activity (MVPA) daily. However, knowledge about the association between physical activity (PA), physical fitness and body mass index (BMI) among elementary school children in the Arctic is limited.

PURPOSE

To examine the association between PA levels, physical fitness and BMI in elementary school children in Northern Norway.

METHODS

Elementary school children in 1st, 3rd, 5th and 7th grade were recruited to wear an accelerometer (wGT3X-BT, ActiGraph, LLC, Pensacola, United States) for seven consecutive days ($n = 216$). PA was categorized according to intensity, and dichotomized into reaching the PA recommendations or not. Physical fitness was measured by using Test of Physical Fitness (Fjørtoft et al. 2011) consisting of a nine-item compound motor activity score that includes various combinations of endurance, strength, agility, balance, and motor coordination, which is calculated as total physical fitness based on z-scores. BMI (kilogram/height²) was used as body composition measure.

RESULTS

In total, 94 (43%) of 216 the children reached the recommendation of 60 min MVPA per day. There was a significant difference ($p < 0.001$) in total physical fitness score between boys (3.01) and girls (-2.35). A positive association between physical fitness score and reaching the PA recommendations was observed in 3rd, 5th and 7th grade ($p < .05$). BMI was inversely associated with physical fitness in 5th and 7th grade ($p < 0.05$) but not in 1st and 3rd grade. There was no significant association between those who achieved the PA recommendations and BMI.

CONCLUSION

Children in elementary school who reach the recommendations for PA seem to have a higher score on the physical fitness test, except for the first graders. BMI was not related to physical fitness or reaching PA recommendations except an inverse association between BMI and physical fitness in higher grades.

- 287** Board #103 May 27 9:30 AM - 11:00 AM
Talk Test As A Measure Of Exercise Intensity In Children
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INTRODUCTION: The Talk Test (TT) is a well-accepted measure of exercise intensity and is a useful surrogate of ventilatory (VT) and respiratory compensation (RCT) thresholds in sedentary, fit, athletic, and cardiac populations. Recently, the TT has also been shown to reflect these same markers in children. **PURPOSE:** The present study was designed 1) to replicate TT results during incremental exercise in children, and 2) to evaluate the ability of the TT to predict when the subjects would be above (-TT) or below (+TT) VT intensity during interval exercise. **METHODS:** Healthy pre-pubertal children (5m, 5f) were studied using the TT and gas exchange during incremental exercise to determine the match between TT stages and VT. Another group of healthy pre-pubertal children (7m, 6f) were studied both during incremental and stochastic exercise, in order to determine how well TT responses during stochastic exercise predicted whether the children were above or below VT. **RESULTS:** During incremental exercise, there was good correspondence between the $\dot{V}O_2@VT$ and the $\dot{V}O_2@$ the last positive (LP) ($r = 0.79$) and the equivocal (EQ) ($r = 0.75$) stages of the TT, which match earlier findings from our laboratory (Giddings et al., 2018; LP TT, $r = 0.62$ & EQ TT, $r = 0.75$). During stochastic exercise, correct matching of predicted vs. observed +TT and predicted vs. observed -TT were present 73% of the time. Discordant results were present 27% of the time. These findings

match earlier findings from our laboratory in adults relative to the matching of observed vs. predicted results. **CONCLUSION:** The TT behaves as a similar surrogate of VT in children, as it does in adults, during both incremental and stochastic exercise.

288 Board #104 May 27 9:30 AM - 11:00 AM
Abstract Withdrawn

289 Board #105 May 27 9:30 AM - 11:00 AM
Effect Of Exercise Intervention On Physical Fitness Factors In Elementary School Children
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(No relevant relationships reported)

Sports have been very popular after-school activities for children. It is quite likely that sports have a positive effect on child growth in many ways. The Ministry of Education, Culture, Sports, and Technology of Japan has reported that the total scores of physical fitness tests differ greatly between those who exercise regularly and those who do not. However, it is not clear how exercise habits affect physical fitness factors during childhood. Such detailed knowledge would be useful in promoting long-term athlete development and improving physical fitness throughout life. **PURPOSE:** To explore the effect of exercise intervention on physical fitness factors in elementary school children. **METHODS:** The subjects of this study were 1,079 1st- to 6th-grade male elementary school students. A questionnaire survey was conducted to investigate the exercise and lifestyle habits and the results of physical fitness tests conducted at Japanese elementary schools. The existence or not of exercise habits after-school activities and the results of physical fitness tests were used for the analysis. The physical fitness test includes measurements of grip strength, sit-ups, sitting front stretches, side steps, twenty-meter shuttle run, fifty-meter run, standing long jump, softball throw, height, and weight. **RESULTS:** There were no significant differences between grades in the existence or not of exercise habits about height and weight. After the 3rd grade, children with exercise habits showed higher performance on sit-ups, side steps, the twenty-meter shuttle run, the fifty-meter run, and softball throw than children with no exercise habits. There was little difference in grip strength, sitting front stretches, and long jump between children with exercise habits and those without. **CONCLUSION:** Endurance, speed, and agility develop greatly in elementary school children who exercise regularly. However, exercise habits have little effect on single strength and power. In addition, differences between children with and without exercise habits are observed after the 3rd grade.

290 Board #106 May 27 9:30 AM - 11:00 AM
Changes In Cardiorespiratory Fitness Among Children In The Hearts And Parks Healthy Lifestyle Intervention
Jonathan D. Kenyon, Alyssa M. Zidek, Josi R. Gabaldon, Alexandra R. Zizzi, Julie D. Counts, Leanna M. Ross, Cameron S. Catherine, Ashley C. Skinner, Jennifer S. Li, William E. Kraus, FACSM, Sarah C. Armstrong. *Duke University, Durham, NC.*
(No relevant relationships reported)

In children, resting heart rate (RHR) and heart rate recovery (HRR) serve as markers of cardiorespiratory fitness (CRF), predicting future cardiovascular morbidity and mortality risk. The 2018 Physical Activity Guidelines for Americans recommends children should engage in at least 60 minutes of daily, moderate-to-vigorous exercise. However, less than one-quarter of children in the U.S. meet this recommendation. The Hearts and Parks randomized controlled trial utilizes a novel clinic-community intervention consisting of clinic-based behavioral support and nutrition education, as well as physical activity through the Bull City Fit program for children 5-17 with a body mass index (BMI) $\geq 95^{\text{th}}$ percentile. One aim of the trial is to assess the efficacy of the intervention for improving CRF. **PURPOSE** To examine the effect of the Hearts and Parks intervention program on RHR and 1-min HRR. **METHODS** To date, 49 participants (age: 9.9 ± 3.3 y; non-Hispanic: 61%; males: 45%) completed ≥ 6 months of the Hearts and Parks intervention program and were included in this preliminary analysis. Pre- and post-intervention anthropometric and physical fitness assessments occurred at Duke Children's Primary Care Clinic. CRF was assessed via the 3-min YMCA Bench Stepping Test, adapted for children 5-18. Heart rate was measured via pulse-oximetry prior to the test (RHR), immediately upon test completion, and 1-min after the test. HRR was calculated as the difference between the 1-min post-test and immediate post-test values. Gender-specific paired t-tests were used to determine whether post- minus pre-intervention values were significantly different ($\alpha = 0.05$). **RESULTS** In females only, there was a significant decrease of 5.3 ± 13.0 BPM in RHR following the intervention ($p=0.02$). There was no significant change in HRR following the intervention for males or females.

CONCLUSION Our results showed a beneficial change in RHR for females completing at least 6 months of the Hearts and Parks intervention program. However, we did not observe any significant changes in HRR after the intervention. These preliminary results suggest the potential for this novel clinic-community intervention framework to have beneficial changes in some markers of CRF in children who have obesity.

291 Board #107 May 27 9:30 AM - 11:00 AM
COMPARISON BETWEEN OBESITY RATES AND PHYSICAL ACTIVITY LEVELS AMONG ADOLESCENTS IN SINGAPORE
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This Asia-Fit study focused on the physical index of adolescents from Singapore (SGP), providing an overall indication of living habits that may affect obesity levels. **PURPOSE:** To compare physical activity (PA) levels and obesity rates among SGP adolescents. **METHODS:** A total of 1648 adolescents from SGP (age: 13.49 ± 1.21 years, height: 159.76 ± 8.94 cm, weight (WT): 51.98 ± 13.41 kg, body mass index: 20.21 ± 4.22 $\text{k}\cdot\text{g}\cdot\text{m}^{-2}$, body fat percentage (BF%): 21.54 ± 10.21 %) participated in this study. A series of physical tests (15m youth Progressive Aerobic Cardiovascular Endurance Run (PACER) test, one-legged sit-and-reach (SRT), handgrip strength (HS) test, and 1-minute sit-up test (SUT)), a PA questionnaire and anthropometric measurements were collected from schools all over Singapore. **RESULTS:** There were significant correlations between WT and BMI (WT: 51.98 ± 13.41 kg; BMI: 20.21 ± 4.22 $\text{k}\cdot\text{g}\cdot\text{m}^{-2}$; $r = 0.90$, $p = 0.00$), BMI and BF% (BMI: 20.21 ± 4.22 $\text{k}\cdot\text{g}\cdot\text{m}^{-2}$; BF%: 21.54 ± 10.21 %; $r = 0.78$, $p = 0.00$), vigorous exercise (VE) and moderate exercise (ME) (VE: 3.19 ± 2.07 days; ME: 3.06 ± 2.06 days; $r = 0.46$, $p = 0.00$). Negative significant correlation was found between VE and WT (3.19 ± 2.07 days; WT: 51.98 ± 13.41 kg; $r = -0.06$, $p = 0.03$). No significant correlation was observed between ME and BMI (3.06 ± 2.06 days; 20.21 ± 4.22 $\text{k}\cdot\text{g}\cdot\text{m}^{-2}$; $r = -0.04$, $p = 0.13$), VE and BF% (VE: 3.19 ± 2.07 days; BF%: 21.54 ± 10.21 %; $r = -0.04$, $p = 0.09$). 89.5% adolescents participated in ME (3.06 ± 2.06 days), 10.5% did not indicate participation. 70.7% adolescents participated in VE (3.19 ± 2.07 days), 12.1% did not indicate participation. 2.8% adolescents adhered to the American College of Sports Medicine (ACSM)'s recommendation of 60 minutes of PA daily. A slightly higher percentage of adolescents sat for more than 8 hours daily (48.9%) than adolescents who sat for 1 to 8 hours daily (43.0%). 9.1% of adolescents did not report their sedentary duration. **CONCLUSIONS:** Results indicate that Singapore adolescents are active and should continue regular PA as it effects BMI. Lifestyle changes of active behavior as opposed to prolong sitting is important as pre-pubertal obesity may predict adult obesity. Singapore adolescents need to adopt a healthy lifestyle that includes a well-balanced diet, with less sitting time and regular PA to reduce the risk of cardiovascular diseases in adulthood.

292 Board #108 May 27 9:30 AM - 11:00 AM
Relationship Between Muscle Strength And Body Composition In Young Athletes
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Introduction: A lower cardiometabolic risk in adulthood has been suggested when a better development of the cardiopulmonary and strength condition is reached at an early age. It is important to be able to assess the cardiometabolic risk against variables such as strength in the upper and lower limbs. **Purpose:** To explore the correlation between anthropometric and strength condition variables in upper and lower limbs in boys and girls assigned to sports training schools (soccer, volleyball, skating) in the municipality of Madrid (Colombia). **Method:** A total of 110 children and adolescents were evaluated using long jump test and handgrip strength (HS). The anthropometrics characteristics are, for boys and girls, respectively: weight (kg): 50.5 ± 12.9 and 49.2 ± 11.9 ; height (m): 158.3 ± 11.8 and 152.6 ± 9.2 ; age (years): 13.7 ± 13.8 and 12.9 ± 2.2 . The Pearson's correlation coefficient (r) was used to calculate the correlations regardless of gender and divided by boys and girls. The correlations studied were between the anthropometric variables (weight, height, body mass index (BMI), waist circumference and fat%), compared to long jump test (LJT), right HS (RHS) and left

HS (LHS). The results of r are indicated with a statistical level of significance of $p < 0.001$. **Results:** In the general analysis, $r = 0.81$ was obtained for height versus RHS and LHS and, for weight, $r = 0.68$ and 0.67 was found in RHS and LHS, respectively. When correcting by gender, the height in girls shows $r = 0.7$ and 0.65 in RHS and LHS; while, in children, it was 0.61 , 0.85 and 0.89 for SL, RHS and LHS, respectively. The weight in girls showed $r = 0.6$ for RHS and, in boys, 0.8 and 0.84 for RHS and LHS, in whom $r = 0.6$ and 0.63 for RHS and LHS were also found when compared were made in front of BMI. No associations were found with LJT. **Conclusions:** The results indicated that the strength in the upper limbs (measured through the determination of handgrip strength) is a strong and moderate association in relation to height and weight respectively and regardless of gender. When comparing by gender, this relation is maintained in boys but the association in height went to a moderate level in girls. Thus, the results suggest that the development of strength measured through HS is closely related to the anthropometric characteristics of young athletes, especially height and weight.

293 Board #109 May 27 9:30 AM - 11:00 AM
Accuracy Of Multi-frequency BIA In %Fat Change During Weight Loss Among Competitive Girl Runners

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(No relevant relationships reported)

Periodical measurement of %fat with accuracy is crucial for optimizing the health and performance in competitive runners who need strict weight control. Multi-frequency bioelectrical impedance analysis (MFBI) is feasible for routine use but the evidence of the accuracy is limited to cross-sectional evaluation and no data is available for tracking of %fat change in competitive runners.

PURPOSE: To determine the accuracy of MFBI for evaluating the decrease in %fat by weight loss among competitive girl runners.

METHODS: The data of %fat were obtained from consecutive 25 freshmen long distance runners over 5 years in the same girl's high school team and were retrospectively analyzed. The team regularly participated in the All-Japan high school Ekiden championship. MFBI was performed at the preparatory season (PRE) and repeated after 5.6 ± 0.5 months at the competitive season (CMP) with dual energy X-ray absorptiometry (DXA) as reference. Weight loss period was defined as that between PRE and CMP and changes in %fat ($\Delta\%$ fat) was calculated by subtracting %fat in PRE from those in CMP. Bland-Altman analysis was used to evaluate the validity of MFBI compared to DXA for $\Delta\%$ fat. Statistical significance of the mean difference between MFBI and DXA was assessed by paired t -test. $P < 0.05$ was considered as statistically significant. Written informed consent was obtained from the runners and their parents.

RESULTS: %Fat by DXA vs. MFBI at PRE and CMP were 19.7 ± 5.6 vs. 17.9 ± 5.4% and 12.7 ± 3.1 vs. 12.2 ± 2.6%, respectively. Thus, systemic error (the mean difference) of $\Delta\%$ fat between the 2 methods was 1.2 percentage points [pp] (DXA, -6.9 vs. MFBI, -5.7pp, $p = 0.008$). Random error (the limits of agreement) was -3.0 to 5.5pp and no proportional error was observed between MFBI and DXA.

CONCLUSIONS: The small size of systemic error (mean difference) allow the use of MBIA to evaluate a group mean of $\Delta\%$ fat. However, due to the large random error size relative to the low level of %fat of the competitive runners, caution should be taken to use MFBI for individual monitoring of %fat change during weight loss period.

294 Board #110 May 27 9:30 AM - 11:00 AM
Physical Qualities Discriminate Playing Level In Elite Youth Hockey Players

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to compare physical test results between playing levels and positions in youth elite hockey players. **METHODS:** Subjects ($n = 49$) came from 3 distinct levels: *Bantam AAA Relève* (the lowest, $n = 16$), *Bantam AAA Major* (the second highest, $n = 17$), and *Midget Espoir* (the highest, $n = 16$). Physical characteristics and qualities were measured. The stationary broad jump was utilized to measure lower-body power. Jump distance was measured from toes to the closest landed heel. The best of two attempts was marked as the final score. The seated medicine ball throw was utilized to measure upper-body power. Throw distance was measured from the back of the wall to where the ball first made contact with the ground. The 20-meter shuttle run test was utilized to measure aerobic capacity. VO_{2max} was estimated from the last level completed with the Leger-Lambert formula. Results are presented as mean and standard deviation. A single factor (level or position) ANOVA and when significant a post-hoc analysis was also performed by using the least significant difference (LSD) for pairwise comparisons between groups tests results. Statistical significance was set at $p < 0.05$. Analysis was conducted with IBM SPSS Statistics for Windows version 25. **RESULTS:** Hockey

players of the two higher levels were significantly ($p < 0.05$) taller ($1.73 \pm 0.08m$ and $1.74 \pm 0.08m$, respectively, vs $1.63 \pm 0.09m$), heavier ($66.68 \pm 8.09m$ and $68.60 \pm 10.96m$ respectively vs $53.52 \pm 8.73m$), jumped further ($2.25 \pm 0.13m$ and $2.26 \pm 0.12m$ respectively vs $2.01 \pm 0.20m$), and had greater aerobic capacity (3.87 ± 0.52 L/min and 3.84 ± 0.57 L/min respectively vs 2.96 ± 0.49 L/min) than the hockey players from the lower level. However, the higher level players, scored lower than the middle level at the seated medicine ball throw ($3.74 \pm 0.49m$ vs $4.60 \pm 0.48m$), even though the middle level scored higher than the lower level ($4.60 \pm 0.48m$ vs $3.49 \pm 0.53m$). Results also show that the goaltenders were significantly taller than the other hockey players ($1.77 \pm 0.10m$ vs $1.72 \pm 0.08m$ for defensemen and $1.67 \pm 0.10m$ for forwards). **CONCLUSION:** The stationary broad jump, the seated medicine ball throw and the 20 meters shuttle run are field tests that could be used in order to discriminate playing levels in youth elite hockey players.

295 Board #111 May 27 9:30 AM - 11:00 AM
Comparison Of Adolescents Fitness Status Between Shanghai And Taipei

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(No relevant relationships reported)

INTRODUCTION: Chinese communities have a tight knit culture with similar culture practices such as lifestyle choices which have a direct impact on health and fitness level. **PURPOSE:** To investigate the health components of adolescents in Shanghai and Taipei. **METHOD:** A total of 3207 adolescents were recruited for the study from Shanghai ($N = 1588$) and Taipei ($N = 1619$). All adolescents had their percentage body fat (%BF) taken by a bio-impedance analysis machine. The health status, muscle strength and flexibility were measured with a handgrip strength test (HGST), one-minute sit-up test (SUT) and a single-leg flexibility test (SLFT) respectively. The HGST was taken three times per arm in alternate turns. The best result of each side was taken and summed for analysis. Adolescents had to complete as many repetitions of sit-ups within one minute for the SUT. The SLFT was taken thrice on each side consecutively and the best score was used for analysis. Their cardiovascular fitness was measured by a 15m Youth Progressive Aerobic Cardiovascular Endurance Run (PACER) test. Adolescents were paired up for the PACER test, with one as the runner and another as the marker. Runners had to run back and forth 15m according to the frequency of the beep. Adolescents need to reach the 15m mark before the beep. Each unsuccessful attempt is indicated on the PACER test results slip. The test ceased upon the third unsuccessful run. **RESULTS:** Significant differences were identified between both countries for %BF (Shanghai: $22.22 \pm 9.64\%$, Taipei: $23.29 \pm 10.30\%$, $p = 0.03$), SUT (Shanghai: 36.21 ± 9.25 count, Taipei: 33.03 ± 9.71 count, $p = 0.00$), flexibility [left side] (Shanghai: 54.59 ± 9.95 cm, Taipei: 51.36 ± 11.52 cm, $p = 0.00$), flexibility [right side] (Shanghai: 55.30 ± 9.91 cm, Taipei: 52.18 ± 11.51 cm, $p = 0.00$), HGST (Shanghai: 55.23 ± 14.08 kg, Taipei: 50.86 ± 14.66 kg, $p = 0.00$) and cardiovascular fitness (Shanghai: 40.12 ± 16.04 laps, Taipei: 37.75 ± 18.87 laps, $p = 0.00$). **CONCLUSION:** Shanghai's adolescents had significantly higher scores than Taipei's in all health components. Though both countries may have similar lifestyle choices, Shanghai's adolescents may have higher energy expenditure with a healthier diet than Taiwan's adolescents. Both countries' adolescents should continue with regular physical activity to maintain their health.

296 Board #112 May 27 9:30 AM - 11:00 AM
Association Between Body Composition And Physical Skills In Early Adolescent Athletes

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(No relevant relationships reported)

PURPOSE: This study aimed at appraising the strength of association of body composition components with a set of physical skills in early adolescent athletes. **METHODS:** A sample of 505 subjects (283 boys and 222 girls) was studied (Age = 13.6 ± 0.8 years, BMI = 20.1 ± 2.4 kg·m⁻²; mean ± SD). Anthropometric assessments were carried out, and the four-compartment model of De Rose and Guimaraes (1980) was applied to estimate body fat, muscle and bone mass percentages (%FM, %MM and %BM). The model was updated using the simple regression equations for male and female athletes proposed by Withers *et al.* (1987; cited by Norton, 1996) to calculate body density, and Siri equation (1961) was then applied to compute the percentage of fat mass. The three body composition components were correlated with the following physical skill tests: Handgrip strength (HAST), Abalakov jump (ABJ), 10 m Sprint test

(10ST), Sit and reach flexibility (SARF) and Simple eye-hand reaction time (SEHRT). Pearson's *r* was used to test correlations within each gender stratum. Statistical significance was fixed at the 0.05 level.

RESULTS: HAST showed negligible to low correlations with %FM, %MM and %BM ($|r| < 0.3$); statistical significance was found in all cases except in the correlations with %FM and %MM observed in girls. On the other hand, the correlations of ABJ with %FM and %MM reached moderate magnitudes in the male stratum ($r = -0.51$ and $r = 0.51$, respectively); ABJ evidenced significant associations with the three body composition components in both genders. Despite the opposite signs of the coefficients, 10ST presented similar degrees of association to the ones of ABJ. And SARF and SEHRT also showed negligible to low correlations with the three body composition components ($|r| < 0.3$), being statistically significant the ones of SARF with %FM and %MM found in boys, the one of SARF with %MM found in girls, and the one of SEHRT with %MM found in boys.

CONCLUSIONS: The athletes, especially the male ones, with lower %FM and higher %MM tended, though not strongly, to have higher performances in the physical skill tests where the power is decisive. In general, %BM showed weak degrees of association with the physical skills.

297 Board #113 May 27 9:30 AM - 11:00 AM
Tethered Swimming Ineffective As Post Activation Potentiation Procedure For 50-m Swimming Performance In Adolescent Swimmers

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PURPOSE: The aim of the study was to investigate if tethered swimming (TS) performed 8 min before a 50-m freestyle swimming sprint could be an effective post-activation potentiation (PAP) method to improve performance. **METHODS:** Regional level male adolescent swimmers (age: 13.0±2.0 y; height: 161.1±12.4 cm; body mass: 52.5±9.5 kg) performed two trial conditions (1 experimental (TS), 1 control (CTR)) on different days. The control group performed a standardized 1200-m warm-up followed by 8 min of rest and a maximal 50 m freestyle swimming sprint. The experimental group performed the same protocol with an added TS component at the end of warm-up, which consisted of 3 x 10 s maximal effort of tethered swimming with 1 min rest in-between sprints. Performance (time-trial), selected biomechanical (stroke length), physiological (blood lactate concentrations, heart rate), psychophysiological (ratings of perceived exertion (RPE)) variables and Counter movement jump (CMJ) flight-time were collected.

RESULTS: Pre-performance tethered swimming had no effect on swimming time, RPE, stroke rate or CMJ flight time. Before the 50 m race, blood lactate concentrations were significantly higher in TS than in control condition ($p=0.03$, $\eta^2 = 0.62$). One minute after the 50 m sprint, heart rate was significantly higher in the control condition compared to the TS ($P=0.046$, $\eta^2 = 0.27$).

CONCLUSIONS: The present study showed that 3 x 10 s tethered swimming performed 8 min prior to the event did not impact the 50 m sprint performance in young swimmers and may not be considered an effective PAP stimulus.

298 Board #114 May 27 9:30 AM - 11:00 AM
Wearable Sensors Differentiate Impacts And Intensity Between Games And Practices Among National Junior Ice-hockey Teams

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Purpose: Use wearable sensors (WS) to compare player incurred impacts (PII) and absolute vs relative workload intensity between practices, games and teams to determine if developmental age affects these factors at the national team level. **Methods:** 90 total members of the U.S. National (NTDP) U17 (45 members) and U18 (45 members) teams consented to procedures approved by EMU Human Subjects Committee. Bioharness-3 (Zephyr, MD) WS recorded triaxial accelerations during practices (P) and games (G) of the two teams over two seasons. Impacts were identified using Impact Processor (Zephyr, MD). Impacts greater than 6 g (Z3, Z4, Z5 and above) were used as previously validated for PII. Triaxial accelerations were used to generate absolute intensity metrics 30 minute exponentially weighted Dynamic Accelerations (DYNAs) and session DYNAs. Relative intensity metrics Individual Hustle Score (IHS) and Intensity factor (IF) were based on session DYNAs relative to

Dynamic functional threshold (DFT). Intensities and PII of two teams were compared between sessions and teams using MANOVA with Tukey post hoc ($\alpha=0.05$; SPSS 26.0, IBM, NY)

Results: 7288 sessions (1400 G, 2802 P; U17 and 1039 G and 2047 P; U18) were compared. For all combined sessions, impacts were greater for U18 (6.4 ± 7.7) than U17 (5.4 ± 7 ; $p<0.05$). Interestingly, impacts in G were not significantly different. Therefore, differences between teams were solely the result of higher impacts in P for U18 (5.8 ± 7.3) vs U17 (4.1 ± 6.3 ; $p<0.05$). For workload intensity, overall, 30-min DYNAs and Session DYNAs were not different between teams or for P, but both were higher in G for U17 (0.372 ± 0.0439 & 0.307 ± 0.0386 , respectively) than U18 (0.360 ± 0.0579 & 0.292 ± 0.0524 , respectively; $p<0.05$). Although 30-min and Session DYNAs were not different for P, IHS and IF were higher for U17 (0.896 ± 0.1016 & 0.790 ± 0.0964 , respectively) than U18 (0.890 ± 0.1116 & 0.767 ± 0.0981 , respectively; $p<0.05$).

Conclusion: Since PII are not different in G between U17 and U18, it appears developmental age does not affect PII in G. PII were higher in P for U18 than U17, but DYNAs were not different and relative intensities IHS and IF were higher, therefore, it doesn't appear as though PII are related to developmental age in these two teams.

299 Board #115 May 27 9:30 AM - 11:00 AM
Vibration Platform Stretching Increases ROM Acutely, With No Long-term Effect In Junior Olympic Women's Gymnasts

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Flexibility, particularly range of motion (ROM) of the hips, is critical for gymnasts' performance. Despite consistent flexibility training, many competitive gymnasts still need greater ROM. **PURPOSE:** To investigate the acute and chronic effects of vibration platform (VP) flexibility training on ROM at the hips in the middle split position. **METHODS:** Participants included 18 female gymnasts aged 7-16 years competing in JO level 6. Gymnasts were paired according to baseline ROM then randomly assigned to either the VP treatment group or the control group. The control group continued normal team stretching at the end of every practice, four days per week. The treatment group substituted standard stretching for VP stretching twice per week. ROM was measured after a single one-minute VP treatment and after 10 weeks of VP treatment. Prior to each measurement gymnasts completed a standard team warm-up including active ROM exercises. Measurements were taken using Myomotion inertial sensors placed on the lateral aspect of the distal femur and overlaying the sacrum. **RESULTS:** After 10 weeks of training, the VP group's ROM increased by 8.4 (±5.5) degrees ($p=0.002$), while the control group's ROM increased by 5.8 (±8.0) degrees ($p=0.064$). There was no significant difference between groups ($p=0.435$). A single VP treatment increased ROM by 3.6 (±7.3) degrees ($p=0.045$). **CONCLUSIONS:** There was a significant, although temporary, improvement in ROM after a single VP treatment. However, VP stretching does not appear to be a viable training option to improve ROM beyond standard stretching over time in child and adolescent female JO gymnasts.

300 Board #116 May 27 9:30 AM - 11:00 AM
Functional Bilateral Asymmetries In Adolescent Competitive Skiers

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When skiing both legs function independently and the stresses experienced by both legs is dependent upon the movement being performed (e.g. turning, jumping, landing, ect...). It is well established that greater stress is placed upon the outside leg when turning and initiating tricks and that the magnitude of these forces changes based on the athlete's momentum and the turn radius. Thus, ski athletes are at risk for developing bilateral asymmetries, which may put them at increased injury risk due to repetitive training on competition courses and non-symmetrical movement patterns. **PURPOSE:** To determine if a pattern of functional asymmetries are present in adolescent ski athletes from the same training mountain. **METHODS:** Competitive adolescent (aged 14-18 years) skiers from Carrabassett Valley Academy in Kingfield, ME ($n = 22$) with a minimum of 2 years competing in their sport, performed a series of bilateral tests to determine dominant and non-dominant lower body strength (5 s isometric mid-thigh pull of a force platform) and power (vertical jump), rotational power (accelerometer measured medicine ball throw) and balance (Y-balance test). Differences between legs were compared using a series of paired t-tests ($p < 0.05$). **RESULTS:** Athletes demonstrated greater rotational power moving towards their non-dominant (1115 ± 680 W) than dominant side (924 ± 605 W, $p=0.046$). However, no differences were observed between dominant and non-dominant legs in lower-

body strength (dominant: 565.5 ± 38.5 N, non-dominant: 549.9 ± 38.1 N, $p=0.063$), lower-body power ($p=0.572$), or balance in the anterior ($p=0.153$), posterior-medial ($p=0.880$), or posterior-lateral ($p=0.164$) directions. **CONCLUSIONS:** In the present study adolescent skiers demonstrated asymmetrical rotational power and non-significant trends asymmetrical lower-body strength but no other noteworthy differences in power or balance. In skiing, rotational power is necessary for rapid initiation of turns away from their dominant side. Training to correct this asymmetry may help athletes when turning towards their dominant side.

301 Board #117 May 27 9:30 AM - 11:00 AM
Determinants Of Head Impact Exposure In Youth Football

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(No relevant relationships reported)

Concussions are on the minds of many football players, parents and coaches; but attention has increased toward the potentially damaging effects of repetitive, subconcussive head impacts, particularly among youth football players. Advocates of the sport are looking for ways to improve player safety and reduce the potential risk of long-term brain abnormalities.

PURPOSE: To identify intrinsic and extrinsic characteristics of play associated with head impact exposure in youth football.

METHODS: Head impacts from one youth football team (7th & 8th grade) were measured during every practice and game during the 2018 & 2019 football seasons via a sideline head impact telemetry system and subsequently evaluated using video collected during each session. Each verified head impact was scored using a validated rubric consisting of up to 12 discrete characteristics of play (5 intrinsic, 7 extrinsic). The mean, median and 95th percentile linear acceleration (LA) was calculated for each play characteristic.

RESULTS: Over two seasons, 1202 practice (median LA: 19.90 g) and 1571 game (median LA: 21.00 g) head impacts (2773 total) were examined. The “kickoff” ($n = 95$ impacts; 6% of all game impacts) had the highest 95th percentile LA (69.89 g) among all game play types (e.g., “run”, “pass”, “punt”, etc.). Impacts that occurred “outside the hash marks” (61.75 g) and in the “redzone” (59.40 g) had the highest 95th percentile LA rankings among horizontal and vertical field positions, respectively. When players did not anticipate being hit ($n = 53$; 1.9% of all impacts), head impacts had a 95th percentile LA of 69.52 g, compared to 47.02 g when they anticipated the impact. Head impacts resulting from players’ helmets hitting the ground (95th percentile LA: 72.94 g) accounted for 11.6% of all impacts ($n = 323$).

CONCLUSIONS: These data indicate that certain, modifiable characteristics of play are associated with higher magnitude head impacts in youth football. Additional research is warranted to continue to examine practice and game situations (extrinsic characteristics) that produce higher magnitude head impacts, which could assist football-governing bodies in developing or modifying policy guidelines to help make the game safer.

Supported by a grant from The National Operating Committee on Standards for Athletic Equipment (NOCSAE).

302 Board #118 May 27 9:30 AM - 11:00 AM
Relationship Between Mixed Relay Performance And Physiological Measures Of Fatigue And Metabolism In Junior Triathletes.

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The mixed relay triathlon is a new event in the Summer Olympics consisting of teams of 2 females and 2 males whom each complete a super-sprint triathlon (~20 min per athlete) in sequential order. Given the duration of the event, the intensity will likely be higher than longer distance triathlons. Thus, muscular power and anaerobic metabolism may be more important determinants of performance. To date, no research has investigated the physiological determinants nor the muscular fatigue associated with the event.

PURPOSE: The primary purpose was to determine the changes in leg muscle power (to assess muscular fatigue) and anaerobic metabolism during a mixed relay triathlon. A secondary purpose was to determine the relationships between leg muscle power and anaerobic metabolism with overall and leg specific (swim, bike, run) performance.

METHODS: Twelve highly-trained junior (5 female, 7 male) triathletes (age: 17.6 ± 1.3 years) competed in the Canadian Mixed Relay Championships (300 m swim, 6 km bike, 1.6 km run). Before and immediately after the race vertical jump height (VJH)

and blood lactate (BLa) were measured. Paired sample t-tests were used to compare pre- and post-race differences. Pearson correlations were used to determine the relationships between finishing time, and swim, bike, and run times with BLA and VJH. **RESULTS:** Mean race time was 22.4 ± 1.4 min, including transitions (swim 4.5 ± 0.4 min, bike 10.3 ± 0.6 min, run 6.05 ± 0.5 min). VJH increased pre- to post-race (pre: 43.8 ± 8.4 cm; post: 46.1 ± 8.0 cm, $p=0.05$) in 7 out of 12 participants. A significant correlation between VJH pre-race and bike time was determined ($r=-0.60$, $p=0.03$). BLA significantly increased from pre- to post-race (pre: 1.3 ± 0.4 mmol·L⁻¹; post: 10.7 ± 2.4 mmol·L⁻¹, $p<0.001$) and significantly correlated to bike and overall finishing time (bike: $r=-0.71$, $p=0.02$; finishing time: $r=-0.76$, $p<0.001$). **CONCLUSIONS:** Based on the high BLA after the race, the mixed relay event requires a large contribution from anaerobic metabolism and faster athletes had greater post-race BLA. Despite the high physiological demands, muscular fatigue was not found in most participants. Furthermore, the relationship between VJH and bike performance demonstrates the importance of muscular power in the mixed relay event.

303 Board #119 May 27 9:30 AM - 11:00 AM
Does 45 Minutes Of Daily Pe Impact Health Related Fitness Of Under-resourced Middle School Females?

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Girls have a greater decline in physical activity compared to boys do during adolescence. **PURPOSE:** The purpose of this study was to examine the impact of 45 minutes of daily PE on the fitness levels of African American middle school females. **METHODS:** An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education on the Progressive Aerobic Cardiovascular Endurance Run (PACER), push-ups, curl-ups and BMI among youth in grades 6th-8th attending Legacy Early College, a Title I school in the southeastern US. Gain scores (final post-test assessment in May 2019 - original pre-test assessment in September 2018) were calculated and analyzed for significance. The interaction between school and time was estimated for each outcome. Each analysis was stratified by gender and adjusted by age to control for baseline differences by school. A Title I control school that provided physical education for only one semester was identified and utilized as a comparison. **Summary of RESULTS:** African American females at Legacy Early College ($N=374$) observed significant differences compared to control middle school females ($N=393$) who did not receive daily PE on the PACER, curl-ups and push-ups assessments at post-test ($P=.000$, $P=.004$ and $P=.003$), respectively. A decrease in aerobic capacity was observed for females at both schools, however this decrease was less at Legacy, but was not significant ($F=1.38$, $P>.05$). BMI of control school females increased significantly ($F=8.206$, $P=0.005$), compared to Legacy students. **CONCLUSIONS:** 45 minutes of daily physical education led to increases in PACER laps, push-ups and curl-ups, as well as decreases in BMI among under-resourced middle school students.

Supported by Campbell Young Leaders

304 Board #120 May 27 9:30 AM - 11:00 AM
Evaluation Of Bioelectrical Impedance Analysis For Estimating Percent Body Fat In Children.

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(No relevant relationships reported)

PURPOSE: To compare percent body fat (%BF) measurements estimated by bioelectrical impedance analysis (BIA) with dual-energy x-ray absorptiometry (DXA) in children.

METHODS: Forty-nine children (28 girls; 21 boys) volunteered to participate in this study (age = 14.5 ± 2.9 years; body mass index = 22.4 ± 5.6 kg/m²). During the assessment, %BF was measured using hand-to-hand bioelectrical impedance analysis (HBIA; Omron HBF-306), leg-to-leg bioelectrical impedance analysis (LBIA; Tanita 300-A), segmental bioelectrical impedance analysis (SBIA; Tanita BC-418), and DXA, which served as the criterion. %BF data from the four devices was assessed using one-way repeated measures ANOVA with Bonferroni-adjusted post-hoc tests. Alpha level was set a priori to $p<0.05$.

RESULTS: LBIA ($24.2 \pm 9.7\%$, $p < 0.001$) and SBIA ($26.4 \pm 8.0\%$, $p = 0.028$) significantly underestimated mean %BF when compared to DXA ($28.7 \pm 11.5\%$) while no differences were observed between DXA and HBIA ($28.4 \pm 7.3\%$, $p = 1.0$). Linear regression revealed significant ($p < 0.001$) correlations between %BF determined by DXA and the BIA methods: LBIA ($r = 0.87$), SBIA ($r = 0.91$), and HBIA ($r = 0.65$).

For a large percentage of the children (LBIA = 37%, SBIA = 53%, HBIA = 67%), %BF values were outside the $\pm 3.5\%$ minimally acceptable standard for accurate estimation.

CONCLUSIONS: The HBIA analyzer produced mean %BF similar to DXA supporting the potential use of this technology when group assessments in this population are of interest. However, due to the large intra-individual variability observed in this study, we do not recommend using the HBIA analyzer when precision of a specific child's %BF is critical.

A-43 Free Communication/Poster - Bone and Bone Mineral Density

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

**305 Board #121 May 27 10:30 AM - 12:00 PM
Mechanical Stimulation Of Osteocyte-like Cells Changes Their Secretome - Implications For Regenerative Medicine**

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(No relevant relationships reported)

Osteocytes are secretory bone cells that regulate bone homeostasis and for this reason, are often coined as the "brain of the bone". *In vitro* studies demonstrated that mechanically stimulated osteocytes release interleukins and growth factors that help coordinating bone formation and resorption, however, their secretome remains largely unknown.

Purpose: To investigate WNT signalling and the secretome of mouse and human osteocyte-like cells. Insights from this study could help to devise informed therapeutic exercise regimen e.g. aiming to preserve bone mass across ageing or accelerate bone fracture healing.

Methods: The murine MLO-Y4 (Kerafast) cell line was cultured according to Kerafast instructions. Human adipose stem cells (ATCC® PCS -500-011™) were expanded and differentiated into osteocyte-like cells (hOC) according to ATCC instructions. Cells were cultured in a computer-controlled bioreactor (Flexcell Int) for mechanical loading (3.4%, 2Hz, 5h). Static cultures were used as control. Relative expression of 84 key genes of the WNT signalling pathway (Sabiosciences) was quantified by RT-qPCR. Relative protein expression was estimated by western blotting. The secretome was analysed by quantitative mass spectrometry (TripleTOF 6600, SCIEX) using SWATH and processed using OneOmics (SCIEX) software.

Results: The relative gene expression remained unchanged in mechanically MLO-Y4 and hOC. Regarding protein quantification, active β -catenin and Cyclin D1 showed an up-regulation trend in mechanically stimulated MLO-Y4 but this was not statistically significant. A total of 917 proteins were identified in the MLO-Y4 secretome, ~12% present exclusively under mechanical active conditions. The secretome obtained under loading contained 14 cyclin-dependent kinases (CDKs) including CDK6, a critical regulator of osteoblasts and osteoclasts differentiation. A total of 329 proteins were identified in the supernatant of hOC, ~9% present exclusively under mechanical stimulation. Unlike MLO-Y4, no CDKs were identified in this cell type. The small ubiquitin-like modifier (SUMO) 2 and 3 were present in the secretomes of mechanically loaded MLO-Y4 and hOC.

Conclusion: Mechanically stimulated osteocyte-like cells secrete a specific set of proteins which could impact bone health and regeneration.

**306 Board #122 May 27 10:30 AM - 12:00 PM
Identifying Triad Risk Factors In Ultramarathon Runners**

Kira F. Skaggs¹, Michael Fredericson, FACSM¹, Emily K. Miller¹, Megan Roche¹, Tracy B. Hoeg², Kristin Sainani¹, Emily Kraus¹. ¹Stanford University, Palo Alto, CA. ²University of California-Davis, Sacramento, CA.
(No relevant relationships reported)

Ultramarathon running has gained popularity in the past decade, necessitating a better understanding of the health benefits and risks of this sport. The Female Athlete Triad (Triad) and a similar condition reported in males are common in endurance athletes, but the prevalence of triad risk factors in ultramarathon runners is unknown

PURPOSE: To identify the prevalence of Triad risk in ultramarathon runners.
METHODS: Runners who qualified to compete in a 100-mile endurance race were recruited pre-race to complete a survey assessing eating behaviors, menstrual history, training, and injury history; and dual-energy x-ray absorptiometry to assess bone

mineral density (BMD). A cumulative Triad risk score was calculated using energy availability, body mass index (BMI), age of menarche and oligomenorrhea (for women), BMD, and history of bone stress injury.

RESULTS: 123 runners (40 female and 83 male) participants had a mean age, respectively, of 41.8 and 46.2 years. 57.5% of females and 26.5% of males received moderate cumulative risk scores; 5.0% of females and 4.8% of males were classified as high risk. 62.5% of females and 39.7% of males scored moderate or high risk for low energy availability, with 13% reporting a history of clinical eating disorders. Mean female and male BMI was, respectively 21.2 kg/m²(SD=2.1) and 22.9 kg/m² (SD=2.6). 15% of females and 0% of males scored moderate or high risk for low BMI, determined to be anything less than 18.5 kg/m². 15% of females and 28.9% of males had BMD Z-score<-1.0, and 6.0% of males had a Z-score<-2.0. 37.5% of females and 79.5% of males reported at least one prior bone stress injury.

CONCLUSIONS: Triad risk factors were common among ultramarathoners, particularly in men.

ACKNOWLEDGEMENTS: Supported with grants from the Western States Endurance Run Foundation and the Napa Medical Research Foundation. Laboratory testing was done in partnership with InsideTracker

**307 Board #123 May 27 10:30 AM - 12:00 PM
Associations Between Measures Of Body Composition And Bone Mineral Density In Adults**

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PURPOSE: To provide a better understanding of the associations of bone mineral density (BMD) with lean mass (LM) and fat mass (FM) as these are currently not well understood.

METHODS: National Health and Nutrition Examination Survey (NHANES 2003-2004 & 2005-2006 cycles) participants (44.1 \pm 14.2 years old, 49.6% female) were included in this analysis if they underwent dual energy x-ray absorptiometry (total BMD g/cm², FM kg, and LM kg) and had complete data for age, sex, race, height (cm), physical activity (PA) (minutes per week), dietary calcium (mg/day), and smoking history.

Hierarchical linear regression models were built to determine associations between BMD with FM and LM (Model 1), adjusting for demographics (Model 2: age, sex, race, and height) and behavioral factors (Model 3: PA, dietary calcium, and smoking history). Interaction terms (FM*sex, FM*age group, LM*age group, and LM*race) were included in Models 2 and 3. Due to significant interactions Model 3 was stratified further by sex and age. Adjusted R² were compared between models to determine fit.

RESULTS: The associations between LM and BMD remained unchanged between all models. There were robust negative linear associations between FM and BMD (β = -0.002, p<0.001) and positive linear associations between LM and BMD (β = 0.006, p<0.001) in Model 1. When stratified by sex, the negative association in Model 3 between FM and BMD was found to have a larger amplitude in men when compared to women (β = -0.004, p=0.02; β = -0.002, p=0.03 respectively), whereas the associations between LM and BMD were consistent between sexes (β = 0.006, p<0.001; β = 0.006, p=0.002 respectively). When stratified by age, a larger negative beta between FM and BMD were found in 45+ as compared to 20-44 year age group (β = -0.007, p<0.001; β = -0.005, p<0.001 respectively) whereas a larger positive beta between LM and BMD were found in 45+ as compared to 20-44 year age group (β = 0.007, p<0.001; β = 0.005, p<0.001; respectively).

DISCUSSION: LM had consistent positive linear associations with BMD in all models and with stratification. The negative associations between FM and BMD varied between men and women, and between age groups. The exact mechanisms driving these differences with FM by sex and age require further investigation.

**308 Board #124 May 27 10:30 AM - 12:00 PM
Effect Of Exercise On Opg And Rankl As Bone Metabolic Markers: A Systematic Review And Meta-analysis**

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Bone metabolism is determined by the balance of bone formation (osteoblast) and bone resorption (osteoclasts). Osteoprotegerin (OPG) and receptor activator of nuclear factor κ B ligand (RANKL) signaling are important factors that regulate bone metabolism.

However, there are conflicting results about effectiveness of exercise on these factors.
PURPOSE: The purpose of this review is to investigate the effect of different types of

exercise and their intervention period on bone metabolism (i.e., OPG/RANKL ratio) through meta-analysis and to examine the influence of moderating variables (e.g., age, gender, type of exercise, intervention duration) on bone metabolism. **METHODS:** The review was conducted according to the Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines. The following databases were used to conduct the research: Academic Search Complete, MEDLINE, and SportDiscus. Keywords used were "exercise" AND "OPG" AND "RANKL" AND "bone". The inclusion criteria for these articles were that: 1) human subjects, 2) the blood collected before and after exercise; 3) the peer-reviewed journals published in English. Out of 161 articles, 10 were eligible to be included in this study. Comprehensive meta-analysis v.3 software was used to compute the effect size (Cohen's d) based on a random effect model and to conduct moderator analyses. **RESULTS:** The results indicate that there were moderate and positive effects of exercise training on bone metabolism (OPG/RANKL ratio) ($ES=.572$, 95% $CI=.220$, $.925$, $p=.001$). Moderator analysis results showed that exercise type (resistance, endurance, a combination of both) partially explained the heterogeneity of ESs ($Q_{between}=7.704$, $df=2$, $p=.021$). The endurance exercise has the highest ES across the groups ($ES=1.343$, 95% $CI=.670$, 2.016). However, gender, age, and intervention duration did not influence on the size of the effect. **CONCLUSION:** The exercise training significantly improves a bone metabolism marker (OPG/RANKL ratio), and the endurance exercise seems to be more effective type of exercise.

309 Board #125 May 27 10:30 AM - 12:00 PM
BONE MINERAL DENSITY, BODY COMPOSITION AND BLOOD PRESSURE IN YOUNG AND MENOPAUSAL RUNNERS AND NON-RUNNERS

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The onset of menopause brings with it various changes in bone mineral density (BMD) and body fat (BF) distribution. Physical activity has been identified as a protective factor from many diseases, especially those that result in physical limitations. Weight bearing activities are recommended for osteoporosis prevention. However, it is unclear how chronic running affects the BF% and BMD in healthy menopausal (MEN) women. **PURPOSE:** This cross-sectional study was designed to assess the effects of chronic running on BMD and BF% in MEN women. The BMD and BF% was compared in young (YNG) and MEN women with and without a running (RUN; NOR) history. **METHODS:** We recruited 169 Women (57 YNG/NOR (34.1 9.9 yrs.), 34 MEN/NOR (55.4 10.4 yrs.), 51 YNG/RUN (40.0 8.7 yrs.), and 27 MEN/RUN (56.9 8.9 yrs.) and evaluated them for differences and relationships between BMD, blood pressure (BP) and BF%. **RESULTS:** Although the MEN women were older, the MEN women did not differ for weight, BMI or body fat%, but did differ for BMD (MEN 1.17 vs YNG 1.24). Weight and central adiposity as measured by waist circumference was related to BMD ($p < 0.05$) in both RUN and NOR. Consistent with expectation, both MEN/RUN and MEN/NOR had lower BMD ($p < 0.05$) than the YNG/RUN and YNG/NOR. The MEN/RUN had a higher BP than the other groups and this may have contributed to their BMD response not being higher than the NOR. **CONCLUSIONS:** Although further study is needed to validate the findings in this study, these data indicate that a history of running does not result in a higher BMD in MEN women. This may have been partially due to the fact that body composition was not different between the groups and therefore the runners were not placing greater stress on the bones.

310 Board #126 May 27 10:30 AM - 12:00 PM
Relationships Of Bone Mineral Density And Muscular Performance In College Students

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 (No relevant relationships reported)

The skeletal system is adapted to mechanical loading such as gravity and muscle contraction. The current gold standard to assess the skeletal health is to use the Dual Energy X-ray Absorptiometry (DXA) to measure bone mineral density (BMD), however, the DXA is costly and not portable. Muscular performance assessment, such as grip strength and jump power, are fairly simple and affordable measurements. **PURPOSE:** To investigate the relationships between BMD and muscular performance in healthy young adults. **METHODS:** Thirty healthy college-age individuals, ten males (23.7 ± 1.9 years; 171.9 ± 6.7 cm; 81.8 ± 11.4 kg) and twenty females (23.1 ± 1.9 years; 161.8 ± 6.1 cm; 64.9 ± 15.3 kg), volunteered for the study. Scans of total body, lumbar spine, dual femur and dual forearm were obtained by the iDXA by a licensed technician. Muscular performance was assessed by grip strength, single-leg vertical jump, knee extension and flexion. Pearson's correlations were used to examine the relationships between BMD, muscular performance, and body composition.

RESULTS: Radius BMDs were significantly correlated with grip strength at their corresponding side ($r = 0.684$ on the right and $r = 0.744$ on the left, $p < 0.001$ for both). Total hip BMDs and femoral neck BMDs had strong correlations with hamstring peak torque (PT) and jump peak power (PP) at their corresponding side ($p < 0.001$ for all) but not quadricep PT (Table 1). We also found strong correlations between all sites BMD and body composition variables: total mass, total bone free lean mass (BFLM), legs BFLM, and arms BFLM ($p < 0.05$). **CONCLUSION:** Our results suggest that muscular performance assessments of grip strength, vertical jump and knee extension are potential alternative tools to estimate bone mineral density in young adults. Further study in a large population and all ages are needed for future investigation.

Table 1. Selected Pearson's Correlation Coefficients (n=30)

BMD Sites	Muscular Performance	R-value	P-value
Right Total Hip	Hamstring PT	.610	0.000
	Jump PP	.640	0.000
Right Femoral Neck	Hamstring PT	.690	0.000
	Jump PP	.722	0.000

PT: Peak Torque; PP: Peak Power

311 Board #127 May 27 10:30 AM - 12:00 PM
Female Distance Runners Display Altered Bone Remodeling In Fasted Blood And 24 Hour Urine Biomarkers

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An increase in underlying bone remodeling is associated with increased fracture risk. The International Osteoporosis Foundation recommend overnight fasted plasma C-terminal cross linked telopeptide type 1 collagen (CTX) and N-terminal propeptide of type 1 procollagen (PINP) as bone turnover markers (BTM) of homeostatic bone remodeling. Reflected by an increase in plasma CTX, endurance exercise increases bone resorption acutely for a number of hours post-exercise. Female distance runners (FDR) engage in frequent weight-bearing endurance exercise that may alter homeostatic bone remodeling and fracture risk.

PURPOSE: To compare bone remodeling in FDR and non-athletic controls (CON). **METHODS:** Daily 24 h urine samples and fasted morning blood samples were collected for 7 consecutive days of habitual activity in 7 FDR (training volume ≥ 60 km/week; mean \pm SD age: 24.1 ± 4.6 y, height: 1.70 ± 0.05 m, mass: 58.5 ± 5.5 kg, fat %: $18 \pm 4\%$) and 11 CON (≤ 3 h/week intentional vigorous physical activity; mean \pm SD age: 23.9 ± 4.1 y, height: 1.67 ± 0.05 m, mass: 64.5 ± 4.4 kg, fat %: $33 \pm 6\%$) who provided prior informed consent for a study which had ethical approval. Plasma CTX and PINP was measured by automated immunoassay (Roche Diagnostics) and urinary N-terminal cross linked telopeptide type 1 collagen (NTX) by ELISA (Osteomark). Data were pooled and analyzed independent of participant. Data violated the assumption of normality and are reported as the median (IQR). Groups were compared by Mann-Whitney U test.

RESULTS: Median CTX was 31.4% lower ($0.393(0.147)$ vs $0.573(0.333)$ ng/ml; $p < 0.001$; $d=0.7$) and PINP was 14.5% lower ($55.12(32.39)$ vs $64.43(16.73)$ ng/ml; $p=0.012$; $d=0.5$) in FDR compared to CON. In contrast, median 24 h NTX was 36.7% higher in FDR ($434.2(572.7)$ vs $317.6(302.6)$ nM bone collagen equivalents; $p=0.033$; $d=0.4$) compared to CON.

CONCLUSION: Lower overnight fasted CTX and PINP are deemed devoid of influence exerted by previous exercise or food intake and may indicate an adaptive, regulatory effect of chronic exercise training on systemic (homeostatic) bone remodeling in FDR. By contrast, 24 h urine NTX captures total bone resorptive activity, including response to exercise and diet accrued during the previous 24 h and appear to confirm significantly greater net daily bone resorption in FDR compared to CON.

312 Board #128 May 27 10:30 AM - 12:00 PM
Bone Mineral Density And Muscle Mass Determine Handgrip Strength Only When Multiple Tests Are Performed
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 (No relevant relationships reported)

BACKGROUND: Handgrip strength is thought to be correlated to bone mineral density and muscle mass. **PURPOSE:** To determine the relationship between handgrip strength and body composition measures (bone mineral density and muscle mass) in large scale. **METHODS:** We have recruited 728 volunteers aged ≥ 20 y. Maximal handgrip strength and average handgrip strength were measured in 10-consecutive attempts with maximal efforts. Rest interval between each grip was 3 s. Bone density and muscle mass of all participants were measured using iDXA. **RESULTS:** Our data show that average handgrip strength of 10 repeated tasks was highly linearly correlated with lean body mass ($r=0.76$, $p<0.01$) and moderately correlated with bone mineral density ($r=0.60$, $p<0.01$), respectively. The maximum grip strength of 10 attempts deems low correlation with muscle mass ($r=0.33$, $p<0.01$) and bone mineral density ($r=0.23$, $p<0.01$). **CONCLUSIONS:** Multiple grip tests seems to be superior in reflecting muscle mass and bone mineral density than single maximal value of handgrip strength.

313 Board #129 May 27 10:30 AM - 12:00 PM
Trabecular Bone Score And Bone Mineral Density In Older Adults
 Matthew C. Scott¹, James Stampley¹, Brett Davis¹, Heather Quiariarte¹, Eunhan Cho¹, Bailey Theall¹, Josh Granger¹, Neil M. Johannsen¹, Steve B. Heymsfield², Frank Greenway², Brian A. Irving, FACSM¹. ¹Louisiana State University, Baton Rouge, LA. ²Pennington Biomedical Research Center, Baton Rouge, LA. (Sponsor: Brian A. Irving, FACSM)
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 (No relevant relationships reported)

The Trabecular Bone Score (TBS) is an estimate of the healthiness of bone microarchitecture that is based on the mathematical reconstruction of 3D micro-computed tomography (μ CT) scans using 2D Dual-energy X-ray Absorptiometry (DXA). Compared to bone mineral density (BMD), TBS is a relatively new DXA-derived metric for predicting fracture risk. **PURPOSE:** This study examined the associations between classically measured vertebral bone mineral density (BMD) and TBS in inactive older adults. **METHODS:** For the present analyses, we included pre-training data from 19 older adults ($X \pm SD$; 71 ± 4.2 y, 4 black, 6 males) participating in an ongoing exercise intervention (REALPA). Whole-body and lumbar spine scans were acquired using a Hologic Horizon[®]A DXA scanner to determine BMD. TBS iNsite[™] was used to determine the TBS score from lumbar spine DXA scans. Multivariate analyses were used to determine associations between whole-body and lumbar spine BMD with TBS scores, and sex differences were assessed by t-tests. **RESULTS:** A strong correlation between both whole-body BMD and lumbar spine TBS ($r=0.815$, $p<0.0001$) was observed; this was also true for lumbar spine BMD and lumbar spine TBS ($r=0.834$, $p<0.0001$). Sex differences were found (males vs. females) for Whole-body BMD (g/cm^2 ; 1.156 ± 0.12 vs 0.972 ± 0.10 , $p<0.009$), lumbar spine BMD (1.150 ± 0.20 vs 0.920 ± 0.15 , $p<0.05$), and lumbar spine TBS (1.409 ± 0.10 vs 1.285 ± 0.09 , $p<0.05$). **CONCLUSION:** The sex differences for BMD and TBS are consistent with the literature, with males having higher BMD and TBS. Strong correlations between BMD and TBS suggest that TBS bone has construct validity. However, future studies are still warranted to determine whether TBS scoring provides clinically meaningful insight into fracture risk beyond traditional BMD. Furthermore, future research studies are warranted to determine whether exercise induced changes TBS are sensitive markers for exercise induced bone remodeling, which would provide additional insight into the clinical utility of TBS. This study was supported by the NIH 5R21AG058181-02.

314 Board #130 May 27 10:30 AM - 12:00 PM
Bone Mineral Density Amongst Collegiate Male Athletes Across Endurance And Strength-based Sports
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 (No relevant relationships reported)

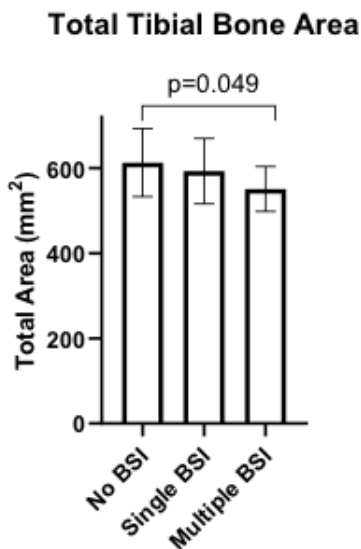
PURPOSE: The primary aim is to compare body composition, specifically bone mineral density (BMD) and associated Z-score, in male National Collegiate Athletic Association (NCAA) athletes across five different sports. Secondary measures include lean body mass (LBM) and body fat percentage (BF%). **METHODS:** In this observational, cross-sectional study, five collegiate sports team athletes representing endurance-dominant (soccer, running, swimming) versus strength-based sports (football, basketball) consented to participate in a pre-season whole-body dual energy x-ray absorptiometry (DXA) scan. One-way ANOVA (Brown-Forsythe) with multiple comparisons tests were used to statistically compare BMD (and associated Z-score), LBM, and BF% values between sports, with significance set at $p<0.05$. **RESULTS:** 165 male athletes participated, with ANOVA tests revealing statistical differences between sports for all body composition parameters measured ($p<0.0001$). Football players ($n=99$) demonstrated the highest while swimmers ($n=19$) had the lowest BMD ($1.37 \pm 0.10 g/cm^2$ vs. $1.14 \pm 0.07 g/cm^2$, $p < 0.001$). There were no differences ($p>0.05$) in BMD between football vs. basketball ($n=16$) players ($1.33 \pm 0.09 g/cm^2$) or soccer players ($N=20$; $1.26 \pm 0.06 g/cm^2$) compared to cross-country runners ($N=11$; $1.17 \pm 0.07 g/cm^2$). While BMD was similar ($p>0.05$) between swimmers and cross-country runners. In comparisons between sports for Z-scores ($F=39.73$; $p<0.0001$), football players had the highest scores (1.48 ± 0.09) followed by basketball players (0.77 ± 0.75), soccer players (0.42 ± 0.77), cross country (0.00 ± 0.57) and swimmers (-0.57 ± 0.77). Basketball players had the highest LBM (78.7 ± 8 kg) next to football (72.0 ± 12 kg) while football had the highest %BF ($24 \pm 6\%$) across sports. **CONCLUSION:** Football and basketball requires greater high intensity resistance training over endurance (vertical + non-vertical loading) training, whereas cross country, swimming and soccer requires greater endurance over resistance training. Furthermore, soccer and cross-country have similar running demands and showed no significance in BMD. We believe that the osteogenic contributions of resistance training on BMD are underappreciated and warrant further investigation as a strategy for maximizing skeletal health in young adults.

315 Board #131 May 27 10:30 AM - 12:00 PM
Female Runners With Multiple Bone Stress Injuries Have Smaller Bone Area Compared To Healthy Runners
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 (No relevant relationships reported)

Bone stress injury (BSI) is an overuse injury reported in up to 20% of female runners. Many runners sustain recurrent BSI. However, the role of impaired bone properties and other risk factors in those with recurrent BSI remain to be characterized. **PURPOSE:** To identify bone features that distinguish women with a history of multiple BSI. **METHODS:** We enrolled 41 female runners, ages 18-30, with a history of 1 lower extremity BSI (1 BSI; $n=15$), ≥ 3 lower extremity BSI (multi BSI; $n=12$), or no BSI ($n=14$), for this cross-sectional study. We collected high-resolution peripheral quantitative CT (HR-pQCT) scans of the distal tibia, areal bone mineral density (aBMD) by dual-energy x-ray absorptiometry, bone material strength index (BMSi) using microindentation (Osteoprobe), and questionnaires. **RESULTS:** There were no differences between groups in age, BMI, age of menarche, or aBMD. Multi BSI had higher Eating Disorder Examination Questionnaire (EDE-Q) scores and prevalence of amenorrhea than no BSI ($p<0.05$). Adjusting for height and weight, multi BSI had smaller total tibial bone area ($p=0.049$, Fig.), and a trend for greater total and trabecular volumetric BMD (vBMD; $p=0.07$, $p=0.09$, respectively) compared to no BSI. 1 BSI had higher BMSi compared to no BSI and multi BSI ($p=0.04$), and lower cortical porosity compared to no BSI ($p=0.048$). Among the cohort, BMSi was significantly associated with cortical porosity ($p=0.04$), but not with cortical vBMD, cortical tissue mineral density, or aBMD. EDE-Q score was inversely associated with total bone area ($p=0.02$). **CONCLUSIONS:** Our findings suggest runners with multi BSI have smaller bones and higher EDE-Q scores than no BSI. Total and trabecular vBMD appear to be higher

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in multi BSI compared to no BSI, though due to the small sample size, differences were not significant. Collectively, our findings suggest several bone properties and eating behaviors distinguish women with multi BSI and 1 BSI from no BSI.



- 316** Board #132 May 27 10:30 AM - 12:00 PM
A Two-year Examination Of Bone Mineral Density In Division I Cross-country Runners
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(No relevant relationships reported)

There have been few longitudinal studies beyond one year examining bone mineral density (BMD) in collegiate distance runners. Weight-bearing activity such as running tends to be osteogenic, however runners often experience bone injuries and may have site-specific deficiencies compared to norms. **PURPOSE:** Examine the BMD of Division I cross country runners across a two-year time frame. **METHODS:** BMD of 19 collegiate cross-country runners (12 men & 7 women) were measured via dual energy x-ray absorptiometry at the beginning of the season for three consecutive years (v1, v2, v3). A repeated measures multivariate analysis of covariance (whole body lean mass as covariate) was used to compare BMD values of men and women runners at four sites: AP spine (APBMD), femoral neck (FNBMD), whole body (WBBMD), and the non-dominant forearm (FABMD). **RESULTS:** Women had a significant decrease from v1 to v2 ($1.240 \pm 0.048 \text{ gm}\cdot\text{cm}^{-2}$ vs $1.194 \pm 0.048 \text{ gm}\cdot\text{cm}^{-2}$, $p=0.003$) and v1 to v3 ($1.240 \pm 0.048 \text{ gm}\cdot\text{cm}^{-2}$ vs $1.185 \pm 0.043 \text{ gm}\cdot\text{cm}^{-2}$, $p=0.002$) in WBBMD and men had a significant increase from v1 to v3 ($0.414 \pm 0.029 \text{ gm}\cdot\text{cm}^{-2}$ vs $0.450 \pm 0.028 \text{ gm}\cdot\text{cm}^{-2}$, $p=0.018$) and v2 to v3 ($0.425 \pm 0.026 \text{ gm}\cdot\text{cm}^{-2}$ vs $0.450 \pm 0.028 \text{ gm}\cdot\text{cm}^{-2}$, $p=0.003$) in FABMD. Men and women had similar BMD at all sites. Z-score analysis using <-1.0 as the cutoff for low BMD revealed that two women had a low z-score at the AP spine at all three time points, one woman had a low z-score at the FN at all three time points, and low WB z-scores increased from one to three women across the three visits. For the men at the AP spine, low z-scores decreased from three to one across the three visits, at FN no men had a low z-score, and there was only one male with a low z-score for WB (v3). For available data at the forearm, one woman and six men had low z-scores at v3. **CONCLUSIONS:** The AP spine in women may be a site of interest with 28.6% of women with low z-scores. It appears that running may not have an osteogenic effect on WBBMD in female collegiate distance runners over two-years, which may be explained by dietary intake. For males, BMD was consistent across two years, with a significant increase in the FABMD, however, 50% of men had a low z-score at this site. Males of this age may still be accruing bone at the AP spine and FA.

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Bilateral Bone Strength Differences In Division II Female Volleyball Players

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(No relevant relationships reported)

Loading (exercise) increases bone strength and reduces the likelihood of fractures later in life. However, questions remain as to the specific loading parameters that optimize bone strength. Past research investigating the effect of loading on bone strength have reported significant bilateral differences in bone characteristics favoring the dominant arm in male racket-sport players (Haapasalo et al., 2000) and former professional baseball pitchers (Warden et al 2014). Results also emphasized positive lifelong effects of loading on bone. Volleyball players primarily utilize a dominant side; therefore they are an excellent model to investigate the effects of bilateral loading on bone. **PURPOSE:** To determine bilateral differences in bone strength, including bone architecture, size and density in the radius. **METHODS:** 16 Division II female volleyball players (mean age 19 years + 1.15, height 1.74 + 0.69 m, weight 69.81 + 8.14 kg, body fat 23.86 + 5.73%) underwent peripheral quantitative computed tomography (pQCT) scans to measure bone strength on both the dominant and non-dominant radius. Trabecular bone variables (4% epiphyseal site) included trabecular bone mineral density (BMD.tb), total bone mineral content (Total BMC), total area (TotA), and compressive strength index (BSIc). Cortical bone variables (66% diaphyseal site) included cortical density (CoD), cortical area (CoA), strength strain index (pSSI), and moment of inertia (J). One-tailed paired T-tests were performed to compare the variables. **RESULTS:** No significant side to side differences were found. The side to side percent (%) differences found at the 4% site were BMD.tb (-0.45%), Total BMC (0.99%), TotA (-0.63%). The side to side percent (%) differences found at the 66% site were CoD (-0.97%), CoA (1.90%), pSSI (0.31%), J (5.23%). **CONCLUSION:** Volleyball may not result in loading significant enough to cause bilateral bone strength differences. Limitations include possible prevalent bilateral strength differences in the humerus, consideration of starting age (pre or post menarche) of playing volleyball, comparison of males and females of different sports.

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Exercise Therapy For Bone Health: Translation To Clinical Practice

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Reported Relationships: B.R. Beck: Ownership/interest/stock; Owner and Director, The Bone Clinic.

We previously reported that high-intensity resistance and impact training (HiRIT) is safe and improves risk factors for osteoporotic fracture in postmenopausal women and older men with low bone mass under trial conditions (LIFTMOR and LIFTMOR-M trials). We have now established a translational research Clinic implementing HiRIT in practice alongside systematic longitudinal monitoring of musculoskeletal and functional outcomes to determine effectiveness and feasibility as osteoporosis prevention and therapy in the 'real world'. **PURPOSE:** The aim of the current report is to present 4 year outcomes from the Clinic. **METHODS:** All Clinic clients undergo testing for height, weight, spine (LS), total hip (TH) and femoral neck (FN) bone mineral density (BMD), lean and fat mass, back extensor strength (BES), and functional indices of fall risk at their baseline visit, and annually thereafter. Twice-weekly supervised HiRIT with balance training and a dietary consult is provided. Compliance and injuries are comprehensively monitored. In the absence of a control group, program effectiveness is determined from one-sample t-tests of percent change from baseline. **RESULTS:** We report outcomes from 275 clients (94.9% female) who have completed a minimum of 12 months HiRIT (63.6±7.1 yrs, 162.3±6.8 cm, 60.6±10.0 kg, LS T-score -2.0±1.1, FN T-score -2.0±0.7, compliance 69.1±39.6%). 70 clients were on bone medications at baseline but only 18 at follow-up. Improvement was observed in weight (0.8±3.8%, $P<0.0001$), LS (2.2±5.1%, $P<0.0001$), TH (1.0±3.7%, $P<0.0001$) and FN BMD (1.4±4.8%, $P<0.0001$), lean mass (2.3±5.5%, $P<0.0001$), fat percent (-4.5±10.7%, $P<0.0001$), functional reach (7.2±13.4%, $P<0.0001$), timed up and go (-9.8±12.0%, $P<0.0001$), tandem walk (-20.6±35.1%, $P<0.0001$), sit to stand (-9.9±15.9%, $P<0.0001$), BES (20.6±35.1%, $P<0.0001$), and kyphosis (5.1±54.8%, $P<0.05$). Clients increased daily dietary calcium (23±67%, $P<0.0001$) and total calcium (19±68%, $P<0.0001$). 20 injuries were sustained in a total of 31,483 training sessions, the majority being minor muscle strains. **CONCLUSION:** We show that, when supervised in clinical practice, an evidence-based, targeted, high-intensity resistance and impact training program is safe and highly effective osteoporosis therapy for older men and women with low bone mass.

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Acute Response Of Biochemical Bone Turnover Markers Induced By Three Different Jumps For Postmenopausal Women

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(No relevant relationships reported)

High-impact training has shown to induce benefits in bone structure, -mineralization and -strength. However, a dose-response relationship has not been established, and the acute response of biochemical bone turnover markers (BTM) after jumping has not been examined.

PURPOSE: To compare the acute BTM response and the associated ground reaction forces (GRF) induced by three different jumps for postmenopausal women. **METHODS:** In a randomized controlled cross-over study over three days, twenty-nine postmenopausal women (age (mean±SD): 60.0±5.6 years) were randomly assigned to 6x10 repetitions of three jumps: counter-movement jump (CMJ), drop jump (DJ), diagonal-drop jump (DDJ). A fourth day without jumping served as control (C). Blood samples were collected before (PRE), after (POST), and 2-hours after (2Hr) exercise. Procollagen type-1 amino-terminal propeptide (P1NP), Osteocalcin (OC) and C-terminal telopeptide of type-1 collagen (CTX) were evaluated by a fully automated immunoassay system (iSYS, Immunodiagnostic Systems Ltd., Bolton, England) by the method of Chemiluminescence. Peak sagittal (Fx), transversal (Fy), and vertical (Fz) GRF were measured by an AMTI (©Advanced Mechanical Technology Inc., Watertown, MA 02472-4800 USA) SGA6-4 force platform and the combined three-axis peak GRF was calculated. The BTM differences between PRE, POST, and 2Hr were tested with linear mixed models, and the differences in GRF between the jumps were tested with repeated ANOVA. Linear regression analyses were used to assess the correlation between ΔBTM and the associated GRF in each type of jump. **RESULTS:** At POST, P1NP was increased (p<0.01) by 7.7±1.8% (CMJ), 9.4±1.3% (DJ), and 10.6±1.6% (DDJ), which were higher (p<0.01) than C. OC was increased (p<0.05) by 5.5±1.8% (DJ), which was higher (p<0.05) than C. CTX was not significantly changed at POST. There were no significant differences in ΔBTM between the jumps at any time point. In CMJ, ΔP1NP POST correlated (p<0.05) with the combined three-axis peak GRF (r=0.71). **CONCLUSION:** The acute, jumping-induced increase in P1NP and OC without any rise in CTX indicates an osteogenic change in bone turnover in favor of bone modeling, which based on the relationship between the combined three-axis peak GRF and the acute P1NP response after CMJ seems to be dose-dependent.

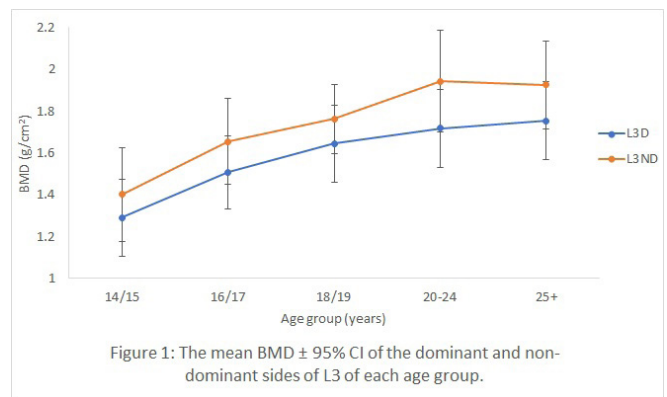
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The Effect Of Age On The Lumbar Spine Of Cricket Fast Bowlers

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Senior cricket fast bowlers (FB) have high lumbar spine bone mineral, particularly on the contralateral side to their bowling arm. It is thought that bone possesses its greatest ability to adapt to loading during adolescence but is unknown at what age asymmetry develops in FB and how adaptation develops with age.

PURPOSE: To determine how lumbar bone mineral and geometrical properties differ according to age in FB. **METHODS:** With NHS and institutional ethics approval, 107 elite adolescent and senior male FB aged 14 to 35 years received a single AP lumbar spine DXA scan (GE Lunar iDXA, GE Healthcare, USA). Bone mineral density (BMD) and bone mineral content (BMC) were derived for each vertebra, along with average vertebral height and width, area and Z-score (Lunar enCore v17, GE Healthcare, USA). Custom regions of interest derived the bone mineral in the lateral third of the non-dominant (ND) and dominant (D) sides of the vertebral body (relative to bowling arm). FB were split into 14-15 (n=27), 16-17 (n=28), 18-19 (n=22), 20-24 (n=16), and 25+ (n=14) age groups. ANOVAs were used to compare the age group means for each variable, with FFM as covariate. **RESULTS:** Lumbar spine BMD, BMC, Z-score, area, width and height significantly differed between age groups at all vertebral levels (P<0.01), but differences in area and height were no longer significant with FFM included as a covariate (P≥0.38). Mean BMD (± SD) L1-L4 Z-scores increased progressively with age from +0.83 ± 1.24 at age 14-15 to +2.69 ± 1.17 at age 25+. BMD and BMC on the ND and D sides significantly differed with age (P≤0.04) and side (P<0.01), and by age on each side (P≤0.04) as highlighted at L3 in figure 1. **CONCLUSIONS:** Adaptation to fast bowling, in terms of whole vertebra and site-specific bone mineral, substantially increases with age particularly on the ND side.



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Feasibility Of Using A Bisphosphonate In Sleeve Gastrectomy Patients For Bone Loss Prevention

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Among older adults with severe obesity, the sleeve gastrectomy (SG) procedure yields rapid weight loss and cardiometabolic improvement; however, it is also associated with significant bone loss and increased fracture risk. Bisphosphonate use reduces osteoporotic fracture risk and may be effective in minimizing bariatric surgery associated bone loss; yet, this hypothesis has not been formally tested.

PURPOSE: The purpose of this study is to determine the feasibility of recruiting, enrolling, treating, and following 24 SG patients (40+ years old) into a randomized controlled trial (RCT) examining the efficacy of Risedronate, a bisphosphonate, use (versus placebo) in the prevention of bariatric surgery associated bone loss. **METHODS:** Feasibility metrics include recruitment, retention, adherence, and adverse event reporting. Self-reported demographic characteristics and dual energy X-ray absorptiometry (DXA) acquired T-scores and 10-year major osteoporotic fracture (MOF) and hip fracture risk were also collected at baseline. **RESULTS:** Study recruitment occurred over 17 months (3/5/18-8/31/19). A total of 70 patients met initial eligibility criteria and were referred by the clinic; of those, 32 were screened by telephone (n=8 excluded after screening), and 24 were randomized to Risedronate or placebo (recruitment yield: 34%; n=12/group). On average, participants were 56±7 years old at baseline, with a BMI of 44.8±6.1 kg/m². The majority of the study sample was female (83%), white (79%), and postmenopausal (75%). Three participants (12%) presented with osteopenia, and MOF and hip fracture risk was low (5.0±3.2% and 0.3±0.4%, respectively). Data collection is ongoing. As of 11/3/2019, two participants have withdrawn, three mild adverse events have been reported (out of 125 contacts; one related and two unrelated), and among active participants, 95% of pills (124 out of 131 total) have been taken (n=22>80% compliant with medication protocol). **CONCLUSIONS:** Use of Risedronate as a novel therapeutic to preserve bone density among SG patients appears feasible and well tolerated. Forthcoming intervention effects will be used to generate effect size estimates to appropriately power a subsequent trial.

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LARC Implant Use Does Not Exacerbate Bone Loss Associated With Hindlimb Unloading

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Combined oral contraceptives (COC; ethinyl estradiol and progestin) reduce exercise-induced gains in bone mineral density (BMD), especially by suppressing bone turnover. Long-acting reversible contraceptives (LARC; progestin-only) provide many practical advantages over COC and will likely be recommended for female astronauts on long-duration missions; however, the impact on bone health with unloading is unknown. **Purpose:** To determine if LARC use will blunt loss of bone associated with hindlimb unloading (HU)

Methods: Virgin female Sprague-Dawley rats (n=52; 4-mo-old) were singly housed and randomly assigned to placebo (PL) and LARC groups, via an implanted slow-release etonogestrel pellet (0.00ug/d vs. 0.30ug/d). A week later, animals were further randomized to weight bearing (WB) and HU groups (n=13/subgroup) for 6 weeks. Calcein injections were delivered 9 and 2 days prior to termination. Pre/post-HU, proximal tibia metaphysis (PTM) and the tibia mid-diaphysis (TD) were scanned with *in vivo* peripheral quantitative computed tomography. At termination tibiae were stored for mechanical testing and dynamic/static histomorphometry. Univariate and repeated measures 2-way ANOVA were used.

Results: Despite increasing their food intake during HU (p<0.01), HU animals lost weight and weighed less than WB animals starting on HU week 2 (p<0.01). Irrespective of pellet type, HU resulted in a loss of total and cancellous volumetric BMD (vBMD) at the PTM (p<0.01), reduced cortical thickness at the PTM and TD (p<0.01), and reduced endosteal and periosteal mineralization (MS/BS, MAR, and BFR; p<0.02) at the TD compared to WB animals. Irrespective of loading group, at the PTM LARC animals lost cancellous vBMD (p<0.05), but had an increase in osteoid (organic bone matrix; p<0.04) compared to PL animals. PTM BV/TV and Tb.Th were greater in PL-WB animals compared to PL-HU animals only (p<0.04). Similarly, ultimate force was greater in PL-WB animals compared to PL-HU animals only (p<0.02).

Conclusions: On balance, LARC implantation did not blunt nor worsen the bone response to unloading. LARC appear to be a viable option for premenopausal female astronauts selected for long-duration missions.

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Differences In Bone Mineral Density At The Femoral Neck And Lumbar Regions Across Female Soccer Players, Olympic Lifters And Power Lifters

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(No relevant relationships reported)

Power lifting can improve total body bone mineral density (BMD), but improvements in the regions most susceptible to injury (femoral neck and lumbar vertebrae) have not been demonstrated. Soccer players, who engage in odd-impact loading, have greater BMD at the femoral neck than sedentary controls. Olympic lifting involves both high- and odd-impact loading at the femoral neck and lumbar regions, but comparisons in BMD across sport-specific athletes have not yet been made.

PURPOSE: To examine differences in total BMD and BMD at the femoral neck and lumbar vertebrae between female power lifters (PL), Olympic lifters (OL), soccer players (SP) and recreationally active individuals (RA).

METHODS: Thirty-seven females participated in this study: 10 PL, 8 OL, 8 SP, and 11 RA (mean age = 24.5 ± 7.9 years). Total BMD, BMD at lumbar vertebrae L1-L4, and BMD at the femoral neck of the dominant leg were measured along with body composition (total fat mass, lean mass, and percent body fat) with dual-energy x-ray absorptiometry. Body composition components were compared across groups with a one-way ANOVA. BMD measures were compared across groups with an ANCOVA with weight, height, and body mass index as covariates. Tukey's tests were used for post-hoc analysis. Significance was accepted at $P < 0.05$.

RESULTS: All three athletic groups had greater total BMD than RA (1.071 ± 0.066 g·cm⁻²). OL (1.306 ± 0.08 g·cm⁻²) had greater total BMD than PL (1.071 ± 0.07 g·cm⁻²), but it was not different than SP. At the femoral neck, OL (1.127 ± 0.09 g·cm⁻²) and SP (1.212 ± 0.10 g·cm⁻²) [but not PL (1.075 ± 0.16 g·cm⁻²)] had greater BMD than RA (0.971 ± 0.99 g·cm⁻²). BMD at the femoral neck was greater in SP than in PL, with no difference between OL and PL. At lumbar spine sites L2 - L4, there was no difference across the three athletic groups. OL and PL had a greater BMD than RA at L2-4, whereas SP had greater BMD than RA at only at L4. There was no difference across all groups at L1.

CONCLUSION: Olympic lifting includes both high- and odd- impact movements in addition to high-force loading. Olympic lifters showed similar BMD at the femoral neck as soccer players and similar BMD in the lumbar spine as power lifters. Thus, Olympic lifting may have greater BMD effects in the two key regions that are susceptible to injury compared to sports that do not combine power and odd-impact training.

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Middle-and Long-term Endurance Runners Exhibit Healthier Fat Distribution Compared To Matched Controls

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(No relevant relationships reported)

PURPOSE: Aerobic exercise training has many known cardiovascular benefits that may promote healthy ageing. Long-term long-distance running is a common aerobic exercise modality, but the number of individuals involved in endurance running decreases with increasing age. This cross-sectional study assesses structural findings, e.g. body composition, bone mineral density and muscle mass, obtained from middle-aged long-term endurance runners, and compares the findings with matched non-runners. **METHODS:** Total and regional lean and fat mass (kg) and total body percent lean and fat mass (%) were assessed by DXA and analyzed using enCORE software version 17. Sagittal Magnetic Resonance images using a T2-weighted sequence captured the cross-sectional area and thickness of the multifidus from L1 to L5.

RESULTS: Analyses included 10 male runners with a mean (standard deviation; SD) age of 49(4)yr, height of 178.9(4.9)cm, weight of 67.8(5.8)kg and body mass index (BMI) of 21.4(1.4)kg/m² that had been running 82.6(27.9)km/wk for 23(13)yr and nine non-runner sex-, age-, height- and weight-matched controls with a mean(SD) age of 51(5)yr, height of 176.0(7.8)cm, weight of 72.8(7.1)kg and BMI of 23.7(2.1) kg/m². Only BMI statistically differed between the groups (P=0.010). Runners had 4.4kg greater mean total body lean mass than controls, which equated to 10percentage-points greater mean total body percent lean mass, albeit only the latter was significant (P=0.001). Runners also had 14% greater trunk lean mass. Moreover, runners had less total body (8.6kg), arm (58%), leg (52%), trunk (73%), android (91%) and gynoid fat mass (64%). No differences were observed between groups for BMD outcomes. No between-group differences in multifidus size were observed.

CONCLUSIONS: Middle-aged long-term male runners exhibit lower total body fat percentage and healthier fat storage distribution, but no different BMD compared sex-, age-, height- and weight-matched non-running participants. Other than cardiovascular benefits, long-term endurance running seems to also provide structural benefits.

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Reliability Of Leg Length Measures Using Dual Energy X-ray Absorptiometry (dxa) Scans In Young Children.

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(No relevant relationships reported)

Dual energy x-ray absorptiometry (DXA) scans were originally used to determine total body and regional bone mineral content and areal density measures. Advances in DXA scanning technology and accompanying software analyses provides total body and regional soft tissue analyses, the ability to analyze uniquely created regions of interest, and anatomical measures including structural angles and segmental lengths.

PURPOSE: To determine the intratester and intertester reliability of leg length measures using total body DXA scans. **METHODS:** Total body DXA scans from 53 young children were acquired and the right and left leg lengths were determined twice (nonconsecutively) by two investigators (Invest 1 and Invest 2). Leg lengths were determined as the vertical distance from the most proximal point of the head of the femur to the proximal aspect of the medial malleolus of the tibia following view enlargements of the legs on the DXA analyses computer screen. Group mean differences, explained variance, and calculation of the 95% confidence intervals were determined and results are expressed as mean ± SE, and significance $p < 0.05$.

RESULTS: Intratester reliability for Invest 1 right leg length (66.48 ± 1.01 versus 66.49 ± 1.02 cm; $r^2 = 0.999$) and left leg (66.64 ± 1.00 versus 66.60 ± 1.01 cm; $r^2 = 0.998$); and for Invest 2 right leg length (66.25 ± 1.01 versus 66.26 ± 1.00 cm; $r^2 = 0.999$) and left leg (66.43 ± 1.00 versus 66.47 ± 1.00 cm; $r^2 = 0.999$) resulted in no significant group mean differences, and significant explained variance. Subsequently, the group mean of the right and the left leg lengths were used for both Invest 1 and Invest 2 to determine the intertester reliability. Similarly, no significant group mean differences and significant explained variance were found for the right leg length (66.49 ± 1.02 versus 66.26 ± 1.00 cm; $r^2 = 0.988$) and the left leg (66.62 ± 1.00 versus 66.45 ± 1.00 cm; $r^2 = 0.973$). Bland Altman plotting resulted in mean differences of 0.23 cm and 0.17 cm; with the 95% confidence intervals ranging from 2.55 to -2.08 cm and 2.60 to -2.26 cm for the right and left legs, respectively. **CONCLUSION:** Leg lengths measured from total body DXA scans provide highly reliable measures and may provide greater accuracy than traditional measures using anthropometric tapes due to the elimination of soft tissue.

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Bone Density Is Lower And Differentially Related To Body Composition In Adults Using ADHD Medications

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Stimulant medications, such as amphetamines, lead to increased activation of osteoclast-mediated bone resorption resulting in decreased bone mass and are first-line medications for Attention-Deficit Hyperactivity Disorder (ADHD). **PURPOSE:** To determine the effect of stimulants on bone mineral density (BMD) and body composition in young adults with ADHD. **METHODS:** Stimulant (methylphenidate or amphetamine) users (ADHD; 14 male, 11 female) and 28 healthy controls (CON; 17 male, 11 female) participated (N=53, 19-27 years of age). Physical activity (PA) was measured with Bone-Specific Physical Activity Questionnaire. Whole body (WB) bone mineral content (BMC), BMD z-scores (to adjust for gender, race, body weight, and age) of the lumbar spine (L1-L4), total hip, and femoral neck, body composition, and relative skeletal mass index (RSMI) were measured by dual X-ray absorptiometry. Independent sample t-tests, multiple regression, and step-wise regression were used to analyze the data. **RESULTS:** Independent sample t-test showed no differences in age, percent body fat, or RSMI between the groups. In the ADHD group, PA was lower compared to CON (-15.9, $p = .003$). WB BMC was lower in ADHD vs. CON (-304.5 g, $p = .02$); and, BMD z-scores of WB ($z = -0.9$, $p = .01$) and lumbar spine ($z = -0.77$, $p = .04$) were lower in ADHD than CON with no differences in total hip and femoral neck. Linear regression analysis showed group and RSMI were independently related to WB BMD z-scores ($r = -0.68$, $p = .05$; $r = 0.33$, $p = .005$, respectively); PA was not related to WB BMD z-score ($r = 0.003$, $p = .75$). The WB BMD z-score was $z = 0.68$ lower in the ADHD group than the control group. When controlling for PA, sex, age, height, and weight, stepwise regression analyses showed that: In ADHD, lean mass was not related to BMD at any of the sites ($p > .05$), but fat mass was negatively related to hip ($r = -.58$, $p = .006$), neck ($r = -.72$, $p < .001$), and WB BMC ($r = -.76$, $p < .001$). In CON, lean mass was positively related to spine and hip BMD ($r = .45$, $p = .03$; $r = .45$, $p = .03$, respectively) and WB BMC ($r = .56$, $p = .004$); fat mass was negatively related to hip BMD ($r = -.43$, $p = .04$) and WB BMC ($r = -.56$, $p = .004$). **CONCLUSIONS:** Lower indices of bone health in the ADHD group and the differential relationship between muscle mass and bone density in ADHD vs. CON may be due to adverse metabolic effects of stimulant medication.

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Effect Of High Intensity Intermittent Exercise On Blood Ionized Calcium And Serum Parathyroid Hormone

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 (No relevant relationships reported)

Purpose: Increased serum parathyroid hormone concentration (PTH) during moderate-intensity exercise has been reported, suggesting that such exercise may stimulate bone resorption. On the other hand, certain data also suggest that supramaximal intensity exercise causes neither a decrease in serum calcium nor increase in PTH. This study was undertaken to observe the effects of high intensity intermittent exercise (HIIE), which improves both aerobic and anaerobic fitness maximally, on bone metabolism. **Method:** Seven young subjects exercised on two days after an overnight fast. On the HIIE day, subjects performed 6-7 exhaustive 20-sec cycling bouts (170% VO_{2max}) with intervening 10-sec rest intervals. On the moderate-intensity exercise (MIE) day, subjects cycled for 60 min at 70% VO_{2max} . Blood was sampled before and after 10 min of warm-up at 50% VO_{2max} , and immediately after and 10, 20, 30, 60, 90 min after the HIIE. For MIE day, blood was obtained before, immediately after, and 10, 30, 60, 90 min after the exercise. **Result:** HIIE induced an increase in iCa (Pre: 1.13 ± 0.06 mmol/l, post: 1.22 ± 0.03 mmol/l, $p < 0.001$) and a decrease in PTH (Pre: 30 ± 5 pg/ml, 10 min after HIIE: 22 ± 45 pg/ml, $p < 0.05$), while MIE significantly elevated serum PTH without a change in iCa. No changes in serum C-terminal telopeptide of Type I collagen (marker of bone resorption) or osteocalcin (marker of bone formation) were observed up to 90 min after HIIE and MIE. **Conclusion:** It is concluded that HIIE does not induce a decrease in blood iCa or increase in PTH, suggesting that HIIE might not deteriorate bone metabolism.

328 Board #144 May 27 10:30 AM - 12:00 PM
Effect Of Running And Swimming On Bone Mineral Density Throughout The Lifespan

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PURPOSE: Bone mineral density (BMD) is used as an indirect indicator of risk of osteoporosis and bone fracture. Both swimming and running have been found to have a positive effect on bone mineral density. A comparison of the effects of swimming and running on bone mineral density in humans has not yet been performed. The purpose of this study was to compare the effects of running and swimming on bone mineral density in young individuals versus mature individuals and to compare intrinsic variables of body weight, height, gender, years swimming or running, distance ran or swam per week, and hours of physical activity per week.

METHODS: This was a quantitative, correlational study that sought to determine whether statistically significant differences in bone mineral density exist between swimmers and runners across the lifespan. Heel bone mineral density of each participant was assessed using the GE Achilles Ultrasonometer.

SUMMARY OF RESULTS: This study included 54 total participants with 12 runners under age 30, 18 runners over age 30, 11 swimmers under age 30, and 13 swimmers over age 30. No statistically significant difference in bone mineral density existed between swimmers and runners in the young adult or mature adult groups ($P = 0.618$). Athlete weight was the only factor that had statistically significant differences in bone mineral density. The results do not indicate that the mode of activity (swimming/running) correlates with significantly different findings in BMD.

CONCLUSION: No correlation between mode of activity and bone mineral density can be established at this time. The degree of causality cannot be determined due to the study's correlational nature. The results demonstrate that swimming and running have similar effects on bone density. Athlete weight had statistically significant differences in bone mineral density. This indicates that the overall body weight plays a larger role in the formation/maintenance of bone mineral density than activity selection did in this study.

329 Board #145 May 27 10:30 AM - 12:00 PM
Association Between Dietary Cholesterol, Saturated Fat And Bone By Calcium Intake Levels.

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 (No relevant relationships reported)

The role of diet in bone health has been widely researched. Numerous studies have concluded that dietary calcium is important for the development of healthy bone but the relationship between cholesterol and saturated fat, which may hint at the role of animal protein in bone health, has drawn less attention among researchers.

PURPOSE: The purpose of this study was to determine the association between dietary cholesterol and saturated fat intake, and bone mineral density (BMD) among women based on calcium intake levels. **METHODS:** A total of 41 women (38.90 \pm 7.92 years) were included in this study. Anthropometric data were collected and BMD (g/cm^2) was measured at the hips, femoral, neck, and lumbar spine with a Hologic dual energy x-ray absorptiometry machine. Dietary intake was assessed using a 3-day food diary. Participants were divided into two calcium intake groups based on average daily calcium intake: calcium sufficient group (calcium intake $\geq 75\%$ of the recommended intake) and a calcium deficient group (calcium intake $< 75\%$ of the recommended intake). **RESULTS:** Among the calcium sufficient group, a significant positive correlation ($p < .05$) was found between lumbar spine BMD and dietary cholesterol intake ($r = .41$, $p = .020$) even after controlling for dietary protein intake ($r = .41$, $p = .024$). A significant positive correlation was found between femoral neck BMD and saturated fat intake ($r = .37$, $p = .038$) but this association disappeared after controlling for protein intake. No significant correlations were found among the calcium deficient group. Among the calcium sufficient group, regression analysis indicated that dietary cholesterol was a significant predictor of lumbar spine BMD only $F(1,30) = 6.02$, $MSE = .03$, $p = .020$, $Adj. R^2 = .14$. **CONCLUSIONS:** Among a group of calcium deficient women, it appears that other nutrients are not associated with BMD. For women who are receiving an adequate amount of calcium, cholesterol and saturated fat intake are both associated with higher BMD. Of particular interest was the positive correlation between dietary cholesterol and lumbar spine BMD even after controlling for protein intake which might indicate the importance of animal sources of protein for bone health. Future research should examine the role of animal protein compared to non-animal protein on BMD. IRB# 1213-0223

330 Board #146 May 27 10:30 AM - 12:00 PM

Association Among Percent Body Fat, Areal Bone Mineral Density, And Handgrip Strength In Young AdultsSoJung Kim¹, Harshvardhan Singh², Eliana Casamassima¹.¹University of Massachusetts Lowell, MA. ²University of Alabama, Birmingham, AL.

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(No relevant relationships reported)

PURPOSE: The purpose of this cross-sectional study was to examine the relationships among percent body fat (%BF), areal bone mineral density (aBMD) and non-dominant handgrip strength in healthy college-aged students. **METHODS:** Healthy college-aged women (n=73, 20.4±1.3 years; 163.5±7.1 cm; 64.7±11.3 kg) and men (n=59, 21.1±1.4 years; 177.4±7.7 cm; 77.7±10.6 kg) between the ages of 18 and 25 years were recruited from the University of Massachusetts Lowell. Body composition (%BF) and aBMD of the non-dominant side of femur (FN: femoral neck, TH: total hip) and lumbar spine (L1-L4) were measured by dual energy X-ray absorptiometry. Isometric handgrip test was measured by JAMAR Dynamometer, and the average of three trials of the non-dominant side was used for data analysis. The total bone-specific physical activity (tBPAQ, average of past and current BPAQ) score was used to obtain a comprehensive account of lifetime physical activity related to bone health. **RESULTS:** Partial correlation tests showed significantly negative relationships between %BF and aBMD of the non-dominant FN ($r_{\text{partial}} = -.387, p=.002$), TH ($r_{\text{partial}} = -.458, p=.0001$), and lumbar spine ($r_{\text{partial}} = -.299, p=.034$) in young women, while controlling for tBPAQ and BMI. Similarly, FN ($r_{\text{partial}} = -.453, p=.001$), TH ($r_{\text{partial}} = -.425, p=.001$), and lumbar spine ($r_{\text{partial}} = -.291, p=.034$) were found in young men. In addition, higher %BF had a negative impact on isotonic hand grip strength in both women ($r_{\text{partial}} = -.446, p=.0001$) and men ($r_{\text{partial}} = -.410, p=.002$), respectively. **CONCLUSIONS:** Our data suggests that regardless of BMI and physical activity, %BF can adversely affect musculoskeletal health in young adults. These results have important implications for prevention of future loss of aBMD in young adults, individuals who may be overweight or obese, and individuals undergoing weight loss.

331 Board #147 May 27 10:30 AM - 12:00 PM

Prior Tobacco Use Is Associated With Tibial Microarchitecture In U.S. Army Recruits: A Preliminary AnalysisColleen M. Castellani, Theresa N. Faller, Katelyn I. Guerriere, Julie M. Hughes, Stephen A. Foulis, Kathryn M. Taylor. *Military Performance Division, United States Army Research Institute of Environmental Medicine, Natick, MA.*

(No relevant relationships reported)

Tobacco use is common and is associated with less favorable bone properties in older adults at risk for osteoporosis. Baseline bone properties are related to stress fracture risk in military populations. Whether a history of tobacco use is associated with less favorable bone microarchitectural properties in military recruits is unknown.

PURPOSE: To examine the influence of prior tobacco use on bone microarchitecture using data from a large prospective field study (789 men and women from a larger planned cohort of 4000 U.S. Army recruits). **METHODS:** We collected high-resolution peripheral quantitative computed tomography images of the ultradistal tibia at the 4% site during the first week of basic combat training (BCT) from 556 male and 233 female recruits. Also, self-reported history of tobacco use was assessed via questionnaire. Generalized linear models stratified by sex were used to evaluate the relationship between a history of tobacco use and baseline bone microarchitecture. Models were further stratified by tobacco type. All models were adjusted for prior physical activity, recruit and parents' level of education, race/ethnicity, age, and body mass index (BMI). **RESULTS:** 21.29% of recruits reported prior tobacco use. Tobacco users were more likely to be male (25.5%, $p<.0001$) and white (26.8%, $p=.0007$). There were no differences in tobacco use by socioeconomic status, prior physical activity, or BMI. At the ultradistal tibia, tobacco use in female recruits was associated with lower indices of cortical thickness and cortical area, with decrements ranging from -2.53% to -10.46% depending on the method of tobacco consumption (all $p<.05$). In male recruits, use of tobacco pipe was associated with a 17.39% lower cortical thickness ($p=.026$). There were no significant differences reported in trabecular bone parameters associated with prior tobacco use in male or female recruits. **CONCLUSIONS:** These data show that recruits, particularly female recruits, with a history of tobacco use may enter BCT with some less favorable microarchitectural properties, potentially placing them at greater risk for stress fracture, although this remains to be determined.

A-44 Free Communication/Poster - Disability

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM

Room: CC-Exhibit Hall

332 Board #148 May 27 10:30 AM - 12:00 PM

Effects Of Testosterone And Resistance Training On Protein Expression And Mitochondrial Functions Following Spinal Cord InjuryAshraf S. Gorgey, FACSM¹, Zachary A. Graham², RobertA. Adler¹, Edward J. Lesnfsky¹, Christopher P. Cardozo³.¹Hunter Holmes McGuire VA Medical Center, Richmond, VA.²Birmingham VA Medical Center/ University of Alabama,Birmingham, AL. ³James J. Peters VA Medical Center/ Icahn

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(No relevant relationships reported)

The signaling pathway responsible for muscle hypertrophy following testosterone replacement therapy (TRT) and resistance training (RT) has not been elucidated after spinal cord injury (SCI). Furthermore, it is unclear whether evoking muscle hypertrophy improves mitochondrial citrate synthase activity (CS) and Complex III (CIII) activities after SCI. **PURPOSE:** To examine the effects of TRT+RT compared to TRT only on protein expression of markers associated with muscle hypertrophy, substrate utilization and mitochondrial biogenesis in men with SCI. **METHODS:** Twenty-two men with motor complete SCI were randomized to 16 weeks of TRT+RT or TRT only. Evoked progressive RT using neuromuscular electrical stimulation (2 lb. increments) was administered twice weekly. TRT patches (2-6 mg/day) were applied at bedtime. Muscle biopsies were captured before and after 16 weeks from the right vastus lateralis. Protein expression of markers associated with muscle hypertrophy were evaluated [FAK, total and phosphorylated Akt, total and phosphorylated mTOR] and substrate utilization and mitochondrial biogenesis [GLUT4, PGC1 α , total and phosphorylated AMPK]. Mitochondrial CS and CIII activity were also measured. **RESULTS:** TRT+RT demonstrated a 27.5% increase ($P=0.01$) in average fiber CSA compared to -9% decrease following TRT only. Circulating IGFBP-3 increased ($P=0.0001$) in both TRT+RT (1764±665 to 2548.5±853 ng/ml) and TRT (1918.5±587 to 2778±967 ng/ml). GLUT4 was elevated in the TRT+RT group compared to the TRT only ($P=0.005$). Total Akt ($P=0.06$) and phosphorylated Akt^{Ser389} ($P=0.049$) were also elevated in the TRT+RT group. Mitochondrial CS (34% $P=0.006$) increased in the TRT+RT group. **CONCLUSION:** Sixteen weeks of TRT+RT resulted in hypertrophy of myofibers that was associated with increased protein expression and markers of activation of Akt. This was further associated with elevations in GLUT4 protein expression and markers of mitochondrial function in persons with SCI.

333 Board #149 May 27 10:30 AM - 12:00 PM

Trabecular Bone Quality In Spinal Cord Injury Following Open Chain Resistance Training And Testosterone ReplacementMatthew E. Holman¹, Adam P. Sima², Gregory Chang³, RobertA. Adler¹, Ashraf S. Gorgey, FACSM¹. ¹Hunter Holmes McGuireVA Medical Center, Richmond, VA. ²Virginia CommonwealthUniversity, Richmond, VA. ³NYU Langone Health, New York, NY.

(Sponsor: Ashraf Gorgey, FACSM)

(No relevant relationships reported)

Spinal cord injury (SCI) adversely affects testosterone levels and bone quality. Resistance training (RT) and testosterone replacement therapy (TRT) have been shown to improve muscle quality in humans following SCI. Such improvements to muscle quality may also result in improved bone quality. **PURPOSE:** To examine if combining open kinetic chain RT and TRT (TRT+RT) can be beneficial to trabecular bone quality following SCI. **METHODS:** Nine subjects with SCI were randomized into a TRT+RT group for a 16-week intervention. Each subject also underwent magnetic resonance imaging (MRI) prior to (BL) and following the intervention (PI). MRI microarchitecture techniques were used to evaluate trabecular bone quality, measured as plate width (PW; μm), trabecular bone thickness (TBTh; mm), trabecular bone spacing (TBSp; mm), and network area (NA; $1/\text{mm}$) for the right proximal tibia (ProxT) and distal femur (DistF). Mixed models with random effects were used to calculate differences between BL and PI (MD \pm SE) and were then transformed to effect sizes similar to Cohen's d (d, 95% CI [effect size]). **RESULTS:** Following the intervention, ProxT PW (MD: 30.56 \pm 22.52; d: 0.48, -0.21 to 1.17 [small]), TBTh (MD: 0.02 \pm 0.01; d: 0.70, 0.01 to 1.39 [medium]), and NA (MD: 0.04 \pm 0.02; d: 0.64, -0.05 to 1.33 [medium]) all increased from BL measures. In contrast, TBSp (MD: -0.25 \pm 0.17; d: -0.52, -1.22 to 0.17 [medium]) decreased from BL. The DistF similarly presented with increases in bone quality from BL for PW (MD: 11.7 \pm 42.70; d: 0.10, -0.60 to 0.79 [negligible]), TBTh (MD: 0.01 \pm 0.01; d: 0.29, -0.41 to 0.98 [negligible]), and NA (MD: 0.03 \pm 0.03; d: 0.39, -0.30 to 1.08 [small]), as well as decreases in TBSp

(MD: -0.22 ± 0.16 ; d: $-0.47, -1.16$ to 0.23 [small]). **CONCLUSIONS:** When combined with TRT, the mechanical stresses induced via open kinetic chain RT displays the potential to improve trabecular bone quality following a longer duration intervention. This was particularly evident within the ProxT as these effect sizes were comparably larger than the DistF. Such differences are likely due to the tissue stress induced on the ProxT through contractions of the quadriceps muscles. Supported by VA-RRD CDA2 (B7867-W).

334 Board #150 May 27 10:30 AM - 12:00 PM

Hypermobility Characterization In Participants With Down Syndrome Attending An Instructor Led Controlled Adaptive Exercise Setting

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Introduction/Background: Joint hypermobility (JHM) and hypotonia are features shown in people with Down Syndrome (DS). Adaptive Exercise Programs adapt not only to the physical but also to behavioral and intellectual challenges. This study characterized JHM and related measures in a sample of adults with DS attending an adaptive exercise program. **Methods:** Thirteen adults with DS (11 males and 2 females, 28.5 ± 3.2 y height: 138.6 ± 45.8 cm, body mass = 78.22 ± 15.03 kg) participated. Participants attended adaptive exercise programming twice a week for ≥ 9 months. Tests included active range of motion (AROM) measured three times (median score reported), JHM was determined through the 9-point Beighton scale, upper body (hand-grip dynamometer) and lower body (30-second sit-to-stand) strength. **Results:** Means \pm SD for AROM included: shoulder extension = $21.3 \pm 8.9^\circ$, shoulder flexion = $179.0 \pm 9.7^\circ$, shoulder abduction = $174.9 \pm 8^\circ$, shoulder medial rotation = $59.2 \pm 13.2^\circ$, shoulder lateral rotation = $86.1 \pm 11.6^\circ$, hip extension = $14.3 \pm 5.8^\circ$, hip flexion = $94.0 \pm 13.6^\circ$, hip abduction = $27.8 \pm 8.4^\circ$, hip adduction = $17.1 \pm 4.5^\circ$, hip medial rotation = $31.5 \pm 6.3^\circ$, hip lateral rotation = $31.9 \pm 5.6^\circ$, ankle dorsiflexion = $16.6 \pm 8.2^\circ$, ankle plantarflexion = $44.9 \pm 8.2^\circ$, subtalar inversion = $25.9 \pm 6.0^\circ$, and subtalar eversion = $19.2 \pm 9.6^\circ$. Participants presented with: no JHM 38.4% (n=5) and with JHM 60.14% (n=8). Strength was 26.4 ± 6 kg and the sit-to-stand included 20 ± 6 movements. There were not significant correlations between JHM and muscle strength ($r = -0.338, p = .259$) or physical function ($r = -0.085, p = .220$). **Discussion/Conclusion:** Adults with DS that participated in an instructor-led adaptive exercise setting showed lower AROM compared to norms in adults without DS, potentially because of persistent hypotonia. Despite the sizable incidence of JHM, JHM was more prominent in hands (50% of 8). Participants showed comparable upper-body strength but higher lower body strength than shown in DS. The program focused on strengthening large muscle groups with less emphasis on wrist or hand muscles which can potentially explain why only 1/3 of participants presented with the overall JHM and good lower body strength. Future studies should evaluate changes in JHM, AROM and muscle strength in response to adaptive exercise training in DS.

335 Board #151 May 27 10:30 AM - 12:00 PM

Lean Mass Changes After 10-week Resistance Training Intervention In Adults With Down Syndrome

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PURPOSE: To examine changes in body composition (i.e. lean mass) after a 10-week resistance training intervention in individuals with Down syndrome. **METHODS:** Data was collected on willing 18 - 40-year-old moderately active men and women with Down syndrome (age 24.4 ± 6.3 years, height 149.2 ± 11.2 cm, weight 72.02 ± 24.5 kg). Twelve participants completed 24 resistance training sessions (duration 45-60 minutes per session). Dual x-ray absorptiometry (DXA) was used to assess body composition both pre- and post-intervention (i.e. body fat, lean tissue mass, fat tissue, bone density). A nonlinear periodized resistance exercise program was implemented; made of light, moderate, and heavy resistances. The participants began the first two weeks of the intervention with exercises using light 12-15 RM Zone repetitions and moderate 8-10 RM Zone progressing from 1-3 sets over the two-week period of time. After that flexible period, using light, moderate, and heavy (4-6 RM zone) for 3 sets were rotated with toleration of the work out noted each training session. The resistance training intervention utilized a body part bodybuilding training program 3 days per week (consisting of 1 upper body, 1 lower body, 1 full body exercises). The exercises consisted of body weight exercises, machine based, resistance bands, and free weight exercises. Each program was individualized per participant regarding specific exercises based off of movement kinetics, understanding, skill, and strength

levels. Participants were kept in a light to moderate intensity heart rate range via heart range chest monitoring straps. **RESULTS:** There was no significant difference between pre- and post-intervention for overall body mass ($p = 0.23$), body fat ($p = 0.75$), or bone mineral density ($p = 0.078$). However, there was a significant increase between pre- and post-intervention in lean mass ($p = 0.033$). **CONCLUSIONS:** A 10-week moderate resistance training intervention is a great enough stimulus to significantly increase lean muscle tissue in adults with Down syndrome. Therefore, implementing resistance training into an individual's weekly routine for adults with Down syndrome is a viable option to increase lean muscle mass, which could also increase potential strength and motor skill, then increasing overall quality of life.

336 Board #152 May 27 10:30 AM - 12:00 PM

Alterations In Musculoskeletal Function And Body Composition In Children With Autism Spectrum Disorder

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(No relevant relationships reported)

Autism Spectrum Disorder (ASD) is a neurological disorder characterized by impaired social interaction and atypical behaviors. Children with ASD appear to have weaker muscular function and low bone mineral density. Recent studies have indicated that adolescents with ASD develop obesity and bone fracture incidence at a higher rate compared to typically developing peers (TDC). Limited information is available to identify levels of obesity and its relation to muscular function and body composition in children with ASD before they start puberty.

PURPOSE: To determine whether differential body composition may affect muscular strength and function in children with ASD

METHODS: Total of 40 adults, TDC and children with ASD participated in the study. Muscular strength (i.e., torque, work, and power) during knee extension and flexion was measured at 90, 150, and 210 $^\circ$ /sec in the lower extremity using Humac Norm Isokinetic Dynamometer. Maximal isometric forearm muscular strength was measured using a handgrip dynamometer. Body mass index (BMI), waist-to-hip ratio, and whole-body scan from Dual Energy X-Ray Absorptiometry were used to identify the body composition.

RESULTS: Compared to control adults, TDC and ASD had lower BMI (20.1 ± 0.7 TDC, 22.3 ± 4.4 ASD vs. 27.2 ± 2.3 Adults, kg/m^2). All groups had similar percent body fat (26.4 ± 2.3 Adults, 29.8 ± 1.83 TDC, 32.9 ± 3.84 ASD, %) and percent lean body mass (69.5 ± 2.2 Adults, 66.8 ± 1.7 TDC, 64.4 ± 3.6 ASD, %). However, compared to TDC, ASD children had significantly lower bone mass percentage (2.7 ± 0.3 ASD vs. 3.2 ± 0.2 TDC, %). Waist-to-hip ratio was significantly higher for ASD (0.91 ± 0.04 ASD vs. 0.85 ± 0.01 TDC). The maximal forearm and leg strength were significantly lower in ASD compared to TDC normalized for their body weight (30.2 ± 5.2 ASD vs. 42.8 ± 2.5 TDC, kg). There is a significant inverse relationship with muscular strength and regional percent fat in the forearm.

CONCLUSION: These findings suggest that body composition appeared to influence muscular strength in children with ASD. Less regional fat and higher bone mass rather than the total body fat may contribute for higher leg or forearm muscular strength in children with ASD.

Supported by CASA RSCA Infusion, Central RSCA, and Undergraduate Research Grant, SJSU

337 Board #153 May 27 10:30 AM - 12:00 PM

Acute Effects Of Photobiomodulation Therapy On Muscle Force Recovery In Persons With Multiple Sclerosis

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Symptomatic fatigue, as well as muscle fatigue, are common in persons with multiple sclerosis (PwMS), and both can negatively affect quality of life (QOL). Photobiomodulation Therapy (PBMT), comprising light in a 600-1000 nm bandwidth, is an emerging therapeutic modality thought to enhance mitochondrial function. There is evidence that PBMT can improve muscle fatigue, inflammation, and psychological status and thus might be beneficial for PwMS.

PURPOSE: To investigate PBMT on muscle force recovery after a fatiguing contraction in PwMS. A secondary aim was to determine if self-reported symptom outcomes influenced the response to PBMT.

METHODS: Randomized double-blinded repeated-measures design. Ambulatory males and females (n=17, 14 females) with relapsing-remitting MS were evaluated pre- and post-PBMT in 4 visits over 4 weeks. The muscle function measurements consisted of 3 maximal voluntary contractions (MVCs) of Tibialis Anterior (TA) muscle

followed by 2 min. of intermittent isometric contraction at 45% MVC. PBMT was then administered to the TA muscle belly at 1 of 4 energies: 40J, 80J, 120J or placebo (active device: 3 pulsed wavelengths at the same time including 640nm, 875nm, and 905nm, placebo device: single pulsed wavelength at 640 nm). After PBMT, recovery MVC's were obtained. Baseline psychosocial measurements comprising depression (CES-D), fatigue (MFIS) and QOL (PROMIS) were obtained during visit 1. McNemar's test was used to test for each light dose compared to placebo and Spearman's correlations were compared with Fisher's r to z transformation.

RESULTS: All subjects were able to recover strength to within 12% of their initial strength during the 120J visit. However, 6/17 subjects did not recover to the same degree after the placebo. This difference in force recovery between high (120J) dose and placebo was significant with $p=0.03$. Muscle recovery correlations with depression and QOL differed between 120J vs. Placebo (0.35 vs. -0.44, $p=0.03$ and -0.09 vs. 0.67, $p=0.03$, respectively).

CONCLUSIONS: PBMT at 120J may improve muscle force recovery in PwMS. Those reporting greater depression, or lower QOL may benefit most from PBMT. Supported by a pilot grant from the National MS Society

338 Board #154 May 27 10:30 AM - 12:00 PM
Effect Of Longterm Resistance Training On Bone Mineral Density, Muscular Strength, And Balance In Cerebral Palsy

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(No relevant relationships reported)

Cerebral Palsy (CP) is a non-progressive neurological disorder caused by lesions in the brain leading to musculoskeletal dysfunction and immobility. Physical deconditioning in individuals with CP appears to accelerate muscle atrophy and osteoporosis; thus, adults with CP are more prone to fall and fracture. Balance is also related to the higher risk of fall in the general public, and resistance training is known to improve bone mineral density (BMD), muscular strength, followed by balance. However, equivocal results were reported whether resistance training has a positive effect on BMD, muscular function and balance in CP population.

Purpose: To determine the influence of long-term resistance training to BMD, muscular strength, and balance in adults with CP who have muscle atrophy and/or osteoporosis.

Methods: 26 adults with and without CP were tested before and after resistance training twice a week for one year. Dual-energy X-ray absorptiometry was used to measure local BMD at the lumbar spine, proximal femur, and radial/ulnar regions. Muscular strength (torque, work, and power) from the lower extremity was assessed at 90, 150, and 210 °/sec using the Humac Norm Isokinetic Dynamometer. The handgrip dynamometer was used for maximal isometric contraction. Balance was measured from the Berg Balance Test, and limits of stability test using the Biodex Balance System.

Results: After one year of resistance training, the CP group showed a significant improvement in BMD compared to before training [BMD at femoral neck (0.63 ± 0.08 pre vs. 0.88 ± 0.04 post, g/cm^2); however, they did not show statistical differences in muscular strength [extensor peak torque (27 ± 9 pre vs. 32 ± 10 post, ft-lbs), flexor peak torque (13 ± 4 pre vs. 12 ± 5 post, ft-lbs)], or balance on limit of stability test [e.g. overall score (32 ± 7 pre vs. 31 ± 6 post)]. However, after training, CP participants who exhibited greater BMD appeared to develop greater muscular strength followed by improved balance.

Conclusion: These findings suggest that long-term resistance training significantly improved BMD in CP adults without a dramatic improvement in muscular strength or balance. In addition, BMD appeared to play a role in enhanced muscular strength and balance in adults with CP, specifically only those who significantly gained BMD after resistance training.

A-45 Free Communication/Poster - Imaging and Assessment in Skeletal Muscle, Bone, and Connective Tissue

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

339 Board #155 May 27 10:30 AM - 12:00 PM
Six Months' Rehabilitation Exercise Affects Lower And Higher Muscle Echo Intensity In Elderly Individuals

Akito Yoshiko¹, Takashi Kaji², Takayuki Sawazaki², Hiroshi Akima³. ¹Chukyo University, Toyota, Japan. ²Kajinoki Medical Clinic, Gifu, Japan. ³Nagoya University, Nagoya, Japan.

(Sponsor: Katsumi ASANO, FACSM)

(No relevant relationships reported)

Muscle echo intensity (EI) reflects the content of fat and connective tissue within a skeletal muscle. Muscle EI becomes higher with aging and/or inactivity caused by increase of fat and connective tissues, and eventually it may induce lower muscle strength. We have previously reported that the EI improved after a few months' resistance and endurance training in elderly individuals. This result would be led by decreasing of fat and connective tissues (i.e. decrease higher EI area) and/or increasing of contractive muscle tissue (i.e. increase lower EI area); however, it is not well understood how the muscle EI change by several months rehabilitation exercise.

PURPOSE: The purpose of this study was to investigate the effects of 6 months rehabilitation exercise on gradation-based muscle EI area in elderly men and women. **METHODS:** Five men and women (2 men and 3 women; age, 75 ± 5 years; height, 156 ± 4 cm; weight, 53 ± 9 kg) participated in this study. They performed rehabilitation exercises consisting of resistance exercises, stretching, and aerobic exercises once or twice a week for 6 months because they needed long-term care during a part of daily living. B-mode ultrasonographic transverse image was taken from rectus femoris.

To obtain EI, region of interest (ROI) was set on rectus femoris as large as possible exclude fascia. Average muscle EI, which was shown by 256 gray scale level, was measured within a ROI. We also calculated cross-sectional area based on 256 grey scale level divided into 6 different components (e.g. 0-49, 50-99, 100-149, 150-199, 200-249 and 250-256 a.u.). **RESULTS:** Average EI decreased after six months exercise (72.70 ± 7.55 vs. 53.50 ± 15.51 a.u., $p < 0.05$). Lower ranged EI area was significantly increased after the exercise (0-49; 1.13 ± 0.88 vs. 1.93 ± 1.00 cm², $p < 0.05$). Middle to higher ranged EI areas were significantly decreased after the exercise (100-149; 0.44 ± 0.20 vs. 0.24 ± 0.15 cm², 150-199; 0.08 ± 0.05 vs. 0.03 ± 0.04 cm², $p < 0.05$).

CONCLUSIONS: Six months rehabilitation exercise improved muscle EI in elderly men and women. This result might be induced by decreasing fat and connective tissues and increasing contractile muscle tissue.

340 Board #156 May 27 10:30 AM - 12:00 PM
A Single-site, Retrospective Review Of Clinical Complications From Ultrasound-guided Tendon Scraping Procedures

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(No relevant relationships reported)

Purpose: To evaluate the safety of ultrasound-guided tendon scraping procedures performed at a single center. **Methods:** This was a single center, retrospective chart review. Following Institutional Review Board approval, all tendon scraping procedures performed by three investigators (JTF, JLS, JS) from January 1, 2011 to September 1, 2018 were identified using the physicians' procedure logs and by searching the electronic medical record with the term "tendon scraping." Patient charts were reviewed to search for procedural complications and comorbidities. **Results:** Fifty-eight tendon scraping procedures performed on 48 people were included in the study. The average age and body mass index were 44.5 (17 to 69) and 28.15 kg/m² (22.33 to 45.36 kg/m²), respectively. There were 29 (60%) males and 19 (40%) females. No complications were reported in the 51 (88%) procedures with follow-up. Procedure location included 25 (43%) patellar tendons, 16 (28%) mid-portion Achilles-tendons, 14 (24%) insertional-Achilles-tendons, and 3 (5%) elbow common extensor tendons. Thirty (52%) procedures were performed on the right and 28 (48%) on the left. Seven (12%) procedures were performed using sterile gloves, sterile ultrasound gel, and sterile ultrasound transducer cover, while 51 (88%) were performed using the same plus a gown, cap, and mask. Comorbidities included hypertension (9 [19%]), hyperlipidemia (7 [15%]), unknown (5 [10%]), hypothyroidism (4 [8%]), migraines (4 [8%]), depression (3 [6%]), anxiety (2 [4%]), fibromyalgia (2 [4%]), obstructive sleep apnea (2 [4%]), tobacco use (1 [2%]), diabetes mellitus (1 [2%]), chronic obstructive pulmonary disease (1 [2%]), non-alcoholic steatohepatitis (1 [2%]), coronary artery disease (1 [2%]), peripheral neuropathy (1 [2%]), undifferentiated connective tissue

disorder (1 [2%]), Sjogren's syndrome (1 [2%]), hyperparathyroidism (1 [2%]), and HIV (1 [2%]). **Conclusion:** This study suggests that tendon scraping is a safe procedure. While we were unable to perform a sub-analysis to determine if there was an association between comorbid factors and increased complication rates, there were no complications reported in this study despite the presence of multiple comorbidities.

341 Board #157 May 27 10:30 AM - 12:00 PM
Does Muscle Architecture Affect Strength In Patients With Multiple Sclerosis?

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 (No relevant relationships reported)

The alignment of the muscle fibers has a significant effect on the strength and function. A number of studies have suggested that the properties of muscle architecture are related to muscle strength in many pathological condition. However, there is no study describing the relationship between muscle strength and muscle architecture in multiple sclerosis (MS) patients. **PURPOSE:** To determine the muscle architecture (pennation angle, muscle fiber length and muscle thickness) of the lower extremity muscles in MS patients and to compare with healthy peers. **METHODS:** Fifteen patients with MS and 10 age and sex matched 10 matches healthy volunteers included in the study. Muscle thickness and pennation angle of the rectus femoris (RF), biceps femoris (BF), tibialis anterior (TA), gastro-soleus (GS) and gastrocnemius (GC) muscles were assessed by B-mode ultrasonography. The fascicle length was calculated with pennation angle and muscle thickness values. Muscle strength was assessed with using digital hand-held dynamometer. **RESULTS:** Pennation angles of RF, BF, TA were lower in MS patients (respectively, $p=0,042$, $p=0,023$, $p=0,002$). There was no difference in fiber length of all muscles. Only in rectus femoris, thickness was lower than control group ($p=0,015$). Moreover, there was a positive correlation between rectus femoris muscle thickness and knee extensor muscle strength ($p=0,014$, $r=0,744$). **CONCLUSIONS:** We found that the muscle architecture was affected in MS patients. Determining the muscle architecture alterations in patients with MS may provide building novel and efficient loading models in related muscles.

342 Board #158 May 27 10:30 AM - 12:00 PM
Measurement Of Muscle Thickness In The Forearms Of Rock Climbers Using Ultrasound

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 (No relevant relationships reported)

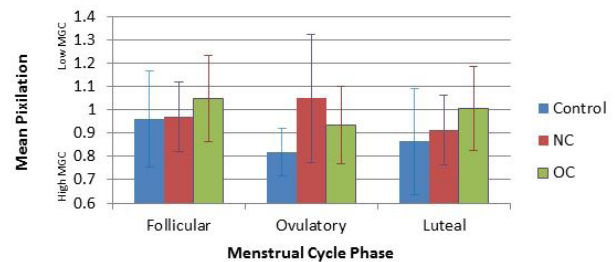
The flexor muscles of the forearm are repeatedly found to be the rate limiting factor in performance for rock climbers. Previous studies have shown that cross sectional area (CSA) measurements via Magnetic Resonance Imaging (MRI) have a strong correlation to ultrasound measured muscle thickness (MT) in the forearm flexors. However, few studies have employed this relatively low-cost alternative to MRI to assessing forearm muscles of rock climbers. **PURPOSE:** To compare differences in MT of the finger flexors in the forearms of early-stage rock climbers and non-rock climbers using ultrasound. **METHODS:** The study consisted of 22 climbers (22.23 ± 3.01 year; 68% male) and 11 controls (21.91 ± 1.97 ; 55% male). Body fat percentage and BMI were measured in all participants. An image of the thickest portion of the forearm, from the ulna and radius to the muscle-skin interface, was captured with ultrasound, and MT was measured using Image J. Independent samples t-tests were conducted to compare MT over the ulna and radius between climbers and controls. **RESULTS:** Climbers had an average of 2.44 ± 1.24 years of experience, and had lower body fat percentages (19.14 ± 6.99) than controls (30.02 ± 7.6) ($p < .001$). BMI was similar for climbers and controls at 21.77 ± 3.23 and $22.62 \pm 22.62 \text{ kg/m}^2$, respectively. Both ulnar and radial MT values were significantly higher in climbers, $4.23 \pm .39 \text{ cm}$ and $2.32 \pm .39 \text{ cm}$ ($p < .001$) respectively, and $3.61 \pm .6 \text{ cm}$ and $1.84 \pm .31 \text{ cm}$ in controls ($p < .001$). **CONCLUSION:** Despite a relatively low average climbing experience rock climbers had larger MT values than controls. The present study demonstrated that ultrasound can be used to detect differences in flexor MT in rock climbers compared to controls. Future studies should examine longitudinal changes in MT in climbers as they progress in training.

343 Board #159 May 27 10:30 AM - 12:00 PM
Assessment Of Changes In Muscle Glycogen Content Across The Menstrual Cycle

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 (No relevant relationships reported)

Muscle glycogen content (MGC) has the potential to impact exercise performance and has implications for timing of exercise testing & prescription. Previously difficult to assess, MGC can now be estimated non-invasively using ultrasound imaging. **PURPOSE:** The aim of this study was to compare changes in muscle glycogen scores across the menstrual cycle using ultrasound imaging. **METHODS:** Twenty-eight subjects (10 male; 18 female) ages 18-30 (24.0 ± 2.78) participated in this study. Subjects were divided into Control (CON; 10 male), Non-Contraceptive (NC; 8 Female), and Oral-Contraceptive (OC; 10 Female) groups. Measurements at 22, 56, & 73% of the thigh were taken on the vastus medialis, vastus lateralis, & rectus femoris of the dominant leg using ultrasound. Subjects were measured at the follicular, ovulatory & luteal phases of the menstrual cycle. Using ImageJ, muscle pixelation values were determined by capturing a $25 \times 8 \text{ mm}$ section of the muscle directly below the superficial aponeurosis. The mean of three images from each site were taken and adjusted for gain setting to calculate a total leg MGC score. A higher pixelation value corresponds to a lower MGC score and vice versa. A repeated-measures ANOVA (group X time) with post-hoc comparisons was performed to assess differences across groups and visits. **RESULTS:** No significant differences in MGC were observed between visits or groups (all $p > .05$). The CON (0.96 ± 0.21 , 0.82 ± 0.10 ; 0.86 ± 0.23) and the OC (1.05 ± 0.17 ; 0.94 ± 0.17 ; 1.01 ± 0.18) groups showed a tendency to increase MGC during the ovulatory visit but for the NC group (0.97 ± 0.15 ; 1.05 ± 0.27 ; 0.91 ± 0.15) to decrease (Figure 1). **CONCLUSIONS:** While there were no significant effects found, there was a trend for the MGC of the CON and the OC groups to increase during the ovulatory visit but for the NC to decrease. Further research is needed to fully understand the implications of these changes during the menstrual cycle and how it relates to exercise performance.

Figure 1 - Muscle Glycogen Content Across the Menstrual Cycle



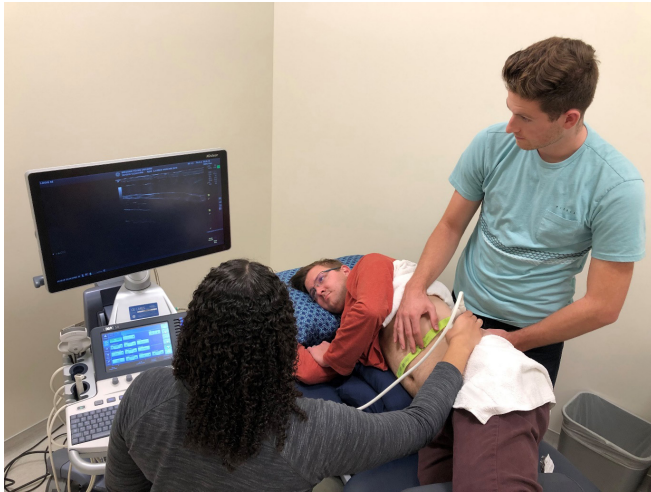
344 Board #160 May 27 10:30 AM - 12:00 PM
Reliability Of Ultrasound Panoramic Imaging Of Muscle Size For The Transversus Abdominis

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 (No relevant relationships reported)

PURPOSE: The transversus abdominis (TrA) is a key muscle in core stability. Measurements of its morphology might shed some light on structure, function and pathology of core muscles. A new ultrasound technique, panoramic imaging, could be used to visualize the whole length of the muscle in one image. The purpose of this study is to assess the degree to which this technique produces stable and consistent results. **METHODS:** 6 female participants; age(years) = 21.3 ± 1.6 ; height(cm) = 167.5 ± 5.1 ; weight(kg) = 65.5 ± 11.0 volunteered for this study. With the participants in side-lying position, muscle length, muscle area and thickness were scanned using GE Logic S8 (6-15 MHz probe). The right and left TrA muscles were imaged twice on each subject at spinal levels L1, L3 and L5 and later measured by two separate investigators. Test-retest reliability was calculated using interclass correlation coefficient (ICC) (random subjects and fixed raters) along with the Standard Error of Measurement (SEM).

RESULTS: Our panoramic measures showed excellent intertester reliability for length, area and thickness measurements (ICC=0.981, 0.982, 0.985, respectively). In addition, the SEM for length, area and thickness were SEM= 0.178, 0.078, 0.046, respectively.

CONCLUSIONS: Our method of assessing TrA morphology showed excellent reliability in the three dimensions measured and had low error rates that were equal to or better than those associated with other muscles previously measured. Panoramic imaging seems to be a reliable technique that could be used to visualize the whole TrA muscle in one image. Comparison to MRI images would further help establish its validity.



345 Board #161 May 27 10:30 AM - 12:00 PM
Validity Of Lower Leg Muscle Cross-sectional Area Measurements Using Ultrasound Imaging Compared To MRI

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Quantification of muscle size can enhance assessment of musculoskeletal conditions in both clinical and research settings. Magnetic resonance imaging (MRI) is often considered a gold standard for assessing muscle morphology, while ultrasound imaging (US) is gaining recognition for its utility in musculoskeletal imaging. In the lower leg and foot, there is a need to validate US based assessment of muscle size compared to MRI in musculoskeletal imaging.

Purpose: To validate muscle size measured from US images compared to images captured using MRI.

Methods: Eighteen people (female n = 10, age = 31 ± 15 y, ht = 176 ± 11 cm, wt = 76 ± 18 kg) had their leg muscle size of the tibialis anterior (TA), tibialis posterior (TP), and fibularis longus (FL) assessed with both US and MRI at 30% of the distance from the knee joint line to the lateral malleolus, while the flexor digitorum longus (FDL) and fibularis brevis (FB) were assessed at the 50% point along the same line. Cross sectional area (CSA) was manually traced from two separate US and MRI images for each muscle and averages were calculated. Statistical analysis included comparison of MRI and US measures using the Pearson product correlation.

Results: High correlations were seen between US and MRI size measurements (TA r = 0.90, p=0.003; TP r = 0.94, p=0.000; FL r = 0.97, p=0.000; FDL r = 0.86, p=0.000; FB FDL r = 0.94, p=0.000. CSAs from MRI were larger than those measured from US by an average of 0.17 cm².

Conclusion: Measurements of CSA using US in selected leg muscles were comparable to those on MRI scans with MRI assessment larger than US. This difference may be due to difficulty in seeing fascial borders in the MRI images. Muscle CSA measurements from US appear to provide valid assessment of leg muscle size and may be used in clinical and research settings to quantify muscle morphology.

346 Board #162 May 27 10:30 AM - 12:00 PM
Between-limb Differences In Ultrasound Spatial Frequency Analysis Parameters Following Acute Hamstring Strain Injury

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 (No relevant relationships reported)

Treatment following hamstring strain injury (HSI) is complicated by a lack of prognostic indicators and high rates of re-injury. Spatial frequency (SF) analysis, a quantitative ultrasound method to assess structural tissue organization, could complement clinical evaluations. **PURPOSE:** To characterize differences in SF parameters between injured and uninjured limbs following acute HSI in Division I collegiate athletes. **METHODS:** Ultrasound imaging was performed within one week of HSI, also confirmed by MRI. Longitudinal B-mode images (Aixplorer, Supersonic Imagine, Aix-en-Provence, France) were acquired by a single musculoskeletal-trained sonographer using a linear array transducer (2-10 MHz) at the injury site of maximum tenderness and corresponding location for the uninjured limb. A region of interest (ROI) was drawn about the site of injury and location-matched on the images of the uninjured limb. A 2D Fourier Transform was performed on all possible 5 mm square kernels within the ROI. Peak spatial frequency radius (PSFR), a parameter corresponding to the frequency of the fascicular banding pattern, and Mmax%, a ratio comparing the prominent banded pattern relative to the background, were computed for each kernel. PSFR and Mmax% from all kernels were averaged across respective ROIs. Paired t-tests were used to compare parameter differences between limbs. **RESULTS:** Seven male athletes sustained HSI (mean age = 19.1 ± 0.8 yrs). PSFR (1/mm) was lower (p = 0.005) in the injured limb (0.81 ± 0.22) compared to the uninjured limb (0.95 ± 0.18). Mmax% was also lower (p = 0.023) in the injured limb (1.44 ± 0.41) compared to the uninjured limb (2.03 ± 0.56). Both measures indicated decreased tissue organization in the injured limb, characterized by disruption of the reflected fascicular banded pattern. **CONCLUSION:** SF analysis successfully detected differences between injured and uninjured muscle tissue. Although differences in SF parameters between limbs cannot differentiate whether alterations are due to mechanical disruption of fascicles or presence of edema, this method may have promise in identifying structural changes following HSI and in monitoring changes throughout recovery. Supported by NBA & GE Healthcare Orthopedics and Sports Medicine Collaboration and NIH Grant UL1TR002373 and TL1TR002375.

347 Board #163 May 27 10:30 AM - 12:00 PM
Spatial Frequency Analysis Identifies Altered Local Micromorphology In Adolescent Athletes With Achilles Tendinopathy

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 (No relevant relationships reported)

Site specific intratendinous Achilles morphology measured with ultrasound image spatial frequency analysis (SFA), quantifies the degree of collagen fiber density and organization. As tendon pain varies in location, and is not always related to hypoechogenicity, it is of interest to establish if spatial frequency parameters discriminate regions of tendon pain where hypoechoic alterations are not readily observable.

Purpose: This study aims to analyze intratendinous micromorphology in adolescent athletes (AA) with Achilles tendinopathy and without sonographic evidence of tendinosis.

Methods: 22 AA (14m/8f, 13.2±1.4 y, 161±11 cm, 47±11 kg) with Achilles tendinopathy (history of tendon pain and pain on palpation) and no visible sonographic hypoechogenicity or focal tendon thickening were included in this analysis. Longitudinal ultrasound scans of the Achilles tendon were acquired. SFA was performed on regions of interest (ROI) corresponding to tendon pre-insertion and midportion, as well as the site of subjectively-reported tendon pain on palpation. Higher values of SFA parameters suggest greater collagen fiber density and alignment. Calculated SFA parameter values were compared using a one-factorial or Wilcoxon ANOVA ($\alpha < 0.05$).

Results: Significantly lower values for three SFA parameters were found at the symptomatic area as compared to tendon pre-insertion ROI, and for two parameters at the symptomatic area as compared to tendon midportion ROI (Table 1).

Conclusion: As indicated by SFA, intratendinous morphology was altered at the painful area, whereas standard ROIs reveal comparable values to previous findings in healthy AA. These results indicate that painful, yet sonographically inconspicuous regions of tendons, have lower fiber density and alignment.

Table 1: SF parameters at tendon pre-insertion (I), midportion (M), and pain site (P) [mean ± SD]

Location	PSFR	P6 Width	Q6 Factor	Mmax	Mmax%	Axis Ratio	Ellipse Rotation	Sum
I	1.88 ±0.21*	0.71 ±0.07*	2.77 ±0.33**	7041 ±1703	7.13 ±1.36*	1.73 ±0.14	90.5 ±0.8	99237 ±15788**
M	1.93 ±0.25*	0.71 ±0.07*	2.83 ±0.32*	6565 ±1327	7.67 ±1.37	1.73 ±0.16*	90.4 ±0.7	86203 ±12907*
P	1.59 ±0.36**	0.71 ±0.08*	2.33 ±0.46**	6290 ±1179	7.98 ±1.12*	1.73 ±0.18*	90.7 ±1.5	79404 ±14094*

Data not normally distributed. **Significant differences (p<0.0003).

348 Board #164 May 27 10:30 AM - 12:00 PM
A Time Course Of Changes In Echo Intensity Following Resistance Exercise In Untrained Individuals

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(No relevant relationships reported)

It has been suggested that changes in echo-intensity (EI) measured through ultrasound can detect the presence of muscle swelling. However, the time course of changes in EI has never been examined relative to a non-exercise control condition following naïve exposure to exercise. **PURPOSE:** To examine the changes in biceps muscle thickness (MT), EI and isometric strength (ISO) before, immediately after, and 24, and 48 hours after 4 sets of biceps curls. **METHODS:** 27 resistance trained individuals visited the laboratory 4 times. During visit 1, paperwork and maximum strength were measured. During visit 2 (2-7 days later) participant's MT and ISO were measured in both arms before performing 4 sets of biceps curls in a randomized arm. Additional measures were taken immediately after exercise, as well as 24 and 48 hours after exercise. MT images were saved for EI measurement. Results are displayed as means (SD). **RESULTS:** For MT there was an interaction (p < 0.001). MT increased from pre [2.88 (.64) cm] to post [3.27 (.67) cm] exercise and remained elevated above baseline 24 [2.92 (.66) cm] and 48 [2.98 (.68) cm] hours post. There were no changes for MT in the control group from pre [2.88 (.66) cm] to post [2.88 (.66) cm] exercise, or 24 or 48 hours post. For EI there was an interaction (p = 0.012). In the experimental group EI increased from pre [22.9 (9.6) AU] to post [29.1 (12.3) AU] exercise and was depressed below baseline 24 hours post [20.4 (9.9) AU]. For the control condition, EI was different between pre [24.8 (10.2) AU] and 48 hours [21.5 (10.7) AU]. In addition, EI were lower 24 [23.3 (11.4) AU] and 48 hours post exercise compared to immediately post exercise [27.4 (13.0) AU]. For ISO, there was an interaction (p < 0.001). In the experimental condition ISO decreased from pre [40.6 (14.7) Nm] to post exercise [24.8 (9.4) Nm] and remained depressed 24 [32.2 (11.3) Nm] and 48 hours [33.9 (11.4) Nm] post exercise. **CONCLUSIONS:** Naïve exposure to resistance exercise produced a swelling response, which was elevated 48 hours post exercise. This swelling was accompanied with a prolonged decrease in ISO, which is likely indicative of muscle damage. Despite an increase in MT, EI was only elevated immediately post exercise. In addition, EI changed in the control condition despite no changes in MT.

349 Board #165 May 27 10:30 AM - 12:00 PM
Influence Of Achilles Tendon Structure On Passive Mechanical Characteristics

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(No relevant relationships reported)

Investigations into tissue (muscle and tendon) stiffness have focused on the whole musculotendinous unit through imaging and dynamometry. However, few studies have examined the relationship between individual structural components of the tendon (e.g., thickness, cross-sectional area, and length) and their contributions on isolated mechanical characteristics of the free tendon (FT) (e.g. elasticity, stiffness, etc). **PURPOSE:** Evaluate the relationship of FT structure (length, FT_L; cross-sectional area, FT_{CSA}; thickness, FT_T) and the mechanical characteristics (stiffness; ST; elasticity; EL, and mechanical stress relaxation time; MSRT) as assessed by myotonometry (MYO). **METHODS:** Ten male (mean ± SD: age = 20.7 ± 1 year) participants laid in a prone position with their ankle at 90°. Ultrasonography (US) FT_{CSA} (cm²) and FT_T (cm) images were scanned in a transverse position at 4 cm proximal to the osteotendinous junction. FT_L (cm) was captured in the extended-field of view setting starting at the calcaneal tuberosity and ending at the most distal muscle fascicles of the soleus. All US image measurements were analyzed using a third-party image analysis software. FT mechanical properties were assessed via MYO, through 5 automated mechanical oscillations and the average ST (N/m), EL, and MSRT (ms) measures were identified and used for statistical analysis of each variable. Pearson product-moment correlation coefficients (r) were used to examine the relationships between FT_L, FT_{CSA}, FT_T, and ST, EL, and MSRT with a level of significance of p ≤ 0.05. **RESULTS:** A significant, strong correlation for FT_T and MSRT (r = 0.637; R² = 0.406; p = 0.048), and a

significant, strong, negative correlation for FT_L and ST (r = -0.676; R² = 0.457; p = 0.032) were observed. There were no significant correlations between FT_T and EL or FT_L and FT_{CSA} with ST, EL, and MSRT (p ≥ 0.05). **CONCLUSION:** These findings indicate that a greater FT_T may contribute to improved compliance of the Achilles tendon; subsequently increasing relaxation time following mechanical oscillation. Taken together, isolation of structural and mechanical characteristics may provide a greater understanding of the viscoelastic characteristics of the FT.

350 Board #166 May 27 10:30 AM - 12:00 PM
Abstract Withdrawn

351 Board #167 May 27 10:30 AM - 12:00 PM
Lateral Abdominal Muscle Symmetry And Risk Of Sports Injury In Baseball Players

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(No relevant relationships reported)

Lateral abdominal muscles play a significant role in trunk control and rotation during baseball batting. Repetitive and unidirectional baseball batting could lead to asymmetric hypertrophy of lateral abdominal muscles. This adaptive change may subsequently impose abnormal loads on the spine and predispose baseball players to sports injury. No study has examined whether adolescent baseball players present lateral abdominal muscle asymmetry and its relationship with risk of sports injury. **PURPOSE:** This study aimed to compare the thickness of lateral abdominal muscles on both sides of the trunk, and to investigate whether asymmetry of lateral abdominal muscle thickness was correlated with risk of sports injury in high school baseball players. **METHODS:** Fifteen position players from a high school baseball team (right-handed batting and throwing; aged 16.0 ± 1.1 years, height 172.6 ± 5.0 cm, weight 73.3 ± 10.8 kg) completed the Functional Movement Screen (FMS) testing. B-mode ultrasound images were recorded from the external abdominal oblique (EO), internal abdominal oblique (IO), and transverse abdominis (TA) at the end of expiration in the crook-lying position. The absolute thickness of each lateral abdominal muscle for both sides was determined and compared using paired t-tests. The relationship between the asymmetry ratio (difference between two sides expressed as a percent of the dominant side) and FMS composite score was analyzed using the Spearman correlation coefficient. **RESULTS:** The EO thickness was significantly greater in the dominant side than in the non-dominant side (6.85 ± 1.13 vs. 5.05 ± 1.46 mm, p < 0.001), and the TA thickness was significantly greater in the non-dominant side than in the dominant side (4.21 ± 0.85 vs. 3.49 ± 0.60 mm, p = 0.003). Only the asymmetry ratio of TA was significantly correlated with the FMS composite score (r = 0.54, p = 0.040). **CONCLUSIONS:** High school baseball players showed side-to-side thickness asymmetry in the EO and TA. The significant correlation between the TA asymmetry ratio and FMS composite score suggests an increased risk of sports injury. High school baseball teams should consider integrating TA training into players' routine training program. Supported by the Ministry of Science and Technology of Taiwan (MOST 108-2410-H-006-098)

352 Board #168 May 27 10:30 AM - 12:00 PM
Evaluation Of Muscle Swelling After Concentric Muscle Contraction Using Bioelectrical Impedance Analysis

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(No relevant relationships reported)

Resistance exercise using concentric and eccentric muscle contraction (i.e., dumbbell curl exercise) decreased significantly bioelectrical impedance analysis (BIA) (Atsuta et al. 2019). However, the influence of muscle contraction type on exercise-induced BIA change remains unclear. **PURPOSE:** The purpose of the present study was to examine time course changes in muscle swelling evaluated by BIA following concentric-muscle contraction. **METHODS:** Nine male subjects (20.0 ± 0.8 yrs, 175.4 ± 2.4 cm, 65.2 ± 6.3 kg) performed isokinetic (60 deg/s) concentric knee extension (6 repetitions × 10sets, 60 s rest period between sets). Before and during 24 h of post-exercise, time course changes in BIA (locally evaluated BIA for vastus lateralis muscle), maximal voluntary contraction (MVC) of knee extension exercise, muscle thickness (evaluated by ultrasound) for vastus lateralis muscle and thigh circumference were evaluated. Blood samples were also drawn to investigate blood lactate, serum creatine kinase (CK) and myoglobin levels. **RESULTS:** Blood lactate and CK levels were significantly increased after exercise (P<0.05). Moreover, the MVC was significantly decreased immediately after exercise

(before exercise: 269.2 ± 30.4 Nm, immediately after exercise: 233.6 ± 28.7 Nm, P<0.05). However, BIA value, muscle thickness and circumference did not change significantly after the exercise (p>0.05 for all variables).

CONCLUSIONS: Resistance exercise consisting of concentric muscle contraction did not affect local BIA. The finding was not consistent with that in our previous study using the resistance exercise consisting of both concentric and eccentric muscle contraction.

353 Board #169 May 27 10:30 AM - 12:00 PM
A Time-Efficient NIRS Protocol For Cross- And Within-limb Comparisons Of Muscle Oxidative Capacity

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The non-invasive determination of muscle mitochondrial oxidative capacity via Near Infrared Spectroscopy (NIRS) typically involves voluntary contraction of a single limb and requires as many as 22 brief ischemic occlusions per measurement. This limits the number of oxidative capacity measurements that can be completed in a given test session and also makes cross-limb muscle comparisons challenging. **PURPOSE:** To establish the efficacy of a recently developed protocol that utilizes fewer (i.e. 6) ischemic occlusions combined with surface electrical stimulation (E-stim) in both limbs simultaneously. **METHODS:** The test employs 2 upper thigh cuffs and 2 NIRS sensors placed directly over the vastus lateralis (VL) muscles (supine position) or the semi-tendinosus (ST) muscles (prone position). Metabolic rate is temporarily increased via E-stim pads placed above and below each NIRS sensor. A standard 6Hz frequency is employed using a pre-modulation setting, with the intensity (mV) increased sufficient to raise metabolic rate (≥ 3 fold), but within the tolerance of each participant. The mitochondrial capacity protocol involves 4 separate sets of 30 sec of E-stim followed by 6 x 5 sec cuff inflation/5 sec cuff deflation cycles. Analysis consists of calculating oxygenation recovery rate constants (Tc) for each muscle (i.e., 4 repeated measurements per muscle, per limb) using a customized software program. **RESULTS:** Within a group of moderately active younger adults without a history of knee surgery (n=3), Tc averaged 34.8 sec in the VL and 40.2 sec in the ST (p = 0.21). Variability of repeated tests (CV % based on 4 replicates/muscle) averaged 9.9% in the VL (n=14 subjects) and 11.1% in the ST (n=3 subjects). Compared to the traditional unilateral 22-cuff occlusion method, this protocol enabled twice as many replicates per muscle in significantly less time (~30 min less). **CONCLUSIONS:** This bilateral E-stim protocol is time efficient and has the potential to facilitate within- and cross-limb comparisons of muscle mitochondrial capacity.

A-46 Free Communication/Poster - Injury, Injury Prevention, Recovery, and Rehabilitation

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

354 Board #170 May 27 10:30 AM - 12:00 PM
Characterization Of Muscle Inflammation Susceptibility: A Potential Prognostic Factor For Optimal Post-surgical Rehabilitation

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(No relevant relationships reported)

Background: Many individuals with end-stage osteoarthritis undergo elective total hip/knee arthroplasty (THA/TKA) to relieve pain and improve mobility and quality of life. However, ~35% suffer long-term mobility impairment following surgery. Previously, we have shown this may be in part due to muscle inflammation susceptibility (MuIS⁽⁺⁾), an overt pro-inflammatory state localized to skeletal muscle

surrounding the diseased joint, found in some but not all TKA/THA patients. **Purpose:** We are interrogating the hypotheses that a) MuIS⁽⁺⁾ status will result in a differential perioperative expression profile that may partially explain low functional outcomes, and b) resistance training rehabilitation will more effectively overcome MuIS⁽⁺⁾ status than usual care for effective recovery post-surgery. **Methods:** Muscle samples were leveraged from our ongoing two-site, randomized, controlled trial (N=84). Participants were dichotomized to MuIS status (+/-) based on surgical (SX) muscle gene expression of Fn14 which drives pro-inflammatory signaling via NFκB. MuIS^(+/-) samples were probed for pro-inflammatory gene and protein expression targets, and indices of skeletal muscle function. Preliminary perioperative comparisons were made using two-tailed T-tests; alpha P<0.05. **Results:** 84 participants (29M/55F; 62±8yrs; BMI 30.7±5.4kg/m²) undergoing THA/TKA were assessed. Thus far, 37 have been clustered as MuIS⁽⁺⁾ (n=14, ~4-fold greater Fn14 mRNA) or MuIS⁽⁻⁾ (n=23). SX thigh muscle mass (TMM), quadriceps power and torque were lower (P<0.05) than the contralateral limb (CTR). Additionally, skeletal muscle fibrosis and type II cross-sectional area were greater in the SX leg and MuIS⁽⁺⁾ respectively (P<0.05). Tumor necrosis factor-α receptor and IL-6 trended higher in MuIS⁽⁺⁾ (P>0.05). Phosphorylated (p)-RPS6 was lower in the SX leg and p-4E-BP1 was significantly lower in MuIS⁽⁺⁾ (P>0.05). **Conclusions:** Preliminary results suggest patients undergoing TKA/THA exhibit more inflammation on the SX limb, accompanied by lower TMM, torque and power. MuIS⁽⁺⁾ leads to greater inflammation and blunted anabolic signaling, highlighting the profound impact of muscle inflammation and emphasizing the potential value in perioperative MuIS assessment to inform optimal post-surgical care. Grant: R01HD084124

355 Board #171 May 27 10:30 AM - 12:00 PM
Myostatin Mediates Quadriceps Muscle Atrophy And Fibrosis Rapidly After ACL Transection In Novel Murine Model

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(No relevant relationships reported)

Anterior cruciate ligament (ACL) injury results in quadriceps muscle atrophy and strength loss that may never fully recover. Underlying mechanisms driving these maladaptations have not been thoroughly investigated.

PURPOSE: Develop an animal model recapitulating observed clinical phenotype after ACL injury to identify the early molecular and morphological signature within quadriceps muscle and clarify the rapidity with which therapies should be administered. **METHODS:** Surgical ACL transection (ACL-T) was performed unilaterally on mice (n=5) followed by 5-Ethynyl-2'-deoxyuridine (EdU) injection. 7d after ACL-T, quadriceps muscle was harvested from injured and uninjured limbs. Immunoblotting measured myostatin signaling, and immunohistochemical techniques assessed morphology. In vivo knee extensor peak torque was measured on a separate group of mice (n=3) before and 7d after ACL-T. **RESULTS:** Myostatin and p-SMAD3 expression increased 7d after ACL-T by 131% (1.6 ± 0.2 vs 0.7 ± 0.1 AU, p=0.02) and 174% (1.1 ± 0.1 vs 0.4 ± 0.1 AU, p<0.01). Fibroblast density increased (Tcf4+/fiber: 45%, p=0.08; Tcf4+/mm²: 106%, p=0.04), as did fibroblast proliferation (215%, p=0.02). Extracellular matrix (ECM) content increased 53% (p=0.03), along with a 31% decrease in fiber cross sectional area (CSA) (1394 ± 91 vs 2011 ± 134 μm², p<0.01). Knee extensor peak torque decreased 21% (p=0.04). Myostatin signaling was correlated with fiber CSA and fibrotic indices 7d after ACL-T (Table 1). **CONCLUSIONS:** Myostatin signaling is starkly and rapidly upregulated 7d after ACL-T in mice, promoting robust decrements in muscle size, quality, and function. Our findings suggest that myostatin-mediated muscle dysfunction represents a modifiable therapeutic target. Pharmacological myostatin inhibition immediately after ACL injury, preceding surgical and loading interventions, may mitigate quadriceps maladaptations and partially preserve strength. Support: R01 AR072061, T32AG000270

Table 1. Elevated myostatin signaling mediates ECM accumulation and myofiber atrophy in quadriceps muscle 7 days after ACL transection.

	myostatin		p-SMAD3	
	R value	P value	R value	P value
fibroblast density (Tcf4+/fiber)	0.7446	0.0341	0.6499	0.0811
fibroblast density (Tcf4+/mm²)	0.9441	0.0004	0.7827	0.0217
fibroblast proliferation (EdU+ Tcf4+)	0.7291	0.0401	0.628	0.0954
ECM content	0.5681	0.1418	0.7564	0.0299
myofiber CSA	-0.8349	0.0084	-0.8575	0.0065

356 Board #172 May 27 10:30 AM - 12:00 PM
The Effect Of Robotic Gait Training On Spinal Cord Transected Rat Femurs
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Robotic locomotor training has been shown to be effective for significantly improving body composition and making some moderate, but not significant, changes in bone mineral density in individuals with spinal cord injury (Karalis et al., 2017). The effect of the training on other important mechanical properties of bone is unknown. **PURPOSE:** To determine the effects of 8 weeks of robotic locomotor training on mechanical properties of rat bones. **METHODS:** Twelve female Sprague-Dawley rats received spinal cord transections at 5 days old. At 3 weeks old, half of them were randomly assigned to a Training group and half to a Control group. The Training group received 5 minutes of robotic gait training with 90% body support for 5 days a week for 8 weeks. The Control group received no exercise. At the conclusion of the 8 weeks, the animals were euthanized and the right femurs were harvested for testing. Anthropometric measures and 3-point bending tests using an Instron material testing system (Norwood, MA) were performed. Independent t-tests were used to determine differences between the two groups ($p < 0.05$). **RESULTS:** There was no difference in body mass between the two groups prior to group assignments, but after 6 weeks of training the Control group had greater mass ($p = 0.035$) and at the end of training this difference continued (mass = 210.3 ± 36.0 g vs. 166.7 ± 14.5 g; $p = 0.012$). The Control group's femur mass was significantly larger ($p = 0.041$), but when considered as a percentage of body mass, the Training group's femur mass was larger ($p = 0.014$). Peak load and rupture loads were not different between the two groups, but when normalized for body mass the Training group had larger load values than the Control group ($59.0 \pm 2.7\%$ and $53.3 \pm 12.1\%$ for the Training and $52.4 \pm 2.0\%$ and $41.6 \pm 8.7\%$ for Control; $p = 0.001$ and $p = 0.035$, respectively). The deflection at rupture was greater for the Control group (0.75 ± 0.09 mm vs. 0.59 ± 0.14 mm; $p = 0.025$), as was the energy absorbed (57.0 ± 6.1 mJ vs. 39.6 ± 12.1 mJ; $p = 0.009$). There were some differences in midshaft diameters, but the cross-sectional areas were not different between the two groups. **CONCLUSION:** Rats who experienced training had stronger and more massive femurs than those who experienced no training. This work was supported by NSF 0850516.

357 Board #173 May 27 10:30 AM - 12:00 PM
Effect Of Gastrocnemius Post-exercise Needling Treatment On Achilles Tendon Tendinopathy Prevention
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 (No relevant relationships reported)

PURPOSE: Long-term post-exercise high intensity gastrocnemius tension can induce the Achilles tendon tendinopathy. The gastrocnemius post-exercise needling treatment can reduce gastrocnemius tension. Therefore, the gastrocnemius post-exercise needling may decrease the risk of Achilles tendon tendinopathy by reduce gastrocnemius tension. **METHODS:** 32 male 12 weeks old SD rats divided into 4 groups: the needling group (NED group); exercise group (EX group); exercise and needling group (EXNED group) and control group (CON group). The animal treadmill protocol was 60% average VO_2 max intensity (16.5m/min) eccentric running at -11° condition lasting 90 minutes for 24 days. The EXNED and NED groups accepted needling treatment with 0.25mm diameter needle which penetrate 5mm on gastrocnemius for 5 minutes after exercise each day. Gastrocnemius and Achilles tendon were harvested at the 26th day then measured collagen I/III, MMP-1, mechanical growth factor (TGF- β , IGF-1) expression and cell apoptosis ratio by western-blot, Immunofluorescence and TUNEL staining. Data was analyzed by SPSS 20.0. **RESULTS:** The gastrocnemius TGF- β in EX group was significantly higher than other three groups (0.20 ± 0.01 VS 0.11 ± 0.01 , 0.13 ± 0.02 , 0.14 ± 0.01 , $P < 0.05$); IGF-1 was no significant difference. In Achilles tendon, TGF- β in EX group was significantly higher than other three groups (733.58 ± 306.82 VS 291.92 ± 156.19 , 153.74 ± 114.96 , 192.67 ± 112.36 , $OD/\mu m^2$, $P < 0.05$); IGF-1 was no significantly difference either. Collagen I in EX and EXNED group were significantly lower than CON and NED group (557.26 ± 210.54 , 798.89 ± 122.06 VS 958.59 ± 176.41 , 1133.60 ± 251.62 , $OD/\mu m^2$, $P < 0.05$); collagen III in EX group was significantly higher than other three groups (1101.25 ± 196.37 VS 393.03 ± 60.13 , 492.25 ± 103.16 , 779.32 ± 140.25 , $OD/\mu m^2$, $P < 0.01$), and it was significantly higher in EXNED group than in CON and NED group (779.13 ± 140.42 VS 393.17 ± 60.15 , 492.20 ± 103.11 , $OD/\mu m^2$, $P < 0.05$). The MMP-1

in the EX group was significantly higher than other three groups (624.09 ± 176.62 VS 393.51 ± 119.66 , 264.9 ± 78.4 , 289.4 ± 85.68 , $OD/\mu m^2$, $P < 0.05$). Cell apoptosis ratio was no significant difference. **CONCLUSION:** The gastrocnemius post-exercise needling treatment can decrease the risk of Achilles tendon tendinopathy by reduce gastrocnemius tension.

358 Board #174 May 27 10:30 AM - 12:00 PM
Effects Of Hip-knee Muscle Strengthening Combined With Whole-body Vibration Training On Patellofemoral Pain Syndrome
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PURPOSE: This study aimed to investigate the effect of whole-body vibration (WBV) training combined with hip-knee muscle strengthening training on adult patellofemoral pain syndrome(PFPS). **METHODS:** Thirty-six adults with PFPS were included in this study and randomly assigned to either a combined training group (Group 1) that received WBV training plus hip-knee muscle strengthening training (n=18) or a control group (Group 2) that performed hip-knee muscle strengthening training only (n=18). Group 1 performed 18 sessions to strengthen knee extensors, hip abductor and lateral rotator muscles for 40minutes per session (20minutes WBV training plus 20minutes hip-knee strengthening training) three times a week for six weeks. Group 2 performed the same number of sessions (2x20 minutes hip-knee strengthening training only per session) to strengthen the muscles of the hip and knee. All patients were evaluated using a Visual Analog Scale (VAS), Anterior Knee Pain Scale (AKPS), and Short Form-36 (SF-36) before and after treatment. **RESULTS:** The results were statistically significant between before and after treatment in terms of VAS ($p < 0.001$) and AKPS ($p < 0.001$), Physical Functioning ($p < 0.001$), Role-Physical ($p < 0.001$), Bodily Pain ($p < 0.05$), General Health ($p < 0.05$) and Social Functioning ($p < 0.05$). However, no significant differences were observed in Role-emotional ($p = 0.19$), Vitality ($p = 0.15$) and Mental Health ($p = 0.32$). No significant between-group differences were found in all this scale ($p > 0.05$). **CONCLUSIONS:** The WBV training plus hip-knee strengthening training and hip-knee strengthening training can both effectively improve pain, knee function and quality of life on adult patients with PFPS. However, whether the WBV training is more effective than hip-knee strengthening training need to be further research.

359 Board #175 May 27 10:30 AM - 12:00 PM
Relationship Between Isokinetic Muscle Strength Test Of Knee And Hip In Knee Osteoarthritis Patients
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 (No relevant relationships reported)

The prevalence of Knee Osteoarthritis(KOA) is increasing, most of the kinesiotherapy is focus on improving the strength of knee muscles. However, the relationship between periarticular muscle strength of Knee and Hip in KOA in old people remains unknown. **PURPOSE:** To explore the relationship between periarticular muscle strength of Knee and Hip. **METHODS:** Forty patients with Knee Osteoarthritis (24females and 16males, Age: 55.31 ± 7.05 years) were enrolled in the study. The Isomed-2000 dynamometer was adopted to measure the peak torque/body weight (PT/BW) and peak work/body weight (PW/BW) of knee and hip at 60° -s-1 and 180° -s-1, respectively. Pearson Correlation Analysis and multiple Regression analysis were used to measure the muscle strength between knee flexors-extensors and hip flexor-extensor, adductor-abductor. **RESULTS:** (1) Pearson Correlation Analysis showed that in the case of 60° -s-1 and 180° -s-1, the results of Isokinetic muscle strength of flexion and extension knee were correlated with the results of PT/BW and PW/BW of flexion and extension hip, adduction and abduction hip in most cases ($p < 0.05$); (2) Multiple regression analysis showed that there was a positive linear relationship between knee flexor, extensor and hip flexor PT/BW at 60° -s-1 ($r = 0.342$, $p = 0.002 < 0.05$; $r = 2.824$, $p = 0.007 < 0.05$, respectively); There was a positive linear relationship between knee flexors and hip extensors ($r = 2.305$, $p < 0.05$). At 180° -s-1, there was a negative linear relationship between hip extensor and knee flexor ($r = -2.417$, $p = 0.02 < 0.05$), and a positive linear relationship between knee flexors and hip adductors ($r = 2.772$, $p = 0.008 < 0.05$). **CONCLUSION:** In this test, the knee flexor and extensor function was affected by the same hip muscle strength. In the case of 60° -s-1, the hip flexor is not only involved in the knee extension function. The knee flexors are also controlled by the hip flexors. Therefore, Practitioners with KOA should not only focus on the function of the knee muscles, but also the use of the muscles around the hip joints.

WEDNESDAY, MAY 27, 2020

360 Board #176 May 27 10:30 AM - 12:00 PM

Correlation Between The Elbow Ulnar Collateral Ligament And Generalized Joint Hypermobility In Young Adults

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(No relevant relationships reported)

Joint hypermobility is largely understood as a dysfunction of collagen fibers within the connective tissues of ligaments and tendons, allowing for a range of motion which is markedly increased over validated normal values. Generalized Joint Hypermobility (GJH) is defined using a Beighton score of $\geq 5/9$. Additionally, previous studies have used microscopic imaging to determine these relationships, and there has yet to be a published study looking into the correlation between the sonographically determined length and width of ligaments, and GJH in a college-aged population in North America.

PURPOSE:

To determine the relationship between the length and width of the anterior bundle of the Ulnar Collateral Ligament (UCL) of the elbow and GJH.

METHODS:

Three hundred and thirty undergraduate students (age 19.24 ± 2.07 yrs) enrolled in A&P I classes completed the Beighton score, including measures of elbow hypermobility. Ultrasound images of the participants' ulnar collateral ligament were obtained in both arms under a gravity induced valgus force in supine.

RESULTS:

Overall, 48 of 330 participants (14.6%) reported generalized joint hypermobility (GJH) based on a Beighton score ≥ 5 . Sixty-three participants reported hypermobility in at least one elbow; there was no difference in prevalence of hypermobility between elbows (Right: $r = .483, p < .001$; Left: $r = .465, p < .001$). Hypermobility in one elbow was strongly correlated with hypermobility in both elbows ($r = .828; p < .001$). We found moderate correlations between UCL thickness and joint gapping for left and right elbows ($r = .422, r = .324, p < .001$).

We found no difference in UCL thickness or joint width between participants with hypermobile elbows and those without (e.g., right elbow joint width under valgus stress: Normal = $.231799$, Hypermobile = $.228415$; $t(251) = .301, p = .763$) Left elbow joint width under valgus stress was weakly correlated ($r = .167, p = .006$) with GJH overall but not specifically with left elbow hypermobility.

CONCLUSION:

There was no relationship between Beighton score and UCL anterior bundle thickness or joint width under gravity induced valgus stress. There was no statistically significant difference in UCL thickness or joint width in participants with elbow hypermobility and those without.

361 Board #177 May 27 10:30 AM - 12:00 PM

Effect Of Forearm Flexors/extensors Strength Training On Functional Capacity After Open Carpal Tunnel Release

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Carpal tunnel syndrome (CTS) is a common peripheral neuropathy of the upper extremity. Open release surgery for CTS may affect post-operative functional capacity of the operated hand. **PURPOSE:** This pilot study examined the effects of a progressive strength training program of the forearm flexors and extensors on functional and clinical parameters after open carpal tunnel release (OCTR). **METHODS:** Seven patients with CTS (5 females and 2 males (age: 57.7 ± 4.8 yrs, height: 169.0 ± 2.5 cm, body mass: 82.0 ± 4.1 kg, BMI: 28.7 ± 1.4) underwent OCTR and then were randomly divided into two groups, the control group (CG; $n=4$) which received usual physical therapy care, and the intervention group (IG; $n=3$) which, in addition to the usual care, followed a 9-week strength training program of the wrist flexors/extensors (3 sets of 10 reps, 4 days/week) started 3 weeks after surgery. Hand grip strength (HGS Test), hand pinch strength (HPS Test) and sensibility (Two-point Discrimination Test-TPDT) were assessed before and 3, 6 and 12 weeks after surgery, while load for strength training was set at 2% of the maximal grip strength and was readjusted accordingly during the experimental period. Patients also completed the Boston Carpal Tunnel Questionnaire (BCTQ) before and 12 weeks after surgery. Two-way ANOVA was used for statistics and data are presented as mean \pm SE. **RESULTS:** No significant main effect was found for groups or time ($p > 0.05$) in HGS (IG: 31.1 ± 8.2

kg, CG: 27.2 ± 4.6 kg), HPS (IG: 8.0 ± 4.6 kg, CG: 8.5 ± 4.2 kg) and TPDT (IG: 2.0 ± 0.2 , CG: 2.5 ± 0.3) at 12 weeks compared to pre-surgery values: HGS (IG: 27.6 ± 12.9 kg, CG: 28.7 ± 6.5 kg), HPS (IG: 7.1 ± 4.1 kg, CG: 8.8 ± 4.4 kg) and TPDT (IG: 2.3 ± 0.4 , CG: 3.3 ± 0.4). In BCTQ, no differences were found between groups ($p > 0.05$), however a significant main effect for time ($p < 0.05$) was revealed at 12 weeks (IG: 1.8 ± 0.68 , CG: 1.5 ± 0.4) compared to pre-surgery (IG: 3.8 ± 0.76 , CG: 3.4 ± 0.5). **CONCLUSION:** Our findings suggest that the addition of the selected muscle strength training program to usual care after OCTR does not appear to add significant benefits to the functional recovery of those patients. Further research utilizing a larger number of patients and other strength training protocols is needed to reveal the potential role of wrist muscle strength training in functional capacity of patients with CTS after OCTR.

362 Board #178 May 27 10:30 AM - 12:00 PM

THE EFFECTS OF ISOLYTIC AND STATIC POSTERIOR SHOULDER STRETCHING IN INDIVIDUALS WITH SUBACROMIAL IMPINGEMENT SYNDROME

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(No relevant relationships reported)

Static posterior shoulder stretching exercise (PSSE) in modified cross-body position (MCBP) improves posterior shoulder tightness (PST) and glenohumeral internal rotation deficit (GIRD). Isolytic stretching (isotonic eccentric contraction) is a form of muscle energy technique. The effects of isolytic PSSE were not investigated in shoulder pathologies.

PURPOSE: To investigate the effects of isolytic and static PSSE in MCBP on shoulder internal rotation (IR) and external rotation (ER) range of motion (ROM) and strength, PST, subacromial space (SAS), supraspinatus tendon thickness (SsTT), supraspinatus tendon occupation ratio (STOR), functionality and disability level in individuals having subacromial impingement syndrome (SIS) with GIRD.

METHODS: Sixty-three participants having SIS with GIRD were randomly divided into three groups. Isolytic Stretching Group (ISG) and Static Stretching Group received standard physiotherapy and isolytic or static PSSE in MCBP. The control group (CG) received physiotherapy without PSSE. Shoulder ROM and PST were assessed with bubble inclinometer, strength with hand-held dynamometer, SAS (at 0° and 60° scapular plane shoulder elevation), SsTT, and STOR with ultrasonography, functionality and disability level with Modified Constant-Murley Scale and Quick Disability of the Arm-Shoulder-Hand Questionnaire. GIRD was determined by the difference in bilateral shoulder IR ROM. Data were analyzed with two-way ANOVA with repeated measures.

RESULTS: All groups improved in terms of shoulder mobility, strength, SAS, STOR, functionality, and disability level after 4-weeks of treatment ($p < 0.05$). IR ROM and SAS increased, PST, GIRD, and STOR decreased more in stretching groups compared to CG ($p < 0.001$). Improvements in stretching groups were similar ($p > 0.05$). ER ROM, strength, functionality, and disability levels improved more in ISG compared to CG ($p < 0.05$).

CONCLUSIONS: Standard physiotherapy including PSSE in MCBP is superior to treatment program without PSSE to improve shoulder mobility, SAS and STOR. Both isolytic and static stretchings are equally effective. Standard physiotherapy plus isolytic PSSE provided a greater improvement in ER ROM, strength, functionality and disability levels compared to treatment program without PSSE. Research was not founded.

363 Board #179 May 27 10:30 AM - 12:00 PM
Effects Of Age And Duration Of Manual Wheelchair Use On The Incidence Of Shoulder Pathology

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(No relevant relationships reported)

Rotator-cuff injuries are one of the most common causes of shoulder related disability in manual wheelchair (MWC) users with spinal cord injury (SCI), which could lead to decreased quality of life. **PURPOSE:** To investigate the prevalence of rotator-cuff and biceps tendon tears in MWC users with SCI and the effects of age and duration of wheelchair use on incidence of the shoulder muscle tendon pathology. **METHODS:** Under Mayo Clinic IRB approval, forty-two MWC users were recruited (34 males, age (SD): $41.3 (12.1)$ yrs, injury level: C6-L1, years of MWC use (SD): $10.7 (10.8)$ yrs). A standard clinical MRI protocol was used to image the bilateral shoulders of all participants. The MRIs were assessed by a board-certified musculoskeletal radiologist. Spearman's correlation and logistic regression were used to investigate the association of age and duration of wheelchair use with the presence of the shoulder muscle tendon tears. **RESULTS:** The total prevalence of the shoulder muscle tendon tears (involving dominant or non-dominant shoulder) was 67%. The total prevalence of tendon tears in

the supraspinatus was 47% (partial = 26 and full = 5), infraspinatus was 36% (partial = 21), subscapularis was 40% (partial = 23), and biceps was 12% (partial = 4 and full = 2). The incidence of rotator-cuff and biceps tendon tears was significantly associated with both age ($r = 0.545, p < 0.001$) and the duration of wheelchair use ($r = 0.406, p = 0.008$). The results from a logistic regression model with age and the duration of wheelchair use as predictors indicated that for each 1-year increase in age (when holding the duration of wheelchair use constant) the predicted odds of any rotator-cuff or biceps tendon tear increased by 13% ($p = 0.02$). **CONCLUSION:** Similar to previous studies, this study found high prevalence of shoulder muscle tendon tears in MWC users. This is notably higher than what has been reported for the able-bodied population. Since duration of wheelchair use and age correlate positively with tendon tears, early intervention should be studied to determine if the decline of tendon health can be slowed in this population. Further longitudinal investigation with a larger population of MWC users with SCI is underway to further elucidate the evolution of shoulder pathology due to MWC use. Supported by NIH Grants R01 HD84423-01 and NCATS UL1 TR002377.

364 Board #180 May 27 10:30 AM - 12:00 PM

Impaired Ankle Proprioception In Individuals With Chronic Nonspecific Low Back Pain

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(No relevant relationships reported)

PURPOSE: Ankle proprioception plays a crucial role in balance control. Previous research indicates that individuals with chronic nonspecific low back pain (CNLBP) rely more on ankle than lumbar proprioception in maintaining balance compared to controls. This study aimed to explore if individuals with CNLBP demonstrated any difference in ankle proprioception compared to healthy controls.
METHODS: Twenty-six participants with no ankle injuries in the last 3 months volunteered in this case-control study. Thirteen CNLBP participants (9 Females, age 29.3±9.6yrs old) and 13 were healthy controls (6 Female, age 25.8±8.2yrs old). The Örebro Musculoskeletal Pain Questionnaire (OMPQ) and the Oswestry Disability Index (ODI) were administered for the CNLBP group. Left and right ankle proprioception was assessed by using the Active Movement Extent Discrimination Apparatus (AMEDA) in standing. To assess ankle proprioception, participants were required to actively invert their ankles to a physical stop and to discriminate between 4 possible ankle inversion angles (10°, 12°, 14° and 16°). The receiver operating characteristic curve (ROC) was generated and the mean Area under the ROC Curve (AUC) was calculated to give each participant an ankle proprioceptive acuity score.
RESULTS: The mean proprioceptive discrimination AUC scores for CNLBP and healthy controls were 0.756±0.361 and 0.793±0.04. CNLBP participants demonstrated significantly worse proprioception than healthy controls ($p=0.02, 95\%CI= [61.70\%-89.4\%]$). In healthy controls, there is significant and strong correlation between left and right ankle proprioception ($r=0.747, p=0.003$), but not significant in the CNLBP group ($r=0.139, p=0.650$).
CONCLUSION: The findings of the present study confirm that the ankle proprioception is impaired in individuals with CNLBP. In addition, a common motor program may be used to bilateral ankle movement control in healthy people that demonstrate impairment in people with CNLBP. These findings provide a possible explanation for impaired balance in individuals with CNLBP and may have implications for physiotherapy intervention.

365 Board #181 May 27 10:30 AM - 12:00 PM

FE Analysis Of Meniscus Injury In A Square Stance Tennis Forehand Drive-a Case Study

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(No relevant relationships reported)

Meniscus tears are common among tennis players. Currently, little is known regarding knee joint kinematic and kinetic characteristics during a square stance tennis forehand that may lead to an increased risk of a meniscus injury.**PURPOSE:**To study loading characteristics of meniscus during a square stance tennis forehand swing using a dynamics model and a three-dimensional (3D) finite element model.**METHODS:** Two female Chinese players (age 14 y) with 6 years of competitive tennis experience

performed three square stance tennis forehand drives. Of the two players, one had a lateral meniscus tear of the left knee joint and the other had no history of knee injury. Three-dimensional kinematic motion and ground reaction force data were collected using VICON and AMTI (120 Hz/1200Hz) and then imported into the OpenSIM software to obtain movement data of the tibia and femur. CT and MRI were used to image a healthy human knee that included the femur, tibia, cartilage layers, menisci and ligaments. 2D data were imported into Mimics software to develop a 3D finite element model of the healthy human knee. The 3D model was imported into HyperWorks software to compute the 3D finite-element models of the knee. Last, the loading data of the movement obtained from OpenSIM was imported and transformed into HyperWorks to obtain the distribution stress of the meniscus. **RESULTS:** Compared with the non-injury player, the athlete with the meniscus tear exhibited excessive tibia rotation, showed a higher level of biomechanical stress of the lateral meniscus and demonstrated greater peak value (figure 1, figure 2). **CONCLUSION:** In the acceleration stage of the square stance tennis forehand, differences were observed in the tibial rotation of the healthy and injured players leading one to speculate that the rotation of the knee joint may be related to meniscus injury. Additional studies are needed to verify this speculation and to infer causality.

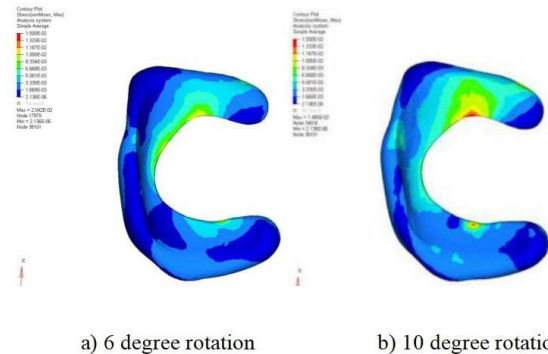


Figure 1. Stress distribution of the meniscus of the injured player

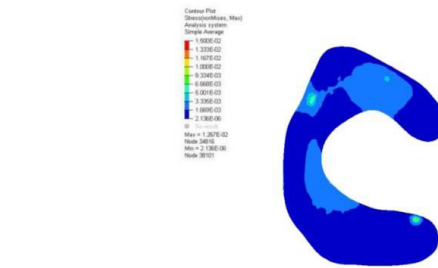


Figure 2. Peak stress distribution of the meniscus of the healthy player

366 Board #182 May 27 10:30 AM - 12:00 PM

Genetic Predisposition Related To Overuse Injuries In Athletes: Genome-wide Association Study In Estonian Elite Athletes.

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(No relevant relationships reported)

Injuries in sports are the most common causes where athletes are forced to change their training plans temporarily, or more, to interrupt trainings and competitions for a certain time. Several genome-wide association studies have concluded that variations in DNA sequence interacting with non-genetic risk factors may play an important role in the etiology of injuries, including overuse injuries.
PURPOSE: To identify potential loci (chromosomal regions) that are associated with the tendinopathy of Achilles and patellar tendons.
METHODS: Study group consisted of 121 elite athletes (21 females and 100 males), current and former Estonian national team members, in the age range 27.5±5.1 years, involved in 16 different sports. The case group (n=42) consisted of athletes with patellar and Achilles tendinopathies, and the control group (n=79) was formed by athletes without these injuries. The electronic health record system was used to find

clinical diagnoses of the respective injuries of the athletes participating in this study. Peripheral venous blood samples for DNA extraction and genotyping for known SNPs (SNP arrays) from all study subjects were collected. The comparison of allelic frequencies of these SNPs was made between cases and controls. For statistical analysis, we used the software PLINK. To estimate the magnitude of the effectiveness OR was used to estimate the magnitude of the effectiveness, and *p*-values for the significance of ORs were calculated using the χ^2 -test. The *p* value of 10^{-8} was set as a threshold for genome-wide statistical significance. To display significant SNPs, the Manhattan plot was used.

RESULTS: Association analysis revealed 2 genes that could be important as risk factors for investigated injuries, the *PAPPA2* (chr 1: rs1158045, OR 13.8, $p=1.64 \cdot 10^{-5}$) and the *GNG12* (chr 1: rs28435277 OR 13.8, $p=1.64 \cdot 10^{-5}$) with the *p*-value remaining at the level of "suggestive significance" ($p=5 \cdot 10^{-5}$).

CONCLUSIONS: Our study results identified suggestive significance in allelic differences of *PAPPA2* and *GNG12* between case and control groups. It is important to continue with further research of genetic risk profile to understand the biological processes associated with injury risk.

367 Board #183 May 27 10:30 AM - 12:00 PM
Loading To Optimize Patellar Tendon Repair After Injury

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PURPOSE: Tendinopathy is one of the most common musculoskeletal issues in jumping sports. In sports like basketball and volleyball, tendinopathy rates reach greater than 45%. Interventions to prevent or treat tendinopathies would improve an athlete's quality of life and team performance. The goal of any intervention to treat tendinopathy is to increase the content of directionally oriented collagen, decrease pain, and increase the tensile strength of the tendon. This study is designed to determine the molecular changes that promote tendon repair.

METHODS: Patellar tendon injury was induced in male Wistar Rats with a 2mm biopsy punch. Rats then recovered with normal cage activity for 15 days to allow a mature scar to form. Following scar formation, groups received either an isometric load (4 x 30 second contraction, 2 min rest) or an equivalent time under tension using dynamic loads (360 contractions lasting 333ms each). The injured region of the tendon was collected 18 hrs after loading and immediately frozen. RNA was isolated from the tendon for RT-qPCR determination of genes involved in tendon (collagen I, III, lysyl oxidase, and scleraxis) and fibrocartilage (collagen II, aggrecan, tenascin C, and Sox9) formation.

RESULTS: Tendon scar formation was confirmed by visual inspection. The injured region showed increased vascularity and greater volume. Our preliminary findings suggest that RNA within the tendon increases from $154.4 \pm 20.5 \mu\text{g}$ at baseline to $497.9 \pm 128.1 \mu\text{g}$ two weeks after injury. Acute isometric exercise of the scarred tendon decreased RNA in the injured region slightly to $341.1 \pm 16.8 \mu\text{g}$. At the time of submission the gene expression studies are being completed.

CONCLUSIONS: This pilot study confirms that following injury there is an increase in cell mass (greater RNA) in the scar. Further work on the expression of tendon and cartilaginous genes within the scar will help with the development of a loading program to repair patellar tendinopathy.

368 Board #184 May 27 10:30 AM - 12:00 PM
Early Physiological Changes To The Vastus Lateralis After Non-invasive Anterior Cruciate Ligament Injury

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(Sponsor: Timothy A. Butterfield, FACSM)
(No relevant relationships reported)

Insufficient recovery of quadriceps muscle strength is commonly reported after anterior cruciate ligament (ACL) injury. Although weakness is secondary to a complex manifestation of inhibition, the extent and time course of the morphological changes in muscle are largely unknown. Using a novel, translational animal model of ACL injury, a longitudinal study was performed to illuminate the mechanisms underlying acute muscle atrophy. **Purpose** To investigate the role of atrophic pathways after non-invasive ACL rupture. **Methods** Male Long-Evans rats were randomly assigned to 8 groups (n=8 per group): 1 control group and 7 ACL injury groups (6, 12, 24, 48-hours, and 1, 2, 4-weeks). The right hindlimbs of ACL injury rats were exposed to a single impulse, longitudinal tibial compression, to induce a non-invasive ACL rupture, followed by normal cage activity. After which rats were euthanized as per assigned group. Right and left vastus lateralis muscles (VL) were harvested, weighed and flash

frozen in liquid nitrogen. The VL were immunoreacted for dystrophin to quantify fiber cross sectional area (CSA), and RNA was isolated to measure the abundance of MuRF-1, MAFbx (markers of protein degradation) and 45s (marker of translational capacity). rRNA expression was determined using RT-PCR. One-way ANOVAs with Bonferroni post-hoc were used to determine differences between groups, and paired t-tests were used to detect VL differences between limbs ($P < 0.05$). **Results** ACL injury resulted in a decrease in muscle wet weight ($p=0.0003$) and a trend toward reduced CSA ($p=0.06$) at 1-week post injury, compared to control, 2- and 4-week time points. CSA of the ACL injured limb VL was smaller than the VL of the contralateral limb at 1-week only ($p=0.01$). MAFbx abundance was significantly increased at 48-hours post-ACL injury ($p=0.0001$), with no differences for 45s rRNA, total RNA concentration or MuRF-1. **Conclusions** Results indicate that ACL injury induces atrophy which is transient and not related to a decrease in ribosome biogenesis but likely due to increased protein degradation. Future studies should focus on a comprehensive analysis of atrophic pathways after ACL injury, to establish key therapeutic windows for targeting therapy-resistant quadriceps weakness after ACL injury. Supported by K01AR071503.

369 Board #185 May 27 10:30 AM - 12:00 PM
Epidemiology Of Acromioclavicular Joint Injuries At A Colorado Ski Resort

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(No relevant relationships reported)

Purpose: Acromioclavicular joint (ACJ) injuries are amongst the most common injuries in winter sports. The purpose of this study was to determine trends with respect to injury mechanism, environmental factors, associated injuries, and demographics amongst patients treated for acute ACJ injuries at the Winter Park Ski Resort clinic in Colorado. **Methods:** This was a retrospective descriptive analysis, specifically using an injured patient cohort from the Winter Park Ski Resort clinic. The timeframe used was from 2012 to 2017. All patients diagnosed with an ACJ injury when seen at the ski clinic at the mountain's base were included in the patient cohort. Chart review was performed to confirm diagnosis and obtain case details. **Results:** A total of 341 acromioclavicular joint injuries (6.7% of total visits) were encountered during the study period. The majority of ACJ injuries were grade I (41.3%) and mainly occurred in men (86.5%). The majority (96.8%) of the cases were primary ACJ injuries on the right shoulder (56.9%). The average age of patients with ACJ injuries was 30.0 years (range 10-72). More than half (62.2%) of ACJ injuries occurred due to snowboarding injuries and the remaining due to skiing injuries (37.8%). The most common mechanism of injury (93.5%) was fall to snow while skiing/boarding. Women were more likely to have a grade I ACJ injury than men (80.4% vs 35.4%; $P < 0.001$). Women with ACJ injuries were more likely to suffer the injury due to skiing than snowboarding (71.7% vs 28.3%; $P < 0.001$), compared to men who were more likely to suffer the injury due to snowboarding than skiing (67.5% vs 32.5%; $P < 0.001$). **Conclusions:** Most of the ACJ injuries were Class I and occurred mostly in men. Snowboarders were more likely to have an ACJ injury than skiers.

370 Board #186 May 27 10:30 AM - 12:00 PM
Increased ATFL Thickness Associates To Decreased Physical Activity Levels After Acute Lateral Ankle Sprain

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Lateral ankle sprains remain one of the most common orthopedic injuries. Most concerning are the number of patients that develop long term ankle instability and have decreased activity levels. Despite these problems there are limited long-term studies examining changes after an acute lateral ankle sprain (LAS). **Purpose:** To examine the post-injury thickness of the anterior talofibular ligament (ATFL) and if that thickness relates to physical activity levels one year after an ankle sprain. **Methods:** Twenty college students (8 males and 12 females, age= 21.2 ± 2.4 yr., mass= 80.9 ± 21.6 kg, ht= 173.3 ± 10.6 cm) with an acute LAS and 20 healthy matched controls (8 males and 12 females, age= 21.9 ± 2.8 yr., mass= 79.1 ± 20.2 kg, ht= 172.5 ± 9.8 cm) participated in the study. ATFL thickness was measured with a LOGIQ Book diagnostic ultrasound. The examiner orientated the probe to visualize the cross sectional view of the lateral malleolus, lateral talar articular surface, and the neck of the talus. Once those landmarks and the ATFL were located, images were saved. Thickness of the ATFL was measured at the midpoint of the ligament between the attachments on the lateral malleolus and talus. The main outcome measures were the thickness of the ATFL (mm) at 3 days post LAS and 1 year post LAS, and physical activity levels as measured by the IPAQ and NASA physical activity scales. **Results:** There was a significant relationship between post-injury ATFL thickness and both the IPAQ and

NASA physical activity scales. As ligament thickness increased, "average time spent performing vigorous physical activity" significantly decreased ($p=.04$, $r^2=.86$) and "average time spent performing moderate physical activity" ($p=.02$, $r^2=.84$) also decreased one year after injury. As ligament thickness increased in subjects with a LAS, time spent walking ($p=.01$, $r^2=.92$), days per week where vigorous activity ($p=.02$, $r^2=.81$) or moderate activity ($p=.04$, $r^2=.85$) was pursued one year after their sprain significantly decreased. **Conclusions:** The changes in ATFL morphology may lead to the decreased physical activity levels by contributing to ligamentous laxity and/or perceptions of instability. Future research needs to focus on early interventions to ensure proper ligament healing occurs to restore joint function.

371 Board #187 May 27 10:30 AM - 12:00 PM

Sex Differences In The Morphology Of The Vastus Lateralis After An Anterior Cruciate Ligament Tear

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(No relevant relationships reported)

Females are three times more susceptible to tear their anterior cruciate ligament (ACL) and have significantly weaker quadriceps after injury. Despite the high frequency of injury, little is known about whether the morphology of the quadriceps alters in a sex specific manner. Muscle imaging of volume, fibrosis, pennation angle, and fiber tract length could provide valuable insights into these differences. **PURPOSE:** To investigate sex differences in morphology of the vastus lateralis (VL) after ACL injury. **METHODS:** 24 ACL deficient patients (11M, 13F, 21.8 ± 5.0 y, 25.0 ± 3.7 kg/m², days since injury 24.6 ± 16.2) underwent magnetic resonance imaging including multi echo T1ρ, DTI, and 2D turbo spin echo. Data was post-processed in MATLAB, where a mono exponential decay curve was fitted to analyze the T1ρ signal. Muscle fiber bundles were tracked by taking the first eigenvector of diffusion tensor starting at the aponeurosis until the fiber exited the side or top of the selected slices. From these tracks pennation angle and fiber length were calculated. Muscle volume was calculated by manually outlining the border of the VL. Independent t-tests compared differences between males and females.

RESULTS: T1ρ times (M: 0.031 ± 0.003 s; F: 0.028 ± 0.002 s; $p = 0.06$) and pennation angle (M: 16.6 ± 2.6°; F: 14.9 ± 1.8°) of the involved limb was not significantly different between sexes; however, fiber length was significantly longer in females compared to males (F: 55.1 ± 6.2 mm; M: 48.3 ± 7.0 mm; $p = 0.04$). Volume of the vastus lateralis was not significantly different between sexes (M: 355.1 ± 117.5 cm³; F: 335.9 ± 97.1 cm³; $p = 0.6$). **CONCLUSIONS:** We show that ACL injury results in a sex specific difference in muscle fiber length. Fiber length is an important determinant in physiological cross-sectional area (PCSA). The longer fiber lengths seen in the females may lead to decreased PCSA which could have a negative influence on quadriceps muscle strength. Potentially, this longer fiber length prior to surgery may be one factor that drives differences in recovery of muscle strength after surgery. Future work is needed to examine how these morphological aspects change over time following ACL reconstruction.

372 Board #188 May 27 10:30 AM - 12:00 PM

Skeletal Muscle Metabolic Gene Profile Associates With Rheumatoid Arthritis Improvements Following High Intensity Interval Training

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(No relevant relationships reported)

Rheumatoid arthritis (RA) is a systemic inflammatory disease characterized by exercise intolerance and increased risk for cardiometabolic disease. High intensity interval training (HIIT) improves both inflammation and cardiorespiratory fitness (CRF) in RA, however the mechanisms underpinning these therapeutic benefits are unclear.

PURPOSE: To identify baseline skeletal muscle pathways linking HIIT with improvements in RA inflammatory disease activity and CRF. **METHODS:** Participants with RA ($n=13$; mean age=63.9±7.2) underwent RA disease activity (DAS), physiologic, and biologic assessments pre- and post-10 weeks of supervised HIIT. Cardiopulmonary exercise testing measured CRF as $\dot{V}O_2$ peak (mL/kg/min). Skeletal muscle RNA was isolated from vastus lateralis biopsies. Illumina Human HT-12v4 Expression BeadChips and Ingenuity Pathway Analysis were used for quantitative whole genome RNA analyses. Differential Spearman correlations ($p<0.05$) assessed associations for baseline gene expression with Δ DAS and Δ CRF (post - pre). **RESULTS:** HIIT improved RA DAS (+23.8%; $p<0.001$) and CRF (+8.2%; $p<0.001$). Δ DAS was strongly correlated with baseline muscle expression of 46 genes ($0.80<r<-0.80$; * $p<0.001$); including genes encoding proteins involved in substrate energy

metabolism ($n=9$; LIAS, NDUFB3, GLDC, AGL, BCKDHB, PDK2, LDHB, ACS2, PANK2) and inflammatory pathways ($n=4$; FCRL6, TNFRSF19, CMT4, NKG7). In contrast, Δ CRF was strongly correlated with baseline expression of 16 genes; only 1 (NDUFB4) involved in cellular metabolism and 0 in inflammation. Novel network analysis revealed muscle upregulation of NF- κ B and MAPK/JNK pathways associated with greater improvements in DAS.

CONCLUSIONS: HIIT-mediated improvements in RA disease activity associate strongly with baseline alterations in skeletal muscle metabolic and inflammatory pathways. Thus, exercise training may improve RA inflammation via coordinated regulation of muscle and immune cell energy metabolism.

373 Board #189 May 27 10:30 AM - 12:00 PM

Effects Of Methyl Sulfonyl Methane On Knee Laxity In Females Throughout The Menstrual Cycle.

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(No relevant relationships reported)

Women have a ~4-fold greater risk of anterior cross ligament (ACL) rupture compared to men. ACL injury is associated with greater estrogen levels. Estrogen increases knee laxity, in part by blocking lysyl oxidase activity, thus decreasing collagen crosslinking and ligament stiffness. Methyl sulfonyl methane (MSM) supplementation is suggested to counter this effect.

PURPOSE: To determine whether MSM supplementation alters knee laxity over the menstrual cycle.

METHODS: Healthy women (ages 18-30) were followed over a 5-month period. Knee laxity measured using a GNRB knee arthrometer (Prothia, Worcester, MA) at menstruation and ovulation during baseline (month 1&2) and intervention phases (month 4 & 5). In a double-blinded manner, from month 3 participants were randomly assigned to daily ingestion of 3g of MSM or placebo (PLA; rice flower). Saliva samples were taken before all laxity measurements to determine estradiol levels (Salimetrics, Carlsbad, CA). Two-way ANOVA (supplementation and time) was used to determine differences with alpha set at $p < 0.05$. At time of submission data remains blinded.

RESULTS: Baseline knee laxity was the same in both groups at all time points ($n=20$, Group A $n=9$, Group B, $n=11$ due to dropout). Compared to baseline, the average knee laxity during the intervention period in Group A was significantly lower at ovulation compared to Group B ($p=0.036$). Upon analysis of estradiol levels and subsequent unblinding, the interaction between estrogen levels, laxity, supplement and time will be determined.

CONCLUSION: Knee laxity decreased at ovulation in Group A. MSM may show efficacy in decreasing knee laxity at ovulation in females and help to reduce ACL injury.

374 Board #190 May 27 10:30 AM - 12:00 PM

Asymmetric Somatosensory Nerve Excitability In Professional Rugby Players With History Of Calf Muscle Strain

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(No relevant relationships reported)

Muscle Strain Injury has been notorious for its high incidence and high recurrent ratio in a wide variety of sports. Severe muscle strain alters morphological properties of the connective tissue. Connective tissue, especially fascia which surrounds muscles, is highly sensory innervated. Therefore, we hypothesize that previous muscle strain injury affects sensory nerve transmission. Altered proprioceptive feedback will affect the muscle function which consequently may lead to muscle strain re-injury.

PURPOSE: This pilot study aimed to compare the differences between injured and uninjured leg in sensory nerve excitability of the tibial nerve in professional rugby players. Moreover, we wanted to compare it with muscle-tendon junction stiffness of gastrocnemius muscles.

METHODS: Five male professional rugby players (age/ height/ weight, ± 3.9/181.2±10.5/101±12.46) who have a history of calf strain (confirmed by MRI) were selected. The measurement was performed at least 6 weeks after injury. To evaluate sensory excitability, we examined somatosensory evoked potentials (SEPs) elicited by tibial nerve stimulation on both injured and uninjured side. Muscle stiffness (strain ratio) was also assessed by strain elastography in both injured and uninjured leg. The relationship between SEPs and strain ratio was analyzed.

RESULTS: The SEPs of the injured side was lower than that of the uninjured side (mean latency injured side/uninjured side, 7.26 m/s±1.21/9.34 m/s±2.01, $p<0.05$). However, there was no difference in muscle stiffness between the legs (mean strain ratio injured side/uninjured side, 0.128/0.124, $p=0.37$). The relationship between SEPs and muscle stiffness was found on non-significant ($p=0.74$).

CONCLUSIONS: SEP of injured gastrocnemius muscle was lower than uninjured one in professional rugby players. However, muscle stiffness did not differ.

375 Board #191 May 27 10:30 AM - 12:00 PM
Oculomotor Function In Adolescent Athletes Following Concussion

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(No relevant relationships reported)

Purpose: Visual impairments affect up to 90% of patients post-concussion and may include deficits in fixation accuracy, smooth pursuit, saccadic latencies, vergence, accommodation, or vestibulo-ocular reflexes. Quantitative assessment of oculomotor function may provide a sensitive measure of concussion recovery since coordinated eye movements require the use of diverse and widely dispersed areas of the brain. This study quantified oculomotor function over time in adolescents following concussion, hypothesizing that initial deficits would resolve by the time of RTP and remain stable after RTP.

Methods: 13 adolescent athletes with mild to moderate concussion (7 male; mean age 15.1, SD 2.1, range 10-17 years) were prospectively evaluated at their initial visit (mean 18, range 4-43 days post-concussion), at the time of RTP clearance (mean 46, range 12-173 days post-concussion), and one month later (mean 26, range 20-41 days after RTP). 11 controls without past concussion or injury (3 male; mean age 12.3, SD 3.1, range 8-17 years) were tested at similar timepoints. Eye tracking was recorded as subjects followed a target moving on a screen in predefined patterns related to sinusoid and trapezoid smooth pursuit, vergence, saccade, and anti-saccade. Metrics characterizing the speed, accuracy, and variability of tracking were compared between groups and visits using t-tests and linear mixed-effects regression.

Results: At baseline, patients tended to have greater overshoot and greater variability in tracking compared with controls, though the differences were not statistically significant. Overshoot (coef -1.97, SE 0.98, $p=0.045$), variability of tracking (-1.04, SE 0.53, $p=0.048$), and variability of overshoot (-2.59, SE 1.04, $p=0.013$) decreased from baseline to RTP. Undershoot during sinusoid smooth pursuit tended to decrease from RTP to 1-month follow-up (-0.16, SE 0.09, $P=0.080$). The rate of convergence in the distance vergence task increased (0.27, SE 0.10, $p=0.005$) while the rate of divergence decreased (-0.32, SE 0.17, $p=0.068$) between these time points.

Conclusion: Possible deficits in eye tracking resolved by the time of RTP and generally remained stable or continued improving after RTP, suggesting that oculomotor function recovers sufficiently under current conservative treatment protocols.

376 Board #192 May 27 10:30 AM - 12:00 PM
Abstract Withdrawn

A-47 Free Communication/Poster - Ankle

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

377 Board #193 May 27 9:30 AM - 11:00 AM
Visual Input Affects Force Steadiness And Accuracy Among Chronic Ankle Instability Patients, Ankle Sprain Copers, And Healthy Controls

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(No relevant relationships reported)

Chronic ankle instability (CAI) patients have demonstrated impairments of the sensorimotor system. The sensorimotor system plays an important role in steadily generating fine forces to control balance and functional movement. Submaximal force steadiness measures sensory, motor, and visual function via feedback mechanisms, which helps researchers and clinicians to comprehend sensorimotor deficits associated with CAI.

PURPOSE: This study aimed to identify effects of stroboscopic glasses on force steadiness and accuracy among CAI patients, ankle sprain copers, and healthy controls.

METHODS: Twenty CAI patients (M=10, F=10; 23±3 yrs, 174±11 cm, 76±17), 20 copers (M=10, F=10; 22±2 yrs, 176±10 cm, 69±10 kg), and 20 controls (M=10, F=10; 22±3 yrs, 174±7 cm, 80±24 kg) participated in this study. Subjects performed

a maximal voluntary isometric contraction (MVIC) of eversion, inversion, and hip abduction. Two days after MVIC tests, subjects performed 2 practices, followed by 3 testing trials of 10% and 20% of their MVIC for 15 seconds for submaximal force steadiness and accuracy measures with and without the stroboscopic glasses. The central 10-sec (20-80% of the total time) of three testing trials was analyzed. Main outcome measures were force steadiness, which was one standard deviation (SD), and force accuracy was a root mean square across the 10-sec data. Force steadiness and accuracy were analyzed by 3 (groups) x 2 (visual conditions) ANOVAS.

RESULTS: The CAI and copers subjects exhibited greater errors than controls in 20% eversion MVIC in force steadiness ($p<.0001$ and $p=.01$, respectively). CAI subjects demonstrated less steadiness in 20% eversion and hip abduction under strobe vision (SC) compared with eyes open (EO) ($p=.02$, both). Additionally, CAI subjects showed less accuracy than copers and controls in 20% eversion MVIC ($p=.0001$ and $p<.0001$, respectively). CAI subjects demonstrated less accuracy in 20% eversion under SC compared with EO ($p=.002$).

CONCLUSIONS: Individuals with a history of a lateral ankle sprain (LAS) showed reduced force steadiness than healthy controls. Only CAI patients relied more on visual input during force steadiness and accuracy tasks. A LAS injury (coper) reduced the ability to control fine force, but recurrence of LASs (CAI) altered reliance on visual input.

378 Board #194 May 27 9:30 AM - 11:00 AM
Effect Of Kinesio Taping On Postural Control In Individuals With Chronic Ankle Instability

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(No relevant relationships reported)

Chronic ankle instability (CAI), which is characterized by deficient postural control, may be improved through Kinesio Taping (KT) intervention. However, the effect of KT on postural control in individuals with CAI is controversial.

PURPOSE: This study aimed to investigate the acute effect of KT on postural control through computerized dynamic posturography (CDP) and perceived sensation in individuals with CAI.

METHODS: A total of 35 male adults with CAI participated in the study. Each participant received four random ankle taping, including KT, athletic taping (AT), sham taping (ST), and no taping (NT). Subsequently, a series of postural stability measurements was performed using CDP. The tests included sensory organization test (SOT), unilateral stance (US) test, limit of stability (LOS) test, motor control test, and adaption test (ADT). In addition, perception stability and comfort were measured through visual analogue scaling. One-way repeated measures analysis of variance was conducted to determine difference on postural control among KT, AT, ST, and NT.

RESULTS: No significant difference was observed for parameters in SOT, US test, and LOS test among four taping. In the motor control test, the amplitude scaling scores of KT were 35.87% lower than NT ($p<.001$) in forward-small slip and 21.58% lower than ST ($p=.035$) in backward-large slip. In ADT, sway energy scores were 7.59% greater in ST than this in AT ($p=.028$). For perception stability, KT was performed better than ST ($p<.001$) and NT ($p<.001$), and AT was performed better than ST ($p=.001$) and NT ($p<.001$). For perception comfort, KT was performed better than AT ($p=.001$) and NT ($p=.031$).

CONCLUSIONS: KT and AT could not facilitate postural control for CAI individuals during static and voluntary measurements. However, they could provide effective support to cope with sudden perturbation. In addition, KT improved perception stability and comfort, whereas AT improved perception stability but provided the least comfort.

379 Board #195 May 27 9:30 AM - 11:00 AM
Balance Training with Stroboscopic Vision is Superior to Balance Training Alone for Chronic Ankle Instability

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Stroboscopic Vision (SV) is characterized by intermittent visual obstruction via the use of goggles with lenses that can switch between opaque and transparent. Incorporating SV into physical training has been shown to induce more significant improvements in sports and medial fields. Given SV that has the potential to improve balance further, it may be effective to restore balance deficits in patients with chronic ankle instability (CAI). **PURPOSE:** To determine the efficacy of SV incorporated into balance training for CAI. **METHODS:** A total of 73 CAI patients were randomly assigned to one of 3 groups: balance training (BT, n=25), BT with SV (BTSV, n=24), and control (no intervention, n=24). BT consisted of progressive balance exercises (e.g., single-leg

stance/hopping on stable/unstable surface), and lasted for 6 weeks, 3 times per week, with a single session lasting about 20 minutes. BTSV was comprised of the same exercises as BT, but exercises were performed under SV. The following outcomes were assessed before and after intervention: (1) dynamic balance, quantified by Star Excursion Balance Test (SEBT) and (2) perceived joint instability, measured by Cumberland Ankle Instability Tool (CAIT). SEBT was composed of 3 directional single leg reaching tasks: anterior (A), posteromedial, and posterolateral. Reaching distances were normalized to height, with higher percentage values indicating better balance. CAIT was used to quantify the severity of ankle instability, with a lower score indicating worse ankle instability. For statistical analysis, we calculated pre-post change scores of each group for each outcome and performed a one-way ANOVA. **RESULTS:** There were significant group differences for all outcomes ($p < 0.001$). Both BT and BTSV groups significantly improved relative to the control group, with very large effect sizes (Cohen's $d = 1.46$ to 7.79). Besides, BTSV induced greater improvements for the SEBT-A performance ($p = 0.001$: pre-BT=78.0±3.5%, post-BT=85.7±3.5%; pre-BTSV=77.3±4.7%, post-BTSV=88.0±4.0%) and CAIT scores ($p = 0.042$: pre-BT=15.3±4.7pts, post-BT=20.8±4.7pts; pre-BTSV=15.1±4.8pts, post-BTSV=23.5±2.8pts). **CONCLUSION:** The current study was the first to demonstrate that CAI patients benefit from a visually challenging rehabilitation environment created by SV.

380 Board #196 May 27 9:30 AM - 11:00 AM
Effects Of Stroboscopic Vision On Postural Control In Individuals With And Without Chronic Ankle Instability
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Chronic ankle instability (CAI) patients have consistently displayed postural control deficits. Previous research postulated that CAI patients rely more on the utilization of visual feedback than controls to compensate for the proprioceptive deficits after lateral ankle sprains. However, little is known about how reduced visual feedback would alter dynamic postural control in CAI patients relative to controls and copers. **PURPOSE:** To identify the effect of visual feedback disruption via stroboscopic glasses on dynamic postural control among groups of CAI, copers, and control. **METHODS:** 20 CAI (10M, 10F, 23.6±3.9 yr, 174.5±11.8 cm, 76.3±17.5 kg), 20 copers (10M, 10F, 22.2±1.4 yr, 176.4±10.2 cm, 69.3±10.9 kg), and 20 control (10M, 10F, 22.6±2.7 yr, 174.4±7.2 cm, 80.0±24.4 kg) subjects were categorized according to the Foot and Ankle Ability Measure (FAAM) and Modified Ankle Instability Index (MAII) questionnaires. Each subject performed three trials of a single-leg-hop stabilization test with eyes open (EO) and stroboscopic vision (SV). Force data (200 Hz) were collected using an in-ground force plate to calculate the dynamic postural stability index (DPSI) and directional stability indices (medial/lateral, anterior/posterior, vertical). Two-way repeated ANOVAs (group × condition) were used to examine the differences between condition (EO, SV) and group (CAI, copers, control). **RESULTS:** Visual condition main effect was driven by differences between EO and SV during dynamic postural control ($p < 0.001$). Only CAI patients displayed altered DPSI scores between EO and SV ($p = 0.005$). However, no differences were observed in copers ($p = 0.31$) and controls ($p = 0.99$). Regardless of visual condition, CAI patients displayed dynamic postural control deficits relative to controls ($p = 0.003$) but no differences between CAI patients and copers ($p = 0.45$). For the directional stability indices, each group displayed no differences between visual conditions. **CONCLUSION:** CAI patients rely more on visual feedback during dynamic postural control than copers and controls. However, they may have decreased ability to compensate for the disrupted visual feedback during dynamic movement. Stroboscopic glasses could be effective visual-disruption devices during dynamic movement tasks regardless of lateral ankle sprain history.

381 Board #197 May 27 9:30 AM - 11:00 AM
Activities Of Hip Muscles In Response To Perturbed Walking In Individual With Chronic Ankle Instability
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 (No relevant relationships reported)

Chronic ankle instability (CAI) is not only an ankle issue, but also affects sensorimotor system. People with CAI show altered muscle activation in proximal joints such as hip and knee. However, evidence is limited as controversial results have been presented regarding changes in activation of hip muscles in CAI population. **PURPOSE:** To investigate the effect of CAI on activity of hip muscles during normal walking and walking with perturbations. **METHODS:** 8 subjects with CAI (23 ± 2 years, 171 ± 7 cm and 65 ± 4 kg) and 8 controls (CON) matched by age, height, weight and dominant

leg (25 ± 3 years, 172 ± 7 cm and 65 ± 6 kg) walked shod on a split-belt treadmill (1 m/s). Subjects performed 5 minutes of baseline walking and 6 minutes walking with 10 perturbations (at 200 ms after heel contact with 42 m/s² deceleration impulse) on each side. Electromyography signals from gluteus medius (Gmed) and gluteus maximus (Gmax) were recorded while walking. Muscle amplitudes (Root Mean Square normalized to maximum voluntary isometric contraction) were calculated at 200 ms before heel contact (Pre200), 100 ms after heel contact (Post100) during normal walking and 200 ms after perturbations (Pert200). Differences between groups were examined using Mann Whitney U test and Bonferroni correction to account for multiple testing (adjust α level $p \leq 0.0125$). **RESULTS:** In Gmed, CAI group showed lower muscle amplitude than CON group after heel contact (Post100: 18±7 % and 47±21 %, $p < .01$) and after walking perturbations (31±13 % and 62±26 %, $p < .01$), but not before heel contact (Pre200: 5±2 % and 11±10 %, $p = 0.195$). In Gmax, no difference was found between CAI and CON groups in all three time points (Pre200: 12±5 % and 17±12 %, $p = 0.574$; Post100: 41±21 % and 41±13 %, $p = 1.00$; Pert200: 79±46 % and 62±35 %, $p = 0.505$). **CONCLUSIONS:** People with CAI activated Gmed less than healthy control in feedback mechanism (after heel contact and walking with perturbations), but not in feedforward mechanism (before heel contact). Less activation on Gmed may affect the balance in frontal plane and increase the risk of recurrent ankle sprain, giving way or feeling ankle instability in patients with CAI during walking. Future studies should investigate the effect of Gmed strengthening or neuromuscular training on CAI rehabilitation.

382 Board #198 May 27 9:30 AM - 11:00 AM
Verbal Encouragement Improves Star Excursion Balance Test Performance In Patients With Chronic Ankle Instability
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PURPOSE: The Star Excursion Balance Test (SEBT) is a common dynamic balance test. Functional limitations on the SEBT are associated with CAI, but psychological constraints such as kinesiphobia or a lack of confidence may affect performance. The purpose of this study was to investigate the effects of verbal encouragement (VE) on maximum reach distance performance between CAI and healthy participants on the SEBT and to explore the role of kinesiphobia with this functional. **METHODS:** Thirty-four individuals: 17 CAI (10 F/7 M; age= 21.06±3.19yr; height=171.2±11.9 cm; weight=67.7±10.8 kg) and 17 healthy controls (10 F/7 M; age=19.41 ±1.23yr; height=169.35±6.36 cm; weight=64.89±8.76kg) volunteered. Independent variables included condition (VE vs No VE) and group (CAI vs Healthy). The Fear Avoidance Beliefs Questionnaire (FABQ) was administered. Participants completed 3 SEBT trials per condition, starting with No VE followed by VE to eliminate the effect of heightened motivation with a randomized order. Analysis of Variance (ANOVA) examined group differences and whether VE affected performance for Anterior (ANT), Posteromedial (PM), and Posterolateral (PL) reach distances. FABQ was compared between the CAI and Healthy groups using a t-test; all alpha levels were $< .05$ a priori. **RESULTS:** With No VE, a significant group-by-condition interaction was observed in both the ANT (CAI: 66.90 ± 5.50 vs Healthy: 70.65 ± 4.52) and PM (CAI: 77.60 ± 7.70 vs Healthy: 81.89 ± 8.25 reach directions, which diminished with VE: ANT (CAI: 70.43 ± 4.52 vs Healthy: 71.77 ± 5.10) and PM (CAI: 85.41 ± 7.19 vs Healthy: 86.45 ± 8.71), showing that the two groups behaved similarly with VE. There was no statistically significant interaction ($p = 0.48$) for the PL reach direction without VE (CAI: 73.60 ± 7.84 vs Healthy: 75.16 ± 11.72) or with VE (CAI: 80.18 ± 9.79 vs Healthy: 80.06 ± 11.93). The CAI group had significantly higher FABQ scores (10.53 ± 9.45) than the healthy group (0.41 ± 1.70) ($p < .001$). **CONCLUSIONS:** The CAI group had lower performance on the SEBT without VE, but with VE, the scores were comparable to healthy controls. Clinicians and researchers should acknowledge the impact that motivation and psychological stresses have on functional performance in patients with pathologies such as CAI.

383 Board #199 May 27 9:30 AM - 11:00 AM
Comparison Of Gender Differences In Ankle And Knee Proprioception
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 (No relevant relationships reported)

It was reported that in same sports program and training intensity, knee and ankle injury in female is 2-8 times higher than males. The decline of posture control is an important cause for sports injuries. Postural control is accomplished by the combination of proprioception, central and neuromuscular control. Proprioception is a crucial component in maintaining the body stability. **PURPOSE:** The purpose of this study was to investigate whether there exist gender differences in knee and ankle

proprioception between male and female in follicular cycle. **METHODS:** Twenty-four healthy college student (male: n=12, age: 23.08±1.8 years; height : 1.73±0.07m; weight : 59.83±12.69kg; female: n=12, age: 21.75±1.77 years; height : 1.64±0.64m weight : 56.25±6.77kg) were included in the study. Knee and ankle proprioception were measured by an electric-driven movable frame which was moved by an electric motor rotated the foot on an axis at a rate of 0.4°/s. The test results were averaged from five times movement in each direction such as knee flexion and extension; plantarflexion, and dorsiflexion in ankle joint. The independent t test was used to compare differences between proprioception of ankle and knee joint in males and follicular females. The significance level was p<0.05. **RESULTS:** There were no significant differences between proprioception of plantarflexion (male: 0.78±0.26 °; female: 0.65±0.27 °, p=0.215) and dorsiflexion (male: 0.64±0.18 °; female: 0.62±0.33 °, p=0.872) between males and follicular females. No significant differences were found on knee flexion (male: 0.54±0.21°; female: 0.54±0.32 °, p=1.000) and extension (male: 0.55±0.23 °; female: 0.43±0.17 °, p=0.132) in male and follicular female. **CONCLUSIONS:** There were no significant gender differences on ankle and knee proprioception. Therefore, proprioception may not be the cause of the decline in posture control of female.

384 Board #200 May 27 9:30 AM - 11:00 AM
Altitude Training Mask Alters Ankle Joint Kinetics During Treadmill Walking

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 (No relevant relationships reported)

Elevation training masks are commonly used in strength and conditioning to simulate working in a hypoxic environment through resisted inspiration (RI). It is further suggested that RI improves the ability of the athlete's muscle to utilize available oxygen carried by hemoglobin. Though some data exists regarding gross training performance in elevation training masks, little data is available regarding the effect of elevation training masks on lower extremity joint biomechanics during an exercise task. **PURPOSE:** to determine the effects of an altitude training mask on ankle joint kinetics during a treadmill walking task. **METHODS:** Seven healthy young adults performed two 10-minute treadmill walking tasks at 1.6 m/s in each of two conditions: normal walking (CON) and with RI. Three-dimensional kinematics and ground reaction forces (GRFs) were simultaneously recorded using a 6-camera motion capture system (250 Hz) and instrumented treadmill (1500 Hz). Peak ankle plantarflexor moments and powers were determined from the second (M2) and tenth (M10) minutes of the treadmill walking task. Two repeated measures ANOVAs were used to determine the effects of time and condition on peak plantarflexor moments and powers. **RESULTS:** No time by condition interactions were observed for plantarflexor moments (p = 0.26) or powers (p = 0.18). The RI condition was associated with greater plantarflexor moments (p = 0.04) and powers (p = 0.01) than the CON condition. No effects of time were observed for plantarflexor moments (p = 0.84) or powers (p = 0.63). **CONCLUSIONS:** These findings demonstrate that ankle joint kinetics are greater when performing a treadmill walking task when wearing an elevation training mask. Given the constant mechanical demand, these data suggest that a multi-joint mechanical adaptation occurred in response to the elevation training mask. Subsequent research may seek to address changes in joint contributions to the walking task when wearing an elevation training mask.

Table 1. Mean ankle joint moments and powers during stance phase propulsion in the second (M2) and tenth (M10) of the CON and RI conditions.

Condition	Moment		Power	
	M2	M10	M2	M10
CON	-1.24 (0.32)	-1.25 (0.34)	2.11 (0.45)	2.12 (0.54)
RI	-1.25 (0.35)	-1.31 (0.35)	2.26 (0.54)	2.50 (0.50)

385 Board #201 May 27 9:30 AM - 11:00 AM
Influence Of Ankle Flexibility On The Single Leg Balance Test Using A Dynamic Balance System

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Ankle range of motion (ROM) is believed to be one of the contributing factors in balance deficits. Multiple studies have investigated balance in reference to vision, strength, vestibular function, proprioception, and sensation. However, most of these studies have utilized geriatric, athletic, or injured populations focusing on static

balance measures. **PURPOSE:** Although there are multiple factors that play a role in balance, the purpose of this study was to assess the influence of ankle flexibility on dynamic single leg balance in fit and unfit males. **METHODS:** Twenty-five male subjects (age = 22 ± 2 years; ht. = 179 ± 7 cm; wt. = 85.6 ± 15 kg) were recruited for this study. Ankle flexibility (which includes dorsiflexion, plantarflexion, eversion, and inversion) was measured in degrees for both legs with a goniometer. Subjects then completed four trials, of which the first two trials were familiarization, of the single leg balance test for each leg on a dynamic balance system. Mean stability index (SI) was calculated for the last two trials and both a Pearson Correlation and Independent T-test were utilized. **RESULTS:** No significant correlations between overall stability and dorsiflexion (p = 0.899), plantarflexion (p = 0.790), eversion (p = .704), and inversion (p = .550) on the left and right ankle were present (p < 0.05). However, there was a significant correlation between inversion of the left ankle and medial/lateral SI (p = 0.022); and between dorsiflexion of the left ankle and anterior/posterior SI (p = 0.049). No significant differences for ankle flexibility or SI occurred between unfit and fit individuals (p < 0.05). **CONCLUSION:** Results suggest ankle ROM may be a contributing factor in dynamic balance on the non-dominant leg.

386 Board #202 May 27 9:30 AM - 11:00 AM
The Relationship Between Perception Of Ankle Instability And Dynamic Balance In Individuals With A History Of Ankle Sprains

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 (No relevant relationships reported)

PURPOSE: Ankle sprains are common injuries which can progress to chronic ankle instability (CAI) and balance impairments. While objective data guide treatment for individuals with CAI, the patient's subjective experience is often overlooked and not counted in the adoption of plan of care. Individual perception of ankle instability is an important factor and has the potential to influence presentation of sensorimotor impairments either through neuromotor or fear-avoidance mechanisms. The purpose of this study was to explore the contribution of perception of unilateral and bilateral CAI on a dynamic balance test.

METHODS: Subjects were males and females 18-35 years old (n=25, age= 23.8 ± 1.8 yr.). All subjects completed the Cumberland Ankle Instability Tool (CAIT) to measure perceived ankle instability (lower CAIT scores are associated with greater perceived instability). Dynamic balance was assessed using 3 repetitions in each direction (anterior, postero-medial, and postero-lateral) of the Y-Balance Test (YBT). Asymmetries in CAIT scores and reach distances were calculated by subtracting right leg values from left leg values. Further comparisons were analyzed between groups of bilaterally highest (>80%) and lowest (<20%) combined CAIT scores.

RESULTS: There was a significant positive moderate correlation between CAIT asymmetries and asymmetries in the anterior reach (r=0.526, p=0.007) and the posteromedial reach scores (r= 0.554, p=0.004). Significant differences were found between participants with the highest (n=5) and lowest (n=5) bilateral CAIT scores in right posteromedial reach (101.60 ± 9.91 vs 86.80 ± 5.89, p=0.02), right posterolateral reach (96.40 ± 7.70 vs 76.80 ± 4.87, p=0.001), and right composite score (89.96 ± 5.93 vs 78.44 ± 3.85, p=0.007).

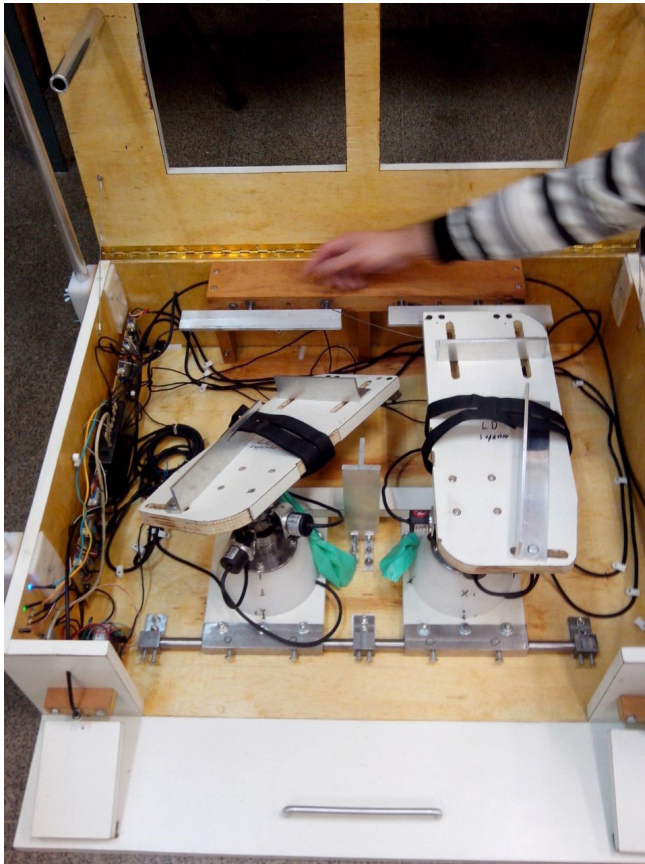
CONCLUSION: Subjects reporting increased perceived ankle instability demonstrated decreased YBT performance on the side of perceived instability. Decreased reach distances may be attributable to neuromuscular consequences of ankle injury, changes in movement strategy associated with apprehension, or both. In fact, the larger the perceived asymmetries the greater the performance deficits. These findings may help clinicians contextualize sensorimotor assessment results in patients with a history of ankle sprain.

387 Board #203 May 27 9:30 AM - 11:00 AM
Static Platform Model Evaluation For Study Of Sudden Ankle Movement.

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 (No relevant relationships reported)

PURPOSE: Ankle sprains are very common in sports and can cause joint instability with clinical and performance consequences. The sudden ankle inversion platform that simulates the sprain movement evaluates the movements performed associated with the electromyography of the fibular and anterior tibial muscles. The aim of this research is to develop a sudden ankle inversion platform limited to 15° medial rotation, 20° plantar flexion, 20° inversion, and to evaluate the mechanical sprain movement associated with the electromyographic response of the fibular and anterior tibial muscles of soccer players. **METHODS:** A total of 30 soccer players between 16 and 19 years

old without history of ankle sprain were studied at the ankle assessment platform. Each athlete was randomly subjected to ankle sprain movement on the platform for 10 repetitions (five on each limb), associated with electromyography of the anterior tibial and fibular muscles. Friedman statistical tests were performed with related samples of nonparametric quantitative data, in cases where there was significance ($p < 0.05$) Dunn's post-test was performed. **RESULTS:** There was no statistical difference ($p > 0.05$) between latency of movement (0.9 ± 0.2 ms) and to reach the maximum range of motion during plantar flexion (78 ± 4.2 ms) and medial rotation (120 ± 2.3 ms). There was an increase in the angular velocity of inversion ($p < 0.05$) during the attempts (230 ± 20.6 °/s). There was no difference ($p > 0.05$) in latency time of the anterior tibial (25 ± 5.2 ms) and fibular muscles (33 ± 4.1 ms). **CONCLUSION:** The sudden static platform was reliable to evaluate the movements performed by the ankle during mechanical sprain, with no difference in the mechanical and electromyographic behavior evaluated during the 10 repetitions.



388 Board #204 May 27 9:30 AM - 11:00 AM
Side Comparison Of Knee Muscle Activities In Response To Perturbed Walking Of Unilateral Ankle Instability

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 (No relevant relationships reported)

Acute ankle sprain leads in 40% of all cases to chronic ankle instability (CAI). CAI is related to a variety of motor adaptations at the lower extremities. Previous investigations identified increased muscle activities while landing in CAI compared to healthy control participants. However, it remains unclear whether muscular alterations at the knee muscles are limited to the involved (unstable) ankle or are also present at the uninvolved leg. The latter might potentially indicate a risk of ankle sprain or future injury on the uninvolved leg. **Purpose:** To assess if there is a difference of knee muscle activities between the involved and uninvolved leg in participants with CAI during perturbed walking. **Method:** 10 participants (6 females; 4 males; 26 ± 4 years; 169 ± 9 cm; 65 ± 7 kg) with unilateral CAI walked on a split-belt treadmill (1m/s) for 5 minutes of baseline walking and 6 minutes of perturbed walking (left and right side, each 10 perturbations). Electromyography (EMG) measurements were performed at biceps femoris (BF) and rectus femoris (RF). EMG amplitude (RMS; normalized to MVIC) were analyzed for 200ms pre-heel contact (Pre200), 100ms post heel contact (Post100) and 200ms after perturbation (Pert200). Data was analyzed by paired t-test/Wilcoxon

test based on presence or absence of normal distribution (Bonferroni adjusted α level $p \leq 0.0125$). **Results:** No statistical difference was found between involved and uninvolved leg for RF (Pre200: $4 \pm 2\%$ and $11 \pm 22\%$, respectively, $p = 0.878$; Post100: 10 ± 5 and $18 \pm 31\%$, $p = 0.959$; Pert200: $6 \pm 3\%$ and $13 \pm 24\%$, $p = 0.721$) as well as for BF (Pre200: $12 \pm 7\%$ and 11 ± 6 , $p = 0.576$; Post100: $10 \pm 7\%$ and $9 \pm 7\%$, $p = 0.732$; Pert200: 7 ± 4 and $7 \pm 7\%$, $p = 0.386$). **Discussion:** No side differences in muscle activity could be revealed for assessed feedforward and feedback responses (perturbed and unperturbed) in unilateral CAI. Reduced inter-individual variability of muscular activities at the involved leg might indicate a rather stereotypical response pattern. It remains to be investigated, whether muscular control at the knee is not affected by CAI, or whether both sides adapted in a similar style to the chronic condition at the ankle.

A-48 Free Communication/Poster - Biomechanics of Clinical Tests

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

389 Board #205 May 27 9:30 AM - 11:00 AM
Correlations Between Dual-task Costs In Clinic Versus Laboratory Movements

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 (No relevant relationships reported)

Identifying increases in injury-relevant biomechanics when athletes are distracted by a secondary task may be important for assessing performance and injury risk in athletic environments. It is unknown if this dual task cost (DTC) measured during detailed motion capture testing is associated with DTC on simple clinical tests. Such a relationship may prove useful for improving clinically feasible return-to-play assessments.

PURPOSE: Investigate whether dual-task ability spans clinical and laboratory methods of assessment. **METHODS:** Twenty-three female soccer players (21 ± 3 yrs, 1.7 ± 0.1 m, 64 ± 10 kg) completed an agility drill requiring two 90° turns and one 180° turn. This was completed in isolation (baseline) and under three dual-task conditions: counting backwards by seven (S7), dribbling a soccer ball (BH), and combined ball dribbling and counting tasks (BHS7). Agility drill DTC (aDTC) was calculated as the percent change in completion time between dual-task and baseline conditions. A jump-land-jump task from a 30 cm box was also completed while 3D kinematics and kinetics were recorded. Dual task jump conditions included working memory (WM), working memory + visual attention task (WMV), and unanticipated working memory + visual attention task (UWMV) tasks. Biomechanical DTC (bDTC) was calculated as the percent change in peak knee valgus moment (pkVM) between dual-task jump landings and a single-task jump landing. Spearman's rho correlations were run between all combinations of aDTC and bDTC (Figure 1). **RESULTS:** Increases in aDTC for the S7 condition were associated with increases in bDTC for the WMV ($p = 0.49$, $p = 0.02$) and the WM ($p = 0.43$, $p = 0.04$) conditions. No other relationships reached significance (i.e., $p > 0.05$). **CONCLUSION:** Dual-task ability spanned clinical and laboratory assessments when the secondary task was an anticipated cognitive task. Further research is needed to establish the clinical utility of these relationships.

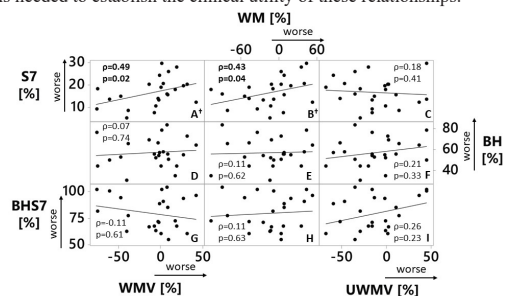


Figure 1: Spearman's Rho correlations for aDTC vs bDTC: (A) S7 vs WMV, (B) S7 vs WM, (C) S7 vs UWMV, (D) BH vs WMV, (E) BH vs WM, (F) BH vs UWMV, (G) BHS7 vs WMV, (H) BHS7 vs WM, and (I) BHS7 vs UWMV. * Indicates $p < 0.05$

WEDNESDAY, MAY 27, 2020

390 Board #206 May 27 9:30 AM - 11:00 AM
Relationships Between Feedforward And Feedback Movement Control Strategies And The Star Excursion Balance Test.

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 (No relevant relationships reported)

PURPOSE: The Star-Excursion Balance Test (SEBT) is commonly used to assess dynamic balance. While the maximum reach distance (MRD) of the posteromedial (PM) direction of the SEBT is lower in individuals with ankle and knee dysfunction, we do not know whether MRD relates to feedforward and feedback movement control strategies. The purpose of this study was to assess the relationships between MRD of PM-SEBT and muscle activation levels, reflex responses to unexpected perturbations, and kinematics during a single-leg squatting (SLS) task.

METHODS: 20 healthy participants performed the PM-SEBT and two, 9-condition SLS tasks on a custom-built device, once with a flexing and once with an upright trunk. SLS conditions varied by speed and resistance with one random perturbation induced per condition. Sagittal motion was captured via Vicon. EMG were recorded from the Quadriceps (Q), Hamstrings (H), Gluteus Medius (GMed), and Soleus (Sol). EMG and kinematics during feedforward (FF) (-50-0 ms) and feedback (short-latency reflex (SLR) 0-50ms, long-latency reflex (LLR) 50-200ms) motor control were compared to MRD. Pearson Correlations were calculated for SLS EMG and kinematics (hip, knee, and ankle) to MRD. Step-Wise Regression to predict MRD was performed using significantly correlated SLS variables.

RESULTS: Significant correlations between SLS EMG and MRD: FF H (Flexing: $p=0.014$, $R=-0.540$; Upright: $p=0.015$, $R=-0.537$), SLR H (Flexing: $p=0.044$, $R=0.454$; Upright: $p=0.017$, $R=-0.528$), SLR QH Ratio (Flexing: $p=0.020$, $R=-0.516$), LLR H (Flexing: $p=0.007$, $R=-0.581$; Upright: $p=0.011$, $R=-0.557$), and LLR QH Ratio (Flexing: $p=0.042$, $R=0.458$). Significant correlations between SLS kinematics and MRD: SLR Hip flexion (Flexing: $p=0.018$, $R=-0.522$) and LLR Hip flexion (Flexing: $p=0.021$, $R=-0.512$). Step-wise regression results: LLR H Flexing explained 33.8% of the variance in MRD ($p=0.007$, $R=-0.581$).

CONCLUSIONS: Greater Hamstrings activation during feedforward and feedback control (SLR, LLR) and greater hip flexion during feedback control of a perturbed single-leg squatting task were associated with poorer dynamic balance during the PM-SEBT.

391 Board #207 May 27 9:30 AM - 11:00 AM
Sex Differences In Lower Extremity Kinematics During Overhead And Single Leg Squat Tests

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The Overhead Squat (OHS) and Single-Leg Squat (SLS) are two clinical tests commonly used by sports medicine practitioners to identify high-risk biomechanical movement patterns. Traditional scoring of these tests requires subjective judgement whereas new technology has allowed for automatic scoring and additional objective data. To date, few studies have examined sex differences in OHS and SLS performance and none measured with a marker-less motion capture system. **PURPOSE:** To determine if biomechanical differences exist between male and female collegiate athletes during performance of an OHS and SLS. **METHODS:** 75 female (18.1±0.4y; 166.9±6.5cm; 64.1±10.2kg) and 58 male (18.7±1.2y; 184.4±7.1cm; 86.9±15.2kg) collegiate athletes completed OHS and SLS testing as part of their pre-participation exam. Men's sports included football (n=24), baseball (n=19), lacrosse (n=10), and swimming (n=5); women's sports included track and field (n=23), field hockey (n=12), softball (n=12), lacrosse (n=9), swimming (n=7), soccer (n=6), golf (n=3), tennis (n=2), and gymnastics (n=1). Participants completed 4 OHSs followed by 4 SLSs on each leg. A Microsoft Kinect sensor using Athletic Movement Assessment software (PhysiMax®) was used to measure all kinematic variables. Differences between males and females were assessed with independent *t*-tests. **RESULTS:** For the OHS, males displayed greater peak knee varus (M: 25.7°±9.6°, F: 19.8°±8.2°; $P<0.001$), peak hip flexion (M: -93.6°±14.41°, F: -86.9°±14.5°; $P<0.05$), and peak trunk flexion angles (M: 11.5°±10.9°, F: 6.3°±9.2°; $P<0.01$). Females displayed greater peak ankle dorsiflexion angles (F: -28.7°±5.8°, M: -26.5°±6.3°; $P<0.05$). For the SLS (dominant limb), males displayed greater peak trunk flexion (M: 32.2°±5.6°, F: 27.6°±6.6°; $P<0.001$) and lateral pelvic angles (M: 4.2°±3.9°, F: 2.9°±2.7°; $P<0.05$). For the non-dominant limb, females displayed greater peak knee valgus angles (F: -12.5°±9.1°, M: -8.9°±9.1°; $P<0.05$) whereas males displayed greater peak trunk flexion angles (M: 31.7°±5.5°, F: 27.5°±6.9°; $P<0.001$). **CONCLUSION:** Male and female collegiate athletes displayed different movement strategies during performance of an OHS and SLS. Injury prevention programs may need to target sex-specific biomechanical patterns to improve movement capacity.

392 Board #208 May 27 9:30 AM - 11:00 AM
Difference In Healthy Male & Female EMG Activity During The Y Balance Test

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Y balance test kit™ (YBT) is commonly used for the clinical assessment of dynamic balance. YBT is an instrumented version of the Star Excursion Balance test (SEBT) that has Anterior (A), Posteromedial (PM), and Posterolateral (PL) directions of the SEBT. Reach distance and kinematic difference on the YBT have been reported to differ across gender.

PURPOSE: To compare muscle activity of the lower extremity muscles between males and females on YBT on the stable and unstable surfaces.

METHODS: Surface EMG was collected on 10 male and 10 female healthy adults for gluteus maximus, gluteus medius (GMED), medial hamstrings, biceps femoris, vastus medialis, rectus femoris, vastus lateralis, anterior tibialis (AT), and medial gastrocnemius (MG) on the stance leg while performing YBT during stable and unstable conditions. During stable condition, the participant stood on the YBT kit to perform the test. Same activity was also performed on the unstable surface that was introduced using Theraband™ stability trainer which was placed on top of the foot placement site of the YBT kit. Independent *t* test assessed differences in EMG between males and females for each direction and each muscle during YBT for stable and unstable conditions separately with α at 0.05. EMG were reported as the percentage of the maximal voluntary isometric contraction (%MVIC).

RESULTS: Females showed significantly higher EMG than males for GMED (31±16 vs 15±8 %MVIC; $P=0.01$), AT (61±14 vs 42±14 %MVIC; $P<0.01$), and MG (60±29 vs 35±20 %MVIC; $P=0.04$) in PL direction on the stable surface. Similarly, on unstable surface females showed significantly higher EMG than males for TA in A (52±9 vs 35±8 %MVIC; $P<0.01$), PM (55±17 vs 37±14 %MVIC; $P=0.02$), and PL (67±18 vs 43±10 %MVIC; $P<0.01$) directions and for MG in A (61±22 vs 36±19 %MVIC; $P=0.01$) and PL (74±34 vs 42±22 %MVIC; $P=0.02$) directions of the YBT.

CONCLUSIONS: Females produced higher muscle activity than males mostly for the ankle muscles irrespective of the surface. Higher muscle recruitment could be an indication of reduced muscle strength in females. This difference in the muscle activation among the genders maybe one of the factors for increased susceptibility of female athletes to injuries.

393 Board #209 May 27 9:30 AM - 11:00 AM
Kinetic Factors Influencing Y-Balance Test Performance Kinetic Factors Influencing Y-Balance Test Performance

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The Y-Balance Test (YBT) is a movement screen which assesses dynamic stability and neuromuscular control of the lower extremity. Several studies have analyzed kinematic predictors of YBT performance, but kinetic factors determining YBT performance are not well understood. **PURPOSE:** To determine relationships between sagittal, frontal, and transverse plane joint kinetics and YBT performance. **METHODS:** 31 healthy individuals (15M, 16F; age 23.1 ± 7.3; height 172.3 ± 9.1 cm; mass 59.05 ± 9.8 kg) participated in this study. Whole body kinematics were recorded using a motion capture system while dominant limb YBT trials were performed on a single force plate. Joint moments were calculated using inverse dynamics. Maximum reach distances normalized to leg length in the anterior (A), posterior-medial (PM), and posterolateral (PL) directions were calculated. Joint moment values at maximum reach in each direction were determined. All joint kinetic variables which were correlated with max reach distances at the $p < 0.1$ level were entered into a stepwise linear regression. **RESULTS:** In the A direction, a model containing knee extensor moment explained 21% of the variance in reach distance ($p = .01$). In the PM direction, a model containing hip extensor and knee rotator moments explained 67% of the variance in reach distance ($p < .001$). In the PL direction, a model containing hip extensor moments explained 34% of the variance in reach distance ($p=.001$). **CONCLUSIONS:** Performance on the YBT is primarily influenced by the joint moments at the hip and knee. These results support previous claims that YBT performance is an indicator of neuromuscular control of the lower extremity, and at the hip and knee in particular. Further studies should evaluate the extent to which muscular strength influences both the moments generated during YBT and relationships between joint kinetics and YBT performance.

Table 1: Stepwise multivariable regression results for relationship between joint moments at peak reach direction and YBT performance.

Reach Direction	Variables in Final Regression Model	Beta	p-value	Lower 95%	Upper 95%
Anterior	Knee extensor moment (Nm/kg)	0.044	0.01	0.012	0.077
Posteromedial	Hip extensor moment (Nm/kg)	-0.125	<0.001	-0.175	-0.076
	Knee rotator moment (Nm/kg)	-0.248	<0.001	-0.362	-0.134
Posterolateral	Hip extensor moment (Nm/kg)	-0.164	0.001	-0.251	-0.076

394 Board #210 May 27 9:30 AM - 11:00 AM

The Association Between Previous Injury And Two Lower Extremity Functional Tests

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Previous injury to the lower extremity may increase an athlete's risk for future injury. Functional screening is one way to determine if an athlete is at a higher risk of future injury. By assessing athletes' performance on these tests, there is potential for medical providers to implement intervention strategies to decrease risk of future injury. **PURPOSE:** To determine the association between previous history of injury and two lesser known lower extremity functional tests, the single-leg hip bridge (SLHB) and the single-leg wall-sit (SLWS). **METHODS:** Sixty-eight recreationally active (participation in exercise or sports for at least 3 days per week for 30 minutes) individuals completed this cross-sectional study. Each participant completed continuous repetitions of a SLHB until failure and repeated on the contralateral leg, as well as a SLWS test, bilaterally, where they were required to hold a single-leg wall sit position until failure. Simple linear regression models were conducted to assess the association between previous injury and the SLHB score and SLWS time. A Poisson regression model was used to assess the association with previous injury for the right and left leg scores on the SLHB. **RESULTS:** Seventy participants were screened for this study. Of the 70, 2 were excluded, leaving 68 total participants (21 men, 22.4 ± 5.7 years old, 181.96 ± 6.78 cm, and 78.66 ± 10.60 kg and 47 women, 23.3 ± 1.7 years old, 166.30 ± 9.06 cm, and 66.22 ± 9.99 kg). Twenty-five (37%) participants self-reported a previous injury. There was a statistically significant association between a previous injury and the SLHB for the right leg (Relative Risk (RR) = 0.93; 95% Confidence Interval (CI): 0.76-0.93), but not statistically significant association between previous injury and SLHB for the left leg (RR = 0.98; 95% CI: 0.86-1.05). There was no statistically significant association between the SLWS time on either the right (mean difference = 5.57 seconds; 95% CI: -14.17-3.04) or left (mean difference = 5.68 seconds; 95% CI: -13.37-2.02) with previous injury. **CONCLUSION:** These findings indicate that previous injury to the lower extremity may not affect SLWS time. The SLHB count could be affected depending on the side the injury was on, but additional research is warranted.

395 Board #211 May 27 9:30 AM - 11:00 AM

Reliability Estimates Of The Tuck Jump Assessment Following A Standardized Training Session

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The Tuck Jump Assessment (TJA), is a "clinician-friendly" test used to assess technique flaws during a 10-second, high intensity, jumping bout. Although the TJA has broad clinical applicability, there is no standardized training to maximize the measurement properties of the TJA. **PURPOSE:** To determine the reliability of the TJA using a variety of healthcare professionals following an online standardized training program. **METHODS:** A website was created by a physical therapist (PT) with videos and written descriptors of the 10 TJA technique flaws and examples of what constituted no flaw, minor flaw, or major flaw (0,1,2) using published standards. The website content was then validated (both face and content) by 4 experts (2 athletic trainers (AT) and 2 PTs). Three raters of different professions: a PT, an AT, and a Strength and Conditioning Coach Certified (SCCC), were selected due to their expertise with injury and athletic performance. The raters scored 41 videos of participants' TJAs after reviewing online standardized training scored the same 41 videos 2 weeks later. Reliability estimates were determined using intraclass correlation coefficients (ICCs) for summative scores of the 10 flaws and Krippendorff α (K α) for the individual technique flaws (ordinal). **RESULTS:** Of all individual technique flaw reliability estimates, only 11 (50 total) were above the acceptable level (K α = 0.80). The summative score had moderate interrater reliability in both sessions (Session 1: ICC_{2,2} = 0.64; 95% CI (Confidence Interval) (0.34-0.81); Standard Error Measurement (SEM) = 0.66 flaws and Session 2: ICC_{2,2} = 0.56; 95% CI (0.04-0.79); SEM = 1.30). Rater 1 (PT) had a good reliability (ICC_{2,2} = 0.76; 95% CI (0.54-0.87); SEM = 0.26),

rater 2 (SCCC) had a moderate reliability (ICC_{2,2} = 0.62; 95% CI (0.24-0.80); SEM = 0.41) and rater 3 (AT) had excellent reliability (ICC_{2,2} = 0.98; 95% CI (0.97-0.99); SEM = 0.01). **CONCLUSION:** All raters, across professions, had at least good reliability estimates for the summative score; yet the same level of consistency was not seen when evaluating each technique flaw. These findings suggest that the summative score may not be as accurate when compared to individual technique flaws, and should be used with caution.

396 Board #212 May 27 9:30 AM - 11:00 AM

Serial 7'S Do Not Discriminate Between Sports-related Concussion And Controls: Alternative Dual-task Paradigms

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Dual-task (DT) tandem gait has been used as a viable, functional task of postural stability and cognitive changes following a sports-related concussion (SRC). Additionally, completing tasks that test cognitive abilities during DT, such as serial 7's, is thought to capture cognitive changes. However, current methods of collecting DT information may not have sensitive psychometric properties. **PURPOSE:** The purpose of this study was to examine differences in time and errors in DT tandem gait testing between NCAA Division I athletes with and without SRC. **METHODS:** 13 Division I athletes with sports-related concussion (SRC: 6 males and 7 females, age=20±1) and 13 nearly-matched controls (CON: age=19±1) completed three trials of DT tandem gait using the Tekscan Strideway (100Hz, Boston, MA). All SRC participants had a medically-verified SRC and were assessed within 24-48 hours post-injury. All CON assessments were collected during pre-season. In the DT condition, all participants completed serial 7's subtraction with random numbers between 50-100. Data collected for tandem gait trials included time to complete the walking task and number of errors emitted. **RESULTS:** Paired t-tests were used to assess the differences across the average time and errors across trials. Results indicate that the SRC group (M time=23.7±7.5s) took significantly longer to complete DT compared to the CON group (M time=17.2±5.1s, p=0.03, d=1.0). Total amount of errors emitted during the DT were not significantly different (SRC: M errors=1.3±1.6, CON: M errors =0.7±0.6, p=0.18, d=0.49). **CONCLUSIONS:** Only time in DT trials appears to be a viable method of discriminating between participants who experienced an SRC compared to those without SRC. This indicates that errors emitted during a serial 7's task may not provide meaningful information regarding cognitive changes following SRC. Extant literature indicates that serial 7's may be a favored task among researchers, however, alternative tasks may provide a more sensitive measure of cognitive changes. Future research should examine the use of alternative tasks, such as an auditory Stroop task, which may provide more clinically meaningful data.

A-49 Free Communication/Poster - Maternal and Child Health

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

397 Board #213 May 27 10:30 AM - 12:00 PM

Objectively Measured Physical Activity During The First Trimester And Glucose Tolerance At 24-28 Weeks Gestation

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Physical activity (PA) during pregnancy may improve glucose tolerance and reduce the risks of adverse outcomes associated with pregnancy hyperglycemia (e.g., pregnancy and delivery complications, delivering a large infant, and developing diabetes later in life), yet the evidence to date has primarily relied on self-reported PA via questionnaire. **PURPOSE:** To examine whether objectively measured PA during the first trimester of pregnancy is associated with glucose tolerance at 24-28 weeks' gestation. **METHODS:** Study participants (n=261) were a subsample of the Gestational Weight Gain and Optimal Wellness (GLOW) trial conducted at Kaiser Permanente Northern California in 2014-2016 to test whether a lifestyle intervention prevents excess gestational weight gain in women with overweight/obesity, as compared to usual medical care. Participants wore an ActiGraph wGT3X-BT for 7 days on the non-

dominant wrist during the first trimester. Valid measurements were defined as having ≥ 600 minutes of wear time [by the algorithm of Choi et al. (MSSE, 2012)] on 4 days, including 1 weekend day. Wrist-specific two-regression algorithms [Hibbing et al. (MSSE, 2018)] were used to estimate daily minutes of moderate to vigorous intensity PA (MVPA), light PA (LPA), and sedentary behavior (SB). Minutes per day of MVPA, LPA, and SB were then combined into weighted (i.e., weekend day vs. weekday) averages. Plasma glucose values from a random, 50-g 1-hour glucose challenge test (GCT) performed at 24-28 weeks' gestation were obtained from the Kaiser Permanente Northern California electronic health records. Associations of MVPA, LPA and SB (i.e., log transformed) with glucose were estimated by linear regression and adjusted for age, race-ethnicity, BMI category, and GLOW trial randomization (i.e., intervention vs. usual care). **RESULTS:** The cohort had a median 38 (IQR= 37) minutes per day of MVPA, 248 (81) minutes per day of LPA, and 389 (97) minutes per day of SB. The median plasma glucose value on the GCT was 112 mg/dl (35). None of the PA variables were statistically significantly associated with plasma glucose ($p > .05$ for MVPA, LPA, and SB). **CONCLUSION:** Objectively measured PA, assessed over 7 days during the first trimester of pregnancy, does not appear to impact glucose tolerance at 24-28 weeks gestation in women with overweight/obesity.

398 Board #214 May 27 10:30 AM - 12:00 PM
Patterns Of Sedentary Behavior In Pregnant Women During The Third Trimester

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The amount of time spent in sedentary behaviors is higher in pregnant populations compared to non-pregnant populations. Time spent in sedentary behaviors has also been shown to increase across trimesters. **PURPOSE:** To describe patterns of sedentary behavior in a sample of pregnant women in their third trimester. **METHODS:** Participants were enrolled in a behavioral physical activity and dietary intervention. Participants wore an accelerometer on their right hip for all waking hours for seven consecutive days during the third trimester (~35 weeks gestation). Participants had to wear the monitor for a minimum of 10 hours/day, on at least 3 days to be included analyses. Sedentary time was defined as any count <100 counts/minute. Sedentary behaviors were quantified (mean \pm SD, or %) as total volume (% of day), % of morning (6am-12pm), afternoon (12pm-6pm), and evening (6pm-12am); % of weekday and weekend; number and length of bouts; and total number and length of breaks from sedentary behavior. **RESULTS:** Participants (n=29) were on average 29.0 \pm 4.4 years of age and had a pre-pregnancy BMI of 26.6 \pm 7.2 kg/m². A majority of participants were White (75.0%), married (86.2%) and had a college degree (58.6%). Women spent 63.8% of waking hours sedentary (549.5 \pm 153.5 minutes), engaging in 77.2 \pm 17.7 total bouts per day, with each lasting on average, 7.7 \pm 2.4 minutes. Time spent sedentary was similar across (1) time of day: 62.8% of morning, 62.5% of afternoon, and 63.2% of evening and (2) type of day: 64.2% weekdays and 62.9% of weekend days. Women took 76.8 \pm 17.6 breaks from sedentary behavior per day, each lasting 4.0 \pm 0.9 minutes. **CONCLUSION:** Emerging evidence suggests that sedentary behavior during pregnancy can have a negative impact on maternal and child outcomes. Our findings suggest that women in their third trimester, even while participating in a behavioral physical activity intervention, spent a majority of their waking hours engaged in sedentary behaviors. Interventions that address challenges commonly seen during the latter part of pregnancy (e.g. fatigue, body size, swelling, etc.) are needed to help reduce time spent sedentary. Increasing light intensity activity (vs. moderate intensity) may be an appropriate place to start.

399 Board #215 May 27 10:30 AM - 12:00 PM
Heart Rate Response Is Influenced By Antenatal Physical Activity On The Third Trimester.

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Pregnancy represents a potent stimulus to the cardiovascular system, eliciting significant hemodynamic adaptations. The factors that mediate these adaptations are largely unknown; whilst habitual PA does not influence resting cardiac function during pregnancy, whether it influences the hemodynamic adaptations observed during exercise is unclear. **PURPOSE:** This study sought to determine whether PA during pregnancy influences the antenatal cardiac response to acute exercise, assessed via heart rate (HR) and stroke volume (SV). **METHODS:** Twenty-three pregnant women participating in the 'PE-CAMP' randomized controlled trial underwent physiological assessment at 34-36 weeks gestation. HR and SV were continuously recorded using the Task Force Hemodynamic

Monitor during rest (5-min), during exercise on a cycle-ergometer at a workload equivalent to 40-60% HR reserve (15-min), and during post-exercise recovery (20-min). Antenatal PA levels were measured for seven consecutive days during T2 (18-22 weeks gestation) and T3 (34-36 weeks gestation), using a wrist-worn accelerometer. A two-step bootstrapped hierarchical regression model examined the influence of four predictor variables (age, Body Mass Index (BMI), and total PA volume (light, moderate and vigorous) in 2T and 3T on HR and SV.

RESULTS: Regression analysis revealed significant influences on mean HR at exercise ($R=.907$; $R^2=.823$; $F(3, 17)=8.147$; $p=.009$) with PA-3T as strongest predictor ($b=.133$; $p=.005$); and on mean HR at recovery ($R=.839$; $R^2=.704$; $F(3, 17)=4.154$; $p=.049$) where PA-3T and BMI were significant predictors ($b=.196$; $p=.007$) and ($b=1.887$; $p=.049$) respectively. PA-3T was predictive of minimum HR at rest ($b=.128$; $p=.041$), as well as BMI was for minimum HR at recovery ($b=1.739$; $p=.033$). **CONCLUSIONS:** Higher levels of PA in 3T increase HR values in the different stages of an exercise protocol. Whether this is a cardiac adaptation due to the pregnancy to higher PA levels needs further investigation; as generally a lower HR would have been expected as a result of an active lifestyle. **Acknowledgement:** This project is funded by the European Union's Horizon 2020 Research and Innovation programme under the Marie Skłodowska-Curie grant agreement No 663830.

400 Board #216 May 27 10:30 AM - 12:00 PM
"Optimal Physical Activity Cut-off Value" For Preventing Gdm Among Pregnant Women In Beijing

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The prevalence of gestational diabetes mellitus (GDM) has rapidly risen during the past decade, and it is considered that GDM contributes to the increasing risk of adverse perinatal outcomes. Physical activity has been reported to be beneficial in improving pregnancy outcomes in pregnant women with GDM, however, there is a lack of evidence-based recommended amounts of physical activity specific for preventing GDM among Chinese pregnant women.

PURPOSE: The study aims to explore the "optimal physical activity cut-off value" for preventing GDM among pregnant women in Beijing, preparing to provide scientific basis for future research of personalized exercise prescription. **METHODS:** A total of 321 pregnant women who took regular prenatal examination in outpatient clinics were finally chosen into the study, including 59 patients with GDM and 262 controls. General information and clinical data of each participant was collected through electronic medical record system, physical activity data was investigated using the short form of International Physical Activity Questionnaires (IPAQ), and physical activity level was calculated based on the standard methods. Difference in means for continuous variables were compared using t-test, and differences in proportions were tested by chi-square test, ROC curve analysis was conducted to screen the "optimal physical activity cut-off value."

RESULTS: Compared with control group, average age (31.62 ± 2.95 vs 29.90 ± 3.34 yrs, $t=3.63$, $P<0.05$), the proportion of participants with low education level (25.42% vs 8.78%, $\chi^2=19.31$, $P<0.05$) and overweight or obese before pregnancy (38.98% vs 24.05%, $\chi^2=7.19$, $P<0.05$) in GDM group are significantly higher. The area under the ROC curve is 0.82(0.77-0.86)($P<0.05$), and the "optimal physical activity cut-off value" is 834 MET*min per week.

CONCLUSIONS: Older age, lower education level and overweight or obese before pregnancy contributes to the risk of GDM. It is recommended that physical activity level of more than 834 MET*min per week, accordingly walking no less than 36 minutes per day is beneficial to reduce the risk of GDM.

401 Board #217 May 27 10:30 AM - 12:00 PM
Pelvic Floor Function, Core Stability And Aerobic Capacity In Postpartum Women Following Functional Training

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After pregnancy and delivery, dysfunctions, such as alterations in pelvic floor function (PFF), core stability (CS), and aerobic capacity (AC), are common in postpartum women. **PURPOSE:** To observe the differences in PFF, CS, and AC in postpartum women before and after an 8-week functional training program.

METHODS: Sixteen postpartum women (age: 32 \pm 3.0years, ≤ 1 year post-delivery) completed an 8-week functional training intervention (60 minutes each time, 4 times per week). The functional training including pelvic floor muscle bio-feedback training,

T-spine mobility exercise, breathing exercises and inner core activation. Before and after the intervention, a pelvic floor bio-feedback test (PFBFT) was used to assess PFF, a Y-balance test (YBT) and an abdomen muscle endurance test (AMET) were used to assess the CS, and a 3-minute step test (ST) were used to assess the AC. During the YBT, values on three directions (A-anterior, PM-posteromedial, and PL-posterolateral) bilaterally were measured. And, during the AME, three muscle groups (F-Flexor, E-Extensor and bilateral lateral flexor-LFL&LFR) were recorded. Paired t-tests were used to compare the pre- and post-intervention values of all variables.

RESULTS: There were significant differences in pre- and post-intervention values of all variables in these postpartum women following 8-week functional training. Specifically, the PFBFT composite score was improved by 33.8% ($p<0.01$), the YBT scores for the directions of AL, PL, PMR, PLL and PLR were improved by 13.4%, 13.2%, 7.1%, 13.5%, and 8.5%, respectively (all $p<0.01$), the AMET scores for abdomen E, F, LFL and LFR were improved by 56.6%, 30%, 26.5% and 30.1%, respectively (all $p<0.01$), and the ST score was improved by 19.9% ($p<0.05$).

CONCLUSIONS: An 8-week functional training program, improved PFF, AC and CS in postpartum women. Future randomized, controlled studies are needed to confirm these findings.

402 Board #218 May 27 10:30 AM - 12:00 PM
Examining Barriers To Physical Activity For Breastfeeding Mothers Through A Socioecological Lens

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Background: Mothers who are physically active after the birth of a child can experience a range of mental and physical health benefits. However, only 1 in 5 women in the postpartum period are currently meeting physical activity recommendations of 150 minutes of moderate-intensity physical activity per week. Further, breastfeeding women experience additional barriers to physical activity. A multi-system approach is needed to better support breastfeeding women's ability to engage in physical activity. The use of a framework like the socio-ecological model (SEM) provides a unique opportunity to understand barriers to physical activity from perspectives at varying levels (i.e., individual, interpersonal, community, organization and policy). **PURPOSE:** The present study was conducted to examine barriers to physical activity among breastfeeding women from SEM representatives. **METHODS:** A total of 49 representatives were identified at various levels of the SEM based on their occupation or if they were a currently breastfeeding mother. All individuals participated in a telephonic interview between May and August of 2019. A direct content analysis was performed as well as a cross-case analytic strategy to determine differences between level representatives. **RESULTS:** General themes found included a lack of time and lack of ability for self-care. In addition, key differences were seen across SEM levels. For example, representatives of the individual level (breastfeeding mothers) reported lack of time as their critical barrier however those at the interpersonal (significant others) and community level (community lactation counselors) saw the greatest barrier to be associated with an inability to provide self-care due to prioritizing the baby. At the organizational level (healthcare administrators) and policy level (state coordinator; breastfeeding medicine experts) a lack of knowledge or misinformation was more frequently cited. **Conclusion:** Future interventions to increase physical activity among breastfeeding women should recognize the differences seen across SEM levels. Further, interventions should focus on enhancing maternal desire for self-care, opportunities to engage in activity with baby and increasing education on how to be active while breastfeeding.

403 Board #219 May 27 10:30 AM - 12:00 PM
Impact Of Postpartum Exercise On Maternal Health And Infant Physical Activity And Sleep Behaviours

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Physical activity (PA) has many implications for health, including effects on weight loss, body mass index (BMI), and sleep behaviours. The literature has established a relationship between mother-child physical activity, however, the impact of this interaction is unknown during the postpartum period. **PURPOSE:** To determine if a structured postpartum resistance training intervention with strollers and babies (60 minutes/session, twice/week for 10 weeks) improves maternal health outcomes and if infant physical activity (IPA) levels and infant sleep behaviours (ISB) are impacted. **METHODS:** Forty-six women voluntarily enrolled in the Active Mom, Active Baby

Intervention. Measures were taken at baseline (t1), 5-weeks (t2; mid-intervention), and 10-weeks (t3; post-intervention). At each time point, maternal weight (kg) was used to calculate BMI (kg/m²), and maternal physical activity (MPA) levels were measured using the self-reported International Physical Activity Questionnaire-long form (IPAQ-L). Infants were assessed using the Rothbart Infant Behaviour Questionnaire-Revised (IBQ-R) for PA and sleep behaviours. A nonparametric test was conducted to determine if there was a significant change in maternal weight, BMI, and PA levels (light, moderate, and vigorous) across the intervention. Comparisons in IPA and ISB were made using a one-way ANOVA with repeated-measures. A post hoc comparison was completed using the Bonferroni test through the three time points. **RESULTS:** Maternal age of participants (n=46) was 32.0±3.5 years at 16.6±7.5 weeks postpartum. The results showed a significant ($p<0.001$) decrease in maternal weight (-1.4±0.04kg) and BMI (-0.5±0.005kg/m²) across the intervention. There was no significant difference in light- or moderate- PA in the mother, however, vigorous-intensity PA increased from t1 (214.2±331.3MET-mins/week) to t2 (837.3±516.7MET-mins/week; $p<0.001$) and was maintained until t3 (736.0±582.6MET-mins/week; $p>0.001$). There was a significant increase in scores for IPA from t1 (3.89±0.85) to t2 (4.47±0.83; $p<0.001$) to t3 (4.80±0.93; $p<0.001$). No change in infant sleep behaviour was found between time points. **CONCLUSION:** A postpartum exercise intervention with babies can increase physical activity in both mother and infant, resulting in maternal weight loss.

404 Board #220 May 27 10:30 AM - 12:00 PM
Prescribed Physical Activity In Postpartum Period Helps Women Increase Physical Activity And Decrease Body Weight

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New mothers frequently report a lack of adequate physical activity (PA) due to a variety of constraints. PA is an important factor in developing and maintaining a healthy lifestyle and may assist new mothers in returning to pre-pregnancy weight. Despite the potential positive impact of PA on new mothers, PA level during the postpartum period is unknown. **PURPOSE:** To evaluate the impact of a PA intervention in increasing postpartum PA level and weight loss. **METHODS:** Thirty-two postpartum women (mean age=33±3, mean BMI=27.8±5.6 kg/m²) were randomized into control (n=16) and intervention (n=16) groups. The intervention group was instructed to engage in 150 minutes of MVPA each week and take 10,000 steps per day, the control group was given no physical activity prescription. Measures of body weight and PA (by wrist-worn ActiGraph Link accelerometers worn continuously over 7 days) were made at 3, 6, 9, and 12 months postpartum. PA data was expressed as the vector magnitude of counts (VMC) across the three axes. Differences in PA and body weight between groups over time were examined using two-way ANOVA with repeated measures and Tukey post hoc analysis. **RESULTS:** The intervention protocol was successful at increasing women's overall PA during the postpartum period (main effect: $2.9 \times 10^6 \pm 0.4 \times 10^6$ vs. $2.6 \times 10^6 \pm 0.4 \times 10^6$ counts, $p<0.05$) but the only significant differences in PA by time between groups was at the initial 3 month postpartum visit ($2.7 \times 10^6 \pm 0.3 \times 10^6$ vs. $2.4 \times 10^6 \pm 0.4 \times 10^6$ counts, $p<0.05$) as the intervention did not lead to a further significant increases in PA throughout the remainder of the postpartum period. The control group showed a significant increase in PA from the 3 month to the 12 month visit ($2.4 \times 10^6 \pm 0.4 \times 10^6$ vs. $2.8 \times 10^6 \pm 0.4 \times 10^6$ counts, $p<0.05$), ultimately reaching similar PA to that of the intervention group. Body weight was similar at the initial 3 month visit and decreased significantly in both groups during the postpartum period, however the intervention group had a significantly lower body mass by the end of the postpartum period compared to the control group (70.2±14.8 vs. 72.6±16.8 kg, $p<0.05$). **CONCLUSION:** Increased PA habits during the postpartum period may help women more successfully return to pre-pregnancy body weight and reduce the risk for overweight or obesity following childbirth.

405 Board #221 May 27 10:30 AM - 12:00 PM
Exercise And Nutrition Patterns Of Pregnant Women Self-Selecting For Participation In A Lifestyle Intervention

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Exercise and healthy eating are integral parts of a comprehensive healthy lifestyle intervention during pregnancy. Women who volunteer to participate in such an intervention in early to mid-pregnancy may already be practicing healthy lifestyle

habits such as walking 10,000 steps/day (active), and consuming 1800-2252 kilocalories/day (kcal), whereas most pregnant woman walk on average 3000-7000 steps/day (sedentary to low active) and consume 1882-2789 kcal/day. As such, intervention participants may not be representative of the general population of pregnant women, especially relating to exercise. **PURPOSE:** To assess the baseline exercise and nutrition patterns of pregnant women who enrol in a healthy lifestyle intervention in London, Canada. **METHODS:** Pregnant women who had self-selected to participate in a nutrition and exercise intervention completed a baseline (12-18 weeks gestation) 3-day step count log and 3-day food intake record (3dFR). Step counts were recorded over 3 consecutive days using a hip-worn pedometer or a wrist-worn activity tracker, and an average was calculated. The 3dFR was completed over the same 3 consecutive days and was analyzed for average energy intake (kcal) using Nutritionist Pro (NP; Axxya Systems). Measured height and self-reported pre-pregnancy weight were used to calculate pre-pregnancy body mass index (BMI). Gestational age at study entry and maternal age were also collected. **RESULTS:** Ninety-seven pregnant women chose to participate in a healthy lifestyle intervention study and completed both the 3-day step count log and 3dFR at baseline. At study entry, mean daily steps were 7399±2741 (low to above normal range) and energy intake was 2305±634 kcal/day (within to above normal range). Pre-pregnancy BMI was 26.2±5 kg/m² (overweight), gestational age was 15±3 weeks, and maternal age was 32±4 years. **CONCLUSION:** Many pregnant women who self-select to participate in a lifestyle intervention in early to mid-pregnancy may already have healthy patterns of exercise and to a lesser extent nutrition. To achieve a more representative sample of pregnant women, interventions could be performed in a clinical setting, which may allow for better identification of effective behaviour change strategies to promote and maintain healthy exercise and nutrition patterns during pregnancy.

A-50 Free Communication/Poster - Protein Metabolism

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

406 Board #222 May 27 9:30 AM - 11:00 AM Effects Of Exercise Training On Circulating Branched-chain Amino Acid And Ketone Levels In Diabetics

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Purpose: Elevated levels of circulating branched-chain amino acid (BCAA) and ketone bodies are recognized as biomarkers for cardiovascular disease (CVD) and other pathological conditions in type-2 diabetes mellitus (T2DM). Aerobic exercise interventions have previously shown decreases in levels of these markers, suggesting improved metabolic status and reduced risk of CVD. However, the efficacy of resistance training and concurrent programs in reducing BCAA and ketone body levels has not been well researched.

Methods: The current study was performed as a secondary analysis of the HART-D trial, a 9-month randomized, controlled exercise-training trial of 262 participants with T2DM. Participants were randomized to one of four groups; non-exercise control, aerobic training (AT), resistance training (RT), or a combined aerobic-resistance training (ATRT). The effects of the 9-month intervention on BCAAs (leucine, valine, and isoleucine) and ketone bodies (β -hydroxy-butyrate, BHB; acetoacetate, AcAc; and acetone) were examined across groups using generalized linear models adjusting for age, race, sex, and baseline BMI. We performed per-protocol analyses limited to all control participants (n=33) and only the exercise group participants who met the criteria of at least 70% adherence to their exercise prescription for 6 months (AT, n=62; RT, n=55; ATRT, n=64).

Results: AcAc (-17.6 ± 6.4, p=0.006), acetone (-10.6 ± 3.6, p=0.003), and total ketone body (-51.4 ± 20.0, p=0.01) concentrations (shown as mean ± SE in μ mol/L) decreased in the RT group compared to the control group. Acetone also decreased in ATRT compared to the control group (-10.2 ± 3.5 μ mol/L, p=0.004).

Conclusions: Our results suggest that RT and ATRT programs could improve ketone body metabolism in those with T2DM.

407 Board #223 May 27 9:30 AM - 11:00 AM

Does Exercise Intensity Influence Dietary Protein Requirements Of Male Endurance Athletes?

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(No relevant relationships reported)

Adequate protein intake is important for endurance athletes to replenish exercise-induced amino acid (AA) oxidation and support post-exercise muscle and whole body protein synthesis. High-intensity endurance exercise is associated with increased carbohydrate oxidation during exercise and greater protein turnover (synthesis and breakdown) after exercise relative to lower intensity exercise. Muscle glycogen depletion can increase AA oxidation during exercise and increase daily protein requirements.

PURPOSE: To determine the impact of exercise intensity during prolonged endurance exercise on estimates of dietary protein requirements in endurance athletes. **METHODS:** Eight males (26±3y, 76±16kg; 62±6 ml O₂·kg⁻¹·min⁻¹; mean±SD) completed two trials in a randomized order with exercise (20-km run) performed at a low (LOW; 72±1% HRmax, 55±5% VO_{2,peak}) or high (HIGH; 88±1%HRmax, 75±7% VO_{2,peak}) intensity. After 2 days of exercise and dietary (1.4g·kg⁻¹·d⁻¹ protein) control, participants consumed 0.6g·kg⁻¹ CHO before a 20-km treadmill run with continuous HR monitoring and periodic measurement of gas exchange (indirect calorimetry). During the 8h post-exercise recovery period, participants consumed 8.6g·kg⁻¹·d⁻¹ CHO and hourly meals providing 0.93g·kg⁻¹·d⁻¹ protein as crystalline AA modeled after egg protein, which was enriched with [¹³C]phenylalanine as an indicator AA. Breath and urine were collected at isotopic and metabolic steady state to determine phenylalanine excretion (F¹³CO₂), flux (Q; estimate of protein breakdown), and oxidation (OX; reciprocal of protein synthesis). **RESULTS:** Preliminary analysis (n=6) showed that respiratory exchange ratio during exercise was higher in HIGH vs. LOW (0.92±0.03 vs. 0.88±0.03, p<0.05), which corresponded to a 37% greater CHO oxidation rate in HIGH (3.12±0.76 vs. 1.96±0.52 g·min⁻¹, p<0.01). Exercise duration was shorter in HIGH vs LOW (86±18 vs. 112±23 min, p<0.01). F¹³CO₂ was not different between trials (HIGH: 0.94±0.25 vs. LOW: 0.89±0.14 umol·kg⁻¹·h⁻¹, p>0.05). Urinary analysis is ongoing to determine Q and OX. **CONCLUSION:** Preliminary findings suggest that prolonged, high-intensity endurance exercise increases CHO oxidation during exercise but has little impact on estimates of protein requirements of male endurance athletes.

408 Board #224 May 27 9:30 AM - 11:00 AM

High And Standard Free-form EAA Intake Equally Stimulate Muscle Protein Synthesis During Moderate Energy Deficit

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(No relevant relationships reported)

BACKGROUND: Muscle protein synthesis (MPS) is regulated by essential amino acid (EAA) intake, postprandial extracellular EAA concentrations, and exercise. During energy balance, consuming approximately 0.10-0.14 g EAA/kg/meal (0.25-0.30 g protein/kg/meal) optimally stimulates MPS after exercise. However, EAA requirements are increased during energy deficit, and whether consuming EAA beyond 0.10-0.14 g/kg/meal further stimulates MPS during energy deficit is unknown.

PURPOSE: Determine the effects of standard and high EAA intake on resting and post-resistance exercise MPS during moderate energy deficit.

METHODS: Nineteen males (mean±SD; age: 22.9±5y; BMI: 25.4±2.7kg/m²) completed a randomized, double-blind crossover study consisting of two, 5d periods of controlled energy deficit (30±4%), separated by a 14d washout. At the end of each energy deficit period, MPS was determined at rest (postabsorptive and postprandial) and post-resistance exercise (postprandial) using a unilateral resistance exercise model and primed, constant ²H₅-phenylalanine infusions. Drinks providing standard (0.10g/kg/meal, 7.87±0.87g) and high (0.30g/kg/meal, 23.5±2.54g) EAA amounts were consumed post-exercise. Circulating EAA concentrations were measured throughout each infusion.

RESULTS: Postabsorptive MPS at rest was not different (p=0.71) between standard (0.047±0.3%/h) and high (0.045±0.02%/h). In the postprandial state, and independent of EAA, MPS at rest (standard, 0.055±0.01%/h; high, 0.061±0.02%/h) and post-exercise (standard, 0.055±0.01%/h; high, 0.065±0.02%/h) was greater than postabsorptive MPS at rest (fed state main effect, p=0.019 and p=0.005). Postprandial MPS at rest and post-exercise did not differ (p=1.0). EAA concentrations were greater in high (peak: 2915±569 μ mol/L; AUC: 228485±54783 μ mol/L/240min) than standard (peak: 1843±497 μ mol/L; AUC: 75727±32254 μ mol/L/240min; both, p=0.001).

CONCLUSION: Despite greater increases in extracellular EAA concentrations for high versus standard EAA intakes and the mechanical stimulus exerted by exercise, the stimulatory effect of varying doses of free-form EAA on MPS are equivalent during moderate energy deficit.

Supported by USAMRDC; authors' views not official U.S. Army or DoD policy

409 Board #225 May 27 9:30 AM - 11:00 AM
Correlation Between Plasma Creatinine, Lean Body Mass, And Grip Strength In Inactive Vegetarians And Vegans

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(No relevant relationships reported)

In recent years vegetarian diets have increased in popularity. While they have been associated with decreased risk for cardiometabolic diseases, concern remains over the potential of low protein intake, which can lead to reduced muscle mass and strength. Plasma creatinine has been shown to be a reliable marker of muscle mass. **PURPOSE** Examine the relationship between plasma creatinine, lean body mass (LBM), and strength in underactive vegetarian and vegan adults. Additionally, to determine any change in creatinine levels following an 8 week protein supplementation intervention. **METHODS** Twenty-six inactive (<150min exercise/wk) vegetarians and vegans (34y±8.9; n=19 vegan) of at least 1 year participated in this study. This study examined relationships between creatinine, strength, and LBM before and after 8 weeks of supplementation with 18 g/day of mung bean protein. Additionally, change in creatinine levels before and after supplementation was determined between control and experimental groups. Handgrip strength was measured at baseline and week eight. LBM was determined via DEXA. Creatinine was determined via standard assay technique. An *a priori* α of 0.05 was used, and Pearson Product Moment correlation assessed relationships between creatinine, LBM and grip strength. A repeated measures ANOVA was used to determine changes in creatinine between groups over time. **RESULTS** There was a positive correlation between baseline creatinine (0.77±0.11 mg/dL) and LBM (40.1±8.8 kg) ($r=0.513$, $n=26$, $p<0.008$) as well as grip (25.5±7.8 kg) ($r=0.445$, $n=26$, $p<0.024$). There was a positive correlation between follow-up creatinine and (0.78±0.12 mg/dL) and LBM (40.2±8.7 kg) ($r=0.480$, $n=26$, $p<0.014$) but not grip (25.5±7.6 kg) ($r=0.390$, $n=26$, $p=0.054$). The change in creatinine (0.004±0.060 mg/dL) was not correlated to change in LBM (0.08±0.76 kg) ($r=-0.015$, $n=26$, $p=0.943$) or change in grip strength (0.18±1.90 kg) ($r=0.081$, $n=26$, $p=0.699$). There was no significant change in creatinine between groups following 8 weeks of protein supplementation $F(1,24) = 0.983$, $p=0.331$. **CONCLUSION** While there was no significant change in creatinine following 8 weeks of protein supplementation, this study shows positive associations between creatinine and lean mass as well as grip strength in underactive vegetarians and vegans.

410 Board #226 May 27 9:30 AM - 11:00 AM
Does Muscle Hypertrophy Relate To Resistance Training-Induced Changes In Myofibrillar Protein Synthesis In Women?

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(No relevant relationships reported)

Resistance exercise (RE) elevates skeletal muscle myofibrillar protein synthesis (MyoPS) for up to 48h, which can be measured under 'free-living' conditions using deuterium oxide (D₂O). The accumulation of repeated bouts of RE (resistance training—RT) results in skeletal muscle hypertrophy, which in men has been reported to correlate with post-RE 'free-living' MyoPS only in the trained state. However, the impact of training status on acute responses to RE and their relationship to hypertrophic adaptations has yet to be investigated in women. **PURPOSE:** The present study examined the MyoPS response over 48h of recovery from an acute bout of RE in the untrained (UT) and trained (T) state to determine its association with hypertrophic adaptations in women. **METHODS:** Ten recreationally active young women (23±5 yr, 62.3±12.0 kg, 23.7±7.4 % body fat; mean±SD) underwent ~8 wk of supervised whole-body RT (4 x 10 repetitions, 75% 1 repetition maximum (1RM), 3x/wk). Whole-body fat free mass (FFM; BODPOD), vastus lateralis muscle thickness (MT; B-mode ultrasound) and 1RM for each completed exercise were measured in the UT and T state to quantify training responses. MyoPS was measured during the mid-follicular phase (day 3-9 of the menstrual cycle) at rest pre-training and for 48h following the first and final bout of RE using orally administered D₂O. Muscle biopsies were obtained at pre-RE (0h), 24h and 48h post-RE to determine MyoPS in both the UT and T state. **RESULTS:** Following RT, there was a ~3.4% increase in FFM (49.3±6.4 vs. 51.0±6.9 kg; $P < 0.001$) and ~8.8% increase in MT (2.31±0.39 vs. 2.50±0.38 cm; $P < 0.05$). Representative 1RM strength increased for bench press and leg press

exercise (28.5±5.8 kg vs. 38.7±9.8 kg and 151.6±63.5 vs. 259.3±92.7 kg, respectively; $P < 0.01$). Forthcoming analysis will determine if: i) training alters the post-exercise MyoPS response, and; ii) whether muscle hypertrophy correlates with acute MyoPS in the UT and/or T state. **CONCLUSIONS:** Women responded favourably to ~8 wk of RT with significant gains in FFM, MT and 1RM strength. Ongoing analysis will provide insight into the potential relationship between acute muscle protein synthesis and training-induced hypertrophy in the understudied female population. Supported by the Natural Sciences and Engineering Research Council of Canada.

411 Board #227 May 27 9:30 AM - 11:00 AM
High Protein Supplementation Facilitates Weight Training Induced Bone Mineralization In Baseball Players

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(No relevant relationships reported)

PURPOSE: To determine whether weight training combined with high protein intake enhances total and regional bone mineral density (BMD) in athletes. **METHODS:** BMD of 27 Division-1 collegiate baseball players aged 18-22 y (N=13, 2 dropouts), received either 14% protein or isocaloric 44% protein supplements, were assessed by dual-energy x-ray absorptiometry (DEXA) before and following a 12-week weight training (challenging upper and lower body). **RESULTS:** Baseline data show unequivocally greater humerus BMD in the dominant arm than their contralateral non-dominant arm (~20 %) among all baseball players. Humerus BMD of non-dominant arm was enhanced by 2.7 % after weight training for both low and high protein groups (main effect, $P = 0.008$), concurrent with an unexpected, small decrease in total body BMD (main effect, $P = 0.014$). Humerus BMD of dominant arm with greater baseline value than non-dominant arm was not increased unless high protein was supplemented (+2.7 %) ($P < 0.05$). **CONCLUSION:** Bones with relatively higher BMD show inert adaptation against training, which can be delimited by high protein supplementation. Total BMD of athletes cannot be further elevated by weight training.

412 Board #228 May 27 9:30 AM - 11:00 AM
Potato Protein Stimulates Muscle Protein Synthesis At Rest And With Resistance Exercise

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Potato protein stimulates muscle protein synthesis at rest and with resistance exercise Sara Y. Oikawa¹, Ravinder Bahniwal¹, Chris McGlory², Steven K. Baker¹, Stuart M. Phillips¹

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Skeletal muscle protein synthesis (MPS) is increased in response to amino acid feeding and to resistance exercise (RE) where RE enhances MPS above feeding alone. The use of vegetable based proteins have increased in popularity, however many vegetable based protein sources are of lower protein quality. Potato protein (PP) is a complete protein and has the highest protein quality score of any vegetable protein, however, its efficacy in stimulating MPS beyond the acute setting has yet to be determined.

PURPOSE

To determine the effects of PP on MPS with and without RE in healthy young women.

METHODS

In a single blind, parallel-group design, twenty-four healthy younger women (21 ± 3 years, n = 12/group) were assigned to consume either 25 g of PP twice daily or a non-protein-containing control (CON). Participants consumed a fully controlled diet for 3 weeks (0.8 g/kg/day CON, 1.6 g/kg/day PP), with non-supplemental protein comprising 51 ± 3% of total protein intake in the PP group. One leg of each participant was randomly allocated to perform RE (Exercise) while the other leg served as a rested control (Rest). RE was performed thrice weekly at ~30% of 1RM (20-25 reps) for 3 sets until volitional fatigue on the leg extension and leg press machines. Myofibrillar MPS was measured at baseline, following supplementation, and at supplementation+RE via the deuterated water method.

RESULTS

PP ingestion increased MPS by 0.14 ± 0.09 %/d at Rest and by 0.32 ± 0.14 %/d in Exercise ($p = 0.008$) while MPS was elevated only in Exercise with CON 0.20 ± 0.11 %/d but was not different from Baseline 0.01 ± 0.04.

CONCLUSIONS

Consuming PP in addition to a habitual diet increased rates of MPS at rest and there was a further increase with RE. PP may serve as a high quality, vegetable-based protein supplement to augment muscle protein anabolism in healthy young women.

Support by The Alliance for Potato Research & Education

413 Board #229 May 27 9:30 AM - 11:00 AM

Leucine-Enriched Essential Amino Acids Enhance Post-Exercise Muscle Recovery Independent Of 'Free-Living' Myofibrillar Protein SynthesisMarcus Waskiw-Ford. *University of Toronto, Toronto, ON, Canada.*

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Reported Relationships: M. Waskiw-Ford: Industry contracted research; Ajinomoto Co. Inc.

Leucine-enriched essential amino acids (LEAA) can acutely enhance post-exercise muscle protein synthesis and may facilitate muscle damage recovery, although the relationship between these outcomes during the prolonged post-exercise recovery period is unclear. **PURPOSE:** We aimed to determine the effect of LEAA on 'free-living' rates of myofibrillar protein synthesis (MyoPS) and its relationship to markers of muscle damage after an unaccustomed bout of resistance exercise (RE) in recreationally-active men. **METHODS:** Twenty healthy males (24.1 ± 4.3 yrs) consuming a controlled diet (1.2g/kg/day of protein) were randomized to consume 4.0g of LEAA (containing 1.6g leucine) or isocaloric placebo (PLA) thrice daily for four days following an acute bout of lower-body RE (5x12 repetitions at 75% maximum of leg press and knee extension). MyoPS at rest and over 96h of recovery was measured by D₂O (150ml, 70% APE) with body water enrichment as the precursor. Total muscle torque (sum of isometric and 60 and 270°/s isokinetic torques; SUM) of the knee extensors, thigh muscle soreness (SOR), Z-band streaming, and muscle heat shock protein (HSP) 25 and 70 expression were measured at rest and during recovery. **RESULTS:** MyoPS increased ~72% after RE ($P < 0.01$) with no differences between groups ($P > 0.05$). By 48h, SUM decreased ~21% and SOR increased (all $P < 0.01$) with both variables generally returning to baseline by 96h. Compared to PLA, LEAA consumption significantly attenuated the decrease in SUM ($P < 0.05$) and had small-to-moderate effects on decreasing SOR. HSP25 increased ~16% post-RE ($P < 0.05$) with no difference between groups ($P > 0.05$). Consistent with a trend toward increased Z-band streaming in PLA ($P = 0.07$), HSP70 expression increased ~32% more ($P < 0.05$) during recovery in PLA as compared to LEAA. SUM correlated with SOR ($r = -0.64$, $P < 0.05$) whereas there were no correlations between MyoPS and any other outcomes ($P > 0.05$). **CONCLUSION:** Daily consumption of LEAA mitigates muscle strength loss and may moderately alleviate muscle damage during recovery from an unaccustomed bout of resistance exercise in recreationally-active men, but this does not appear to be related to the extent of myofibrillar protein synthesis.

Supported by Ajinomoto Co. Inc.

414 Board #230 May 27 9:30 AM - 11:00 AM

IMPACT OF CASEIN PROTEIN CONTAINING L-TRYPTOPHAN AND MELATONIN ON SLEEP QUALITY AND ENERGY EXPENDITURESILVIO VALLADAO¹, Thomas Andre¹, Robert Sanders¹, Hannah Nelson¹, Neil Schwarz², Melinda Valliant¹, Josh Hogg¹. ¹University of Mississippi, OXFORD, MS. ²University of South Alabama, Mobile, AL.

(No relevant relationships reported)

Increases in morning resting energy expenditure (REE) have been observed following late evening ingestion of protein. However, the impact of late night protein supplementation containing melatonin and L-Tryptophan has yet to be examined. **PURPOSE:** The purpose of this study is to determine the impact of the ingestion of pre-sleep casein protein supplement that contains L-Tryptophan and melatonin (PRO) on sleep quality, energy expenditure prior, during, and post exercise. **METHODS:** Aerobically active females ($n = 13$; age = 22.6 ± 1.9 yrs; ht = 1.65 ± 0.06 m; wt = 60.5 ± 9.6 kg; % bf = 22.5 ± 4.3 ; $VO_{2max} = 44.1 \pm 5.3$ ml/kg/min) participated in the study. In a cross-over design, PRO (Casein; 34.3g; 140 kcal; 289mg L-Tryptophan; 1mg Melatonin) or placebo (PLA) (cocoa powder; 10g; 20 kcal) were ingested 30 min prior to sleep. Sleep quality and perceived satiety were assessed using 10cm sliding scale the following morning. REE was measured for 30 minutes with at least 5 min of steady state before and after exercise. The exercise protocol consisted of 20 min of aerobic exercise on a treadmill at 40-50% of VO_{2max} . Total calories during exercise were used to compare exercise energy expenditure (EEE). For the statistical analyses, Paired-samples t-tests and two-way repeated measures ANOVA. Results were considered significant at ≤ 0.05 . **RESULTS:** Sleep quality during PRO was not significantly different than the PLA trial (61.6 ± 21.5 mm vs 68.4 ± 20.5 mm; $p = 0.39$). Perceived satiety during PRO was not significantly different than PLA (29.6 ± 8.2 mm vs 23.9 ± 6.6 mm; $p = 0.43$). EEE during PRO was not significantly different than PLA (112.1 ± 20.4 kcal vs 112.2 ± 21.8 kcal; $p = 0.91$). The main effects (supplement: $p = 0.93$; time: $p = 0.15$) and the interaction (Supplement x Time: $p = 0.75$) for REE pre and post exercise in PRO and PLA were not significantly different. **CONCLUSIONS:** No changes were observed ingesting PRO prior to sleep on next morning EEE and REE

before and after exercise. Future investigations should examine the effects of relative (g/kg bw) pre-sleep protein containing tryptophan and melatonin ingestion on next morning EEE.

415 Board #231 May 27 9:30 AM - 11:00 AM

Pre-sleep Or Post-exercise Protein Intake Does Not Augment Resistance Training Adaptations In Older AdultsAlex Klemp, Mingchia Yeh, Chester Sokolowski, Do-Houn Kim, Michael J. Ormsbee, FACSM, Lynn B. Panton, FACSM, Jeong-Su Kim, FACSM. *Florida State University, Tallahassee, FL.* Email: Aok09@fsu.edu

(No relevant relationships reported)

Resistance training (RT) and protein consumption are recommended to attenuate decreases in muscle mass and strength with age. Immediate post-exercise (Post-ex) protein intake has been regarded as optimal for augmenting RT adaptations. However, nocturnal sleep is the longest post-absorptive period with muscle protein synthesis lower than basal rates. Thus, pre-sleep (Pre-sleep) protein intake may be more advantageous for older adults, who display blunted muscle anabolism, than Post-ex protein intake. **PURPOSE:** To examine the effects of pre-sleep versus post-exercise protein intake during 12 weeks of RT on muscle thickness (MT) and one-repetition maximum (1RM) strength in older adults. **METHODS:** 30 healthy, sedentary older males (age: 65.7 ± 4.0 yrs, body mass: 85.9 ± 13.1 kg) underwent the same 12-week whole-body RT program (2x/wk) and were randomly assigned to 1 of 3 groups, 1) consumed 40 g of protein immediately Post-ex ($n=9$), 2) consumed 40 g of protein 30 minutes Pre-sleep ($n=11$), or 3) did not consume additional protein supplementation (Ex only, $n=10$). MT was measured via ultrasound as the added values of the right rectus femoris, vastus intermedius, and vastus lateralis muscles. 1RM strength was assessed on the leg press machine. A 3x3 mixed-model ANOVA was used to analyze outcomes at pre-, mid-, and post-testing with significance at $p \leq 0.05$. **RESULTS:** There were significant main time effects for both MT (Pre: 6.29 ± 0.98 ; Mid: 6.63 ± 0.86 ; Post: 6.75 ± 0.94 cm) and 1RM strength (Pre: 155.9 ± 30.0 ; Mid: 170.1 ± 36.0 ; Post: 184.2 ± 47.1 kg). There were no group x time interactions or main group effects. Interestingly, only Post-ex significantly increased MT from pre to mid (Pre: 6.14 ± 0.91 ; Mid: 6.67 ± 0.88 ; Post: 6.70 ± 1.16 cm). **CONCLUSION:** During 12 weeks of RT in older adults, Post-ex protein intake increased MT in the first 6 weeks; however, after 12 weeks, improvements were similar to Pre-sleep protein intake and Ex only groups. Further, neither Post-ex nor Pre-sleep protein intake augmented RT-induced improvements in 1RM strength.

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416 Board #232 May 27 9:30 AM - 11:00 AM

Effect Of Whey Protein Isolate On Cortisol Awakening Response In Recreationally Active WomenMICHAEL D. OLDHAM, Vic Ben-Ezra, Anthony A. Duplanty, Kyle D. Biggerstaff. *Texas Woman's University, Denton, TX.* (Sponsor: David L. Nichols, FACSM)

(No relevant relationships reported)

Introduction: The hypothalamus-pituitary-adrenal (HPA) axis plays a major role during stress responses and is associated with the secretion of cortisol. Serum cortisol concentration peaks between 30 and 45min after awakening, and is known as the cortisol awakening response (CAR). Disruptions in CAR have been associated with repetitive strenuous physical exercise. Whey protein branched chain amino acids (BCAA) compete for tryptophan transporters in the brain, subsequently reducing fatigue associated with exercise. **PURPOSE:** To determine the effects of whey protein on CAR after strenuous exercise, in recreationally active women, on post-exercise days. **METHODS:** Eleven recreationally active women (19 ± 2 yrs; $VO_{2max} = 31.6 \pm 4.5$ ml/kg/min) completed a double blinded, randomized, cross-over placebo trial, with a 7 day washout between trials. The supplement regimen (25g of maltodextrin (PL) or 25g of maltodextrin plus 25g of whey protein isolate (WH)) was given between 8am - 9am and 30min prior to exercise on 3 consecutive days of each trial. On Day 2 and 3 of each trial participants walked 30 min on a treadmill at 70-75% VO_{2max} (21.7 ± 0.1 ml/kg/min), rested 5 min, and completed a 30s Wingate anaerobic threshold test (WAnT). Saliva (2ml) was collected on days 1-4 of PL and WH, between 6am and 8am, immediately upon waking and every 15 min for the next hour. Saliva samples were analyzed for cortisol concentration using an enzyme linked immunosorbent assay (ELISA) and the area under the curve (total AUC) was calculated for cortisol. A repeated measures ANOVA (2 trial x 4 days) was used to determine significant differences ($p < .05$) in cortisol AUC. A repeated measures ANOVA (2 trial x 2 day) was used to determine significant differences ($p < .05$) in WAnT fatigue index. **RESULTS:** Main effect means for AUC were significantly different ($p = 0.033$) between PL (33.36 ± 2.0 $\mu\text{g} \cdot \text{hr}/\text{dL}$) and WH (30.88 ± 0.8 $\mu\text{g} \cdot \text{hr}/\text{dL}$). No significant difference ($p = 0.149$) in WAnT fatigue index means occurred between PL ($20.79 \pm 6.1\%$ Day 2 & $21.97 \pm 6.4\%$ Day 3) and WH trials ($22.52 \pm 6.2\%$ Day 2 & $22.78 \pm 6.4\%$ Day 3).

CONCLUSIONS: Whey protein isolate may decrease CAR on post-exercise days, in recreationally active women, indicating a possible reduction in central fatigue associated with strenuous exercise, but may not alter the ability to perform short-duration sprint cycling.

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The Influence Of A Whey Protein Preload Prior To Carbohydrate Consumption On Cycling Performance

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(No relevant relationships reported)

INTRODUCTION: The consumption of carbohydrates during a bout of endurance exercise has been shown to promote a glycogen sparing effect and lead to an improvement in exercise performance. The consumption of whey protein prior to a prolonged bout of endurance exercise may augment insulin secretion and further spare muscle glycogen.

PURPOSE: To examine if a whey protein solution consumed as a preload prior to a glucose bolus influenced performance and metabolic responses during a cycling performance trial.

METHODS: Ten recreationally trained cyclists and triathletes completed two experimental trials. Each participant was required to perform two separate cycling performance tests, which consisted of cycling for 30 min at 90% lactate threshold, followed by a 30 min time trial. Participants consumed a whey protein isolate preload (0.7 g/kg/LBM) or a placebo 20 min prior to the consumption of a glucose beverage (0.9 g/kg/LBM). The glucose beverage was consumed 10 min prior to the cycling performance test. During both trials, plasma glucose, c-peptide, insulin, glucagon, and NEFA concentrations were measured.

RESULTS: There were no significant differences in overall time trial performance (WP 16.8 ± 0.34 km; PL 17 ± 0.4 km; $p = .346$). WP stimulated a significant increase in plasma insulin concentrations at time point 0 (WP = 222.88 ± 45.1 pg/ml; PL = 85.95 ± 45.1 pg/ml; $p = .047$) compared to the placebo trial. Despite an increase in plasma insulin, there were no significant timepoint differences for plasma glucose. WP stimulated a significant increase in plasma glucagon concentrations for timepoint -10, 0, 15, 30, 45, and 60 when compared to the PL trial (all values $p < .05$).

CONCLUSION: Although there were significant alterations in plasma insulin concentration due to the consumption of the whey protein isolate preload, this did not influence overall cycling performance or substrate utilization.

Funding Source: National Strength and Conditioning Association – GNC Sport Nutrition Grant

418 Board #234 May 27 9:30 AM - 11:00 AM
The Effects Of A Relative Dose Of Pre-sleep Protein On Recovery Following Evening Resistance Exercise

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(No relevant relationships reported)

Pre-sleep consumption of protein has been shown to enhance recovery of muscle function after evening exercise. Previous studies have primarily compared casein protein (CP) to carbohydrate (CHO), however, less data exists examining the effects of a blend of CP and whey protein (WP; (CP+WP)) or a dose relative to an individual's lean body mass (LBM). **PURPOSE:** To assess the acute effects of pre-sleep consumption of isocaloric CP, CP+WP, or CHO at a dose relative to LBM on recovery following an evening lower-body resistance exercise (RE) bout. **METHODS:** Fifteen active males (age: 21±1yrs, body fat:14.2±2.7%) participated in this randomized, double-blind, crossover study. One-repetition maximums were performed on the leg press and extension machines to determine RE intensity. Participants performed an evening (1600-1900) lower-body RE bout and were provided with 0.4g/kg/LBM WP supplement post RE. A single dose of 0.6g/kg/LBM of CP, 0.4g/kg/LBM CP and 0.2g/kg/LBM WP (CP+WP), or CHO was consumed 30 minutes prior to sleep and each trial was separated by 72 hours. Measurements of perceived recovery (visual analogue scales (VAS) for recovery, soreness and fatigue), appetite (VAS for hunger, satiety and desire to eat), as well as pressure-pain threshold (dolorimeter) and average power (Biodex™) of the right thigh muscles were assessed the following morning. ANOVAs were used for analyses and significance was accepted at $p < 0.05$. **RESULTS:** There was no significant difference in perceived morning recovery, soreness and fatigue between pre-sleep supplements. There was a significant difference in pressure-pain threshold at the rectus femoris ($p=0.001$), vastus medialis ($p=0.001$) and vastus lateralis ($p<0.001$). Both CP (98.0±17.3N), and CP+WP (98.2±21.7N) had a greater pressure-pain threshold (i.e. less soreness) than the PLA (80.6±21.7N) at the rectus femoris. Average power was similar between supplements. Hunger was significantly greater after CP than CP+WP (52.2±17.2 vs. 39.9±15.9 mm; $p=0.048$). There was no difference for satiety and desire to eat. **CONCLUSIONS:** Pre-sleep consumption of

CP and CP+WP at a dose relative to LBM may enhance overnight recovery to a greater extent than CHO as a result of less muscle soreness the following morning after an acute evening RE bout.

419 Board #235 May 27 9:30 AM - 11:00 AM
Effects Of Vespa Amino Acid Mixture On Submaximal And Maximal Cycling Performance

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(No relevant relationships reported)

Introduction: The ability to increase fat utilization during exercise and VO₂max could dramatically improve exercise performance, especially among endurance athletes. Prior research suggests that the chronic use of a Vespa Amino Acid Mixture (VAAM) may increase fat metabolism and VO₂max among elderly women (Sasai 2011). VAAM consumption provides a unique combination of amino acids (tyrine, phenylalanine, proline, and alanine) that are effective at increasing Krebs's Cycle activity, thereby facilitating increased aerobic metabolism. **Purpose:** The purpose of this study was to determine if a single pre-exercise dose of VAAM increased fat metabolism, VO₂max, or ventilatory threshold during cycling exercise. **Methods:** In this single-blind pilot study, three highly active male cyclists (age 37.3 + 10.1 years) completed two exercise tests separated by one week. Prior to each exercise test, in random order, subjects consumed either an 8 ounce drink containing 100mg of VAAM (Vespa CV-25, Vespa Power Products LLC, Davis CA) or an 8 ounce isocaloric placebo. On a cycle ergometer subjects completed four 5-minute submaximal exercise stages, followed immediately by a VO₂max test. Fat metabolism (FM, kcal/min), maximal oxygen uptake (VO₂max, ml/kg/min), and ventilatory threshold intensity (VT, Watts) were measured. **Results:** The results of these tests demonstrated an increase in submaximal FM, VO₂max, and VT following the consumption of VAAM. **Discussion:** The findings of this study indicate a potential improvement in aerobic exercise performance through increased fat metabolism, VO₂max, and VT intensity when consuming a single 100mg dose of VAAM prior to exercise compared to a placebo.

420 Board #236 May 27 9:30 AM - 11:00 AM
Effect Of Protein Supplementation On Running Exercise-induced Muscle Damage And Soreness: A Randomized Controlled Trial

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(No relevant relationships reported)

Purpose: The benefits of protein supplementation on endurance exercise-induced muscle damage and soreness remain inconclusive. Therefore, we assessed whether a protein supplementation protocol with optimized timing and amounts could attenuate running-induced muscle soreness and muscle damage compared to iso-caloric placebo supplementation.

Methods: A double-blind randomized controlled trial was performed among 323 recreational runners (age 44±11 years, 56% male) participating in a 15-km road race. Participants received 2 supplements per day containing 80% caseinate and 20% whey protein (intervention) or carbohydrate (placebo). Supplements were consumed post-race (at the finish line and prior to sleep) and during 3 consecutive days (at breakfast and prior to sleep). Habitual protein intake was assessed using 24hr recalls at baseline, on the day of the race and 1, 2 and 3 days post-race. Race characteristics were determined and muscle soreness was assessed with the Short-Form Brief Pain Inventory at baseline and 1 day, 2 days and 3 days post-race. In a subgroup ($n = 149$), muscle soreness was measured with a strain gauge algometer and concentrations of the muscle damage markers creatine kinase (CK) and lactate dehydrogenase (LDH) were measured 25 to 48hr post-race.

Results: At baseline, no group-differences were observed for habitual protein intake (79.9±26.5 g/d versus 82.0±26.8 g/d, $P=0.49$) and Numeric Pain Rating Scale muscle soreness (0.45±1.08 versus 0.44±1.14, $P=0.96$) in the protein group compared to the placebo group. Subjects completed the race at an exercise intensity of 94±6% of HRmax and a running speed of 12±2 km/h. The protein group reported higher muscle soreness 24hr post-race compared to the placebo group (2.96±2.27 versus 2.46±2.38, $P=0.039$), but no differences were observed on day 2 and 3 post-race. Similarly, we found a lower pressure pain threshold for the quadriceps muscle in the protein group compared to the placebo group (71.8±30.0 N versus 83.9±27.9 N, $P=0.019$). Similar concentrations of CK and LDH were found post-race in both groups.

Conclusion: Post-exercise protein supplementation is not more preferable than carbohydrate supplementation to reduce muscle soreness or damage in recreational athletes with a protein intake of 1.14 ± 0.35 g/kg/d running a 15-km road race.

421 Board #237 May 27 9:30 AM - 11:00 AM
Skeletal Muscle Regulatory Markers Responses Following Whole And Egg White Ingestion In Resistance Trained Men

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Protein ingestion is recommended to maximize muscular adaptations post resistance training (RT). Eggs are a rich food source commonly consumed post-workout to meet protein requirements. Although removing egg yolk is often promoted for the improvement of body composition (BC), whole-egg (WE) consumption has been shown to cause a greater stimulation of post-exercise muscle protein synthesis than egg-white (EW). However, changes in BC and skeletal muscle regulatory markers to chronic RT coupled with WE or EW consumption have not been evaluated.

PURPOSE: To compare the effects of WE vs. EW ingestion after 12 wks of RT on BC and skeletal muscle regulatory markers in RT men. **METHODS:** Thirty RT men [age (24 ± 2 yrs), were randomized to either a WE (n=15) or EW (n=15) consumption group for 12 wks. The WE group ingested three WE while the EW group ingested six EW immediately post-workout and at the same time on non-training days. RT consisted of 10 exercises/session, 3x wk. Three sets of 3-14 reps (load was progressed) were performed for each exercise. Body weight, fat mass (FM), skeletal muscle mass (SMM) as well as serum follistatin (FOL), myostatin (MYO) and basic fibroblast growth factor (FGF-2) levels were measured at baseline and after 12 wks. **RESULTS:** Significant main effects of time were observed for body weight, SMM, FOL and FGF-2 which significantly (P < 0.05) increased, and for FM and MYO which significantly (P < 0.05) decreased. However, no significant group × time interactions were noted for any markers. Although non-significant, the WE group had ~1 Kg of extra FM loss than EW group. **CONCLUSIONS:** There are no differences in the changes achieved in BC and skeletal muscle regulatory factors after 12 wks of RT between WE and EW consumption. Although BC did not differ between groups, the ~1 Kg of extra FM loss seen after WE consumption may be an advantage for fitness enthusiasts with aesthetic goals.

422 Board #238 May 27 9:30 AM - 11:00 AM
Proteins Or Carbohydrates Influence On Strength And Functionality After Exercising In Elderly Type II Diabetics.

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In seniors with type 2 diabetes mellitus (SDM2), skeletal muscle LOSS is two to four times higher than in non-diabetics. In addition, SDM2 have a greater reduction in neuromuscular function and worse performance in functional tests. Hence, the recommendation of physical exercise is consensual for this population. Exercise-induced muscle damage is known to hinder motor learning and carbohydrate with protein intake reduces this damage, possibly improving the functional outcomes from exercises. **PURPOSE:** Verify the role of protein or glycemic intake on muscle strength and functionality of SDM2 undergoing resistance training. **METHODS:** This is an experimental, controlled, randomized, double-blind study. Twenty-six males SDM2 with a mean age of 68.5 (± 4.3) years randomly put into two groups: Protein Group (GP) (13) and Carbohydrate Group (GC) (13). The training sessions were held twice a week for 12 weeks. Eight exercises were performed for the main muscle groups, being 3 sets of 8 to 12 repetitions. The intensity was continuously adjusted

between 7 - 8, according to the Subjective Effort Perception (1 to 10). Ingestion of macronutrients was performed immediately after strength training, using 20 g of water-diluted whey protein for the GP group and 20 g of water-diluted maltodextrin for the GC group. Muscle strength was assessed by isokinetic dynamometry of knee extensors and flexors, upper limbs by the Hand Grip Strength Test (HGS) and functionality by the Short Physical Performance Battery Test (SPPB). **RESULTS:** No significant differences were found between the groups, nor before and after training in relation to the dominant side muscle strength (DS) - Extensors torque peak = (F = 1.51 = 0.247; p = 0.62; η = 0.005) and flexors (F = 1.51 = 0.345; p = 0.56; η = 0.007); non-dominant side (NDS) - Peak torque of extensors (F = 1.51 = 0.143; p = 0.70; η = 0.003) and flexors (F = 1.51 = 0.187; p = 0.66; η = 0.004); FPM (DS) (kg / f) (F = 1.51 = 0.455 p = 0.50; η = 0.009); HGS (NDS) (kg / f) (F = 1.51 = 0.020 p = 0.88; η = 0.000). In functionality there was a significant gain in the protein group in the interaction between groups * condition (pre and post) (F = 1.51 = 6.23; p = 0.01; η = 0.115). **CONCLUSION:** Ingestion of both macronutrients does not produce an increase in muscle strength alone, but protein supplementation shows improvements in functionality.

423 Board #239 May 27 9:30 AM - 11:00 AM
Effects Of Protein Intake On Gastrointestinal Symptoms In Runners - A Pilot Study

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 (No relevant relationships reported)

PURPOSE: Gastrointestinal (GI) symptoms often hinder running performance and are responsive to nutrient intakes. Currently, the recommendation is to “limit” protein intakes to minimize symptoms, but a threshold has not been established. The purpose of this study was to examine the effect of a highprotein (HP) vs a low protein (LP) shake on running induced GI symptoms. **METHODS:** Five (n=2 male) endurance trained runners were administered a HP (0.4 g/kg body weight) or LP (0.15 g/kg/ body weight) shake one hour prior to a 10 km run at 85% of their race pace in a single-blind, randomized cross-over design. Carbohydrate and water intakes remained consistent across trials. Exercise induced GI symptoms were measured pre-shake, 60 minutes post-shake, and post-run. Symptoms were rated on a 10 point scale and included six upper abdominal problems, seven lower abdominal problems, and five systemic problems. **RESULTS:** Symptoms experienced during the LP run included belching (2), stomach cramps (2), intestinal cramps (3), flatulence (1), urge to defecate (1), stitch (1), dizziness (1), muscle cramp (1), urge to urinate (2), and fullness (1). Severity was consistently low with only urge to urinate rated as a 4. Symptoms experienced during the HP run included re-flux (1), belching (2), bloating (1), stomach cramps (2), intestinal cramps (1), flatulence (1), stitch (1), and fullness (1). Severity was consistently low with a maximum of 3. There was no significant difference in the severity of symptoms experienced between the two trials and no difference in the number of symptoms. **CONCLUSIONS:** A pilot trial indicates no difference in exercise-induced GI symptoms with a HP or LP shake pre-run and suggests intakes up to 0.4g/kg body weight can be well tolerated. Supported by a Mount Royal University Innovation Grant.

424 Board #240 May 27 9:30 AM - 11:00 AM
Preschool Children Consumption Of School Lunches Different From Menus That Meet Dietary Guidelines And To What Is Served

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Preschool menus must meet the Dietary Guidelines for Americans however, what is actually served and consumed by children is not restricted, potentially affecting consumption of a balanced diet. **PURPOSE:** Compare preschool lunch menus that meet dietary guidelines to what is actually served and consumed by children. **METHODS:** Fifty-two preschool children (mean ± SD, age 3y and 10m ± 8m) from a university early childhood center participated in the 10-week study. Each day, 15 children were randomly selected for nutritional analysis of their lunch. Prior to and immediately after consumption, a picture of the child's tray was taken using digital photography. If a child had additional food (second's), additional pictures were taken. Analysis of energy and nutrient content for menus, food served, and food consumed was completed using Food Processor Nutrition Analysis by ESHA. Food color (white, brown, orange, yellow, red, green, other) was determined by observation during analysis. A food preference survey was administered orally to children immediately after each meal. **RESULTS:** There was a significant (p<0.05) difference for total kilocalories (kcal) between menu (448 ± 130), served (523 ± 148) and consumed (361 ± 178). There was a significant (p>0.05) difference for grams of carbohydrate between menu (55.3 ± 18.9g) and served (56.5 ± 20.5g) compared to what was consumed (38.5 ± 21.7g). There was a significant (p<0.05) difference for grams of fat between menu (15.9 ± 8.7g), served (21.2 ± 9.7 g) and consumed (14.5 ± 10.0g). There was a

significant ($p < 0.05$) difference for protein between menu (21.7 ± 5.7 g), served (27.9 ± 10.6 g) and consumed (19.5 ± 11.8 g). The majority of food served was white (38.1%), brown (20.4%), or yellow (14.2%) with minimal from orange (10.2%), red (6.1%) or green (10.7) foods. Children described food as yummy (75.2%), okay (7.6%), and yucky (17.2%). Consumption of vegetables (46.9%) was significantly ($p < 0.05$) lower than dairy (88.9%), fruits (82.0%), grains (81.8%), and meats (72.8%). Children consumed a high percentage (77.9%) of fats/sweets. **CONCLUSION:** The amount of food consumed at lunch was significantly less than the menu and served amounts, indicating that children were not meeting the dietary recommendations as intended, potentially contributing to long-term health consequences.

425 Board #241 May 27 9:30 AM - 11:00 AM
The Effects Of Two Different Patterns Of Protein Ingestion On Muscle Growth In Trained Men.

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It is known that different patterns of protein ingestion might influence the muscle protein synthesis rate in different magnitudes. However, it is questionable whether this could be translated into differential muscle growth, when the total amount of protein ingested throughout the day is equal and optimal to induce muscle hypertrophy.

PURPOSE: To examine whether consuming the recommended amount of protein, for hypertrophy, in 3 or 5 meals results in different muscle growth on trained men submitted to 8 weeks of resistance training.

METHODS: 19 men (24.9 ± 5.6 years old), with more than 1 year of experience in resistance training, were randomly allocated in one of two groups: P3X ($n=10$) or P5X ($n=9$). All volunteers had a diet program prescribed by a registered dietitian. Men in the P3X group, were instructed to ingest the recommended amount of protein (1.6-2.2g/kg), mainly, in three meals; while, men in the P5X were instructed to ingest the total amount of protein in five meals. While dieting, both groups were submitted to an equal program of lower limbs resistance training, for 8 weeks, twice a week. Each session comprised 5 sets of unilateral horizontal leg press and 3 sets of unilateral knee extension, with a range of 8-12RM and 2 minutes of interval between sets. Before, and after, the intervention, the cross-sectional area (CSA) of muscles rectus femoris (RF) and vastus lateralis (VL) were measured by ultrasonography and then, data were analyzed. The normality and homogeneity of data were tested with Shapiro-wilk's and Levene's tests, respectively, and then a repeated measures GLM analysis was run to test the effects of intervention (P3X vs P5X) vs time (baseline vs 8 weeks) on muscle CSA.

RESULTS: Both groups showed an increase in the CSA of RF (P3X: 9.97 ± 0.58 to 10.76 ± 0.56 cm², P5X: 8.53 ± 0.61 to 9.64 ± 0.59 cm², $p=0.014$), VL (P3X: 30.19 ± 1.54 to 33.60 ± 1.49 cm², P5X: 31.95 ± 1.62 to 34.13 ± 1.57 cm², $p=0.003$), and in the sum of the CSA of both muscles (P3X: 40.16 ± 1.70 to 44.36 ± 1.72 cm², P5X: 40.48 ± 1.79 to 43.77 ± 1.81 cm², $p=0.002$). However, there was no statistically significant difference between groups for any of the variables.

CONCLUSIONS: The ingestion of the total amount of protein, recommended for induction of muscle hypertrophy, in three or five meals a day had no influence in rectus femoris and vastus lateralis muscles growth.

426 Board #242 May 27 9:30 AM - 11:00 AM
Protein-enriched Meals At Breakfast Increase Muscle Accretion In Healthy Young Men Undergoing 12-week Resistance Training

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 (No relevant relationships reported)

While daily protein intake has been reported to be essential for muscle regulation, the breakdown of daily protein intake in individuals is typically the lowest at breakfast and skewed towards dinner. Skewed protein intake pattern and inadequate protein intake at breakfast was reported to be a negative factor for muscle regulation, and no study has examined the effects of protein intake pattern at each meal on anabolic response such as muscle hypertrophy.

PURPOSE: This study aimed to examine whether a protein-enriched meal at breakfast to achieve adequate protein intake at all 3 meals is more effective for muscle accretion compared to typical protein intake pattern, skewed protein intake towards dinner.

METHODS: This 12-week, parallel-group randomized clinical trial included 26 men (means \pm SEs; age, 20.8 ± 0.4 years; BMI, 21.8 ± 0.4 kg/m²). The participants were divided into 2 groups: HBR ($n = 12$), consuming a protein-enriched meal at breakfast to achieve adequate protein intake at all 3 meals; LBR ($n = 14$), consuming a provided meal at breakfast to achieve adequate protein intake at lunch and dinner. The

participants performed 12-week supervised resistance training (RT) program 3 times/week (3 sets of 8-12 repetitions at 75-80% of one repetition maximum for 5 exercises). We used dual-energy X-ray absorptiometer to measure total fat-free mass (TotalFFM). **RESULTS:** No significant difference in TotalFFM was observed between the 2 groups at baseline (HBR vs LBR: 52.4 ± 1.3 vs 53.4 ± 1.2 kg). After completing the 12-week diet plan and RT program, both the groups gained significant TotalFFM (2.1 ± 0.2 kg, 4.0 ± 0.4), with the HBR group having greater changes in TotalFFM than the LBR group [HBR vs LBR, 2.5 ± 0.3 vs 1.8 ± 0.3 kg; $P = 0.056$; cohen's $d = 0.795$ (Large effect size)].

CONCLUSIONS: Protein-enriched meal at breakfast to achieve adequate protein intake at all three meals is more effective than skewed protein intake at dinner for RT-induced muscle hypertrophy.

This work was supported by the Japan Society for the Promotion of Science, Grants-in-Aid for Scientific Research (no. 17H02183 to S. Fujita).

427 Board #243 May 27 9:30 AM - 11:00 AM
Effects Of Protein Pre-run On Glucose And Perceived Exertion - A Pilot Study

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Purpose: Protein recommendations pre-running have yet to be established and will need to consider performance responses as well as the potential for exercise-induced gastrointestinal symptoms. The purpose of this study was to examine the impact of a high protein (HP) shake consisting of 0.4 g/kg body weight (BW) protein vs. a low protein shake (LP) 0.15 g/kg BW protein pre-run on glucose, gut fullness, and perceived exertion. **Methods:** Five ($n=2$ male) endurance trained runners were administered a HP or LP shake one hour prior to a 10 km run in a randomized cross-over design. Carbohydrate and water intakes remained consistent across trials. Blood glucose was measured at fasting, 30, and 60 minutes post-shake and post-run using a glucose meter. Perceived exertion was measured using Borg's scale. Exercise induced gastrointestinal symptoms were measured at fasting, pre-run and post-run using a 10-point questionnaire. Gut fullness was measured using a visual analogue scale at fasting, 15, 30, 60 minutes post-shake and post-run. **Results:** Blood glucose peaked at 30 minutes post-shake and there was no difference between the HP and LP shakes. There was a significant interaction between time and shake ($p=0.044$), however no main effect of time or shake. There was no difference in perceived exertion between the two interventions. Gut fullness changed over time ($p=0.005$), however, was not affected by the composition of the shake. There was no difference in the number of exercise-induced gastrointestinal symptoms experienced on the HP and LP shakes. **Conclusion:** The results from this pilot study suggest that the inclusion protein in the pre-run meal is feasible and provides support for a fully powered trial. Supported by Mount Royal University Innovation Grant

428 Board #244 May 27 9:30 AM - 11:00 AM
Human Skeletal Muscle Mrna Expression In Response To Treadmill-based Endurance Training And Post-exercise Protein Supplementation

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Nutrient availability is known to influence the exercise response. However, there is a paucity of information regarding the role of post-exercise protein ingestion in modulating intra-muscular adaptation to treadmill-based endurance exercise training.

PURPOSE: To examine the influence of post-exercise protein ingestion on mRNA gene expression in response to six-weeks treadmill running. **METHODS:** In a randomized parallel group design, 15 individuals ($VO_{2max} 55 \pm 6$ ml·kg⁻¹·min⁻¹) completed six weeks of treadmill running (4 sessions per week), progressively increasing in both duration (30-60 min) and intensity (70-75 % VO_{2max}). Participants were randomly assigned to a group receiving a supplement containing carbohydrate (CHO; 1.6 g sucrose·kg⁻¹; $n=7$) or carbohydrate-protein (CHO-P; 0.8 g sucrose·kg⁻¹ and 0.8 g whey protein hydrolysate·kg⁻¹; $n=8$) ingested immediately post-exercise and then 1 h later. To determine mRNA expression of several mitochondrial, mitogenic signaling, protein synthesis and lipid/carbohydrate metabolism genes, muscle biopsy samples were collected at baseline and follow-up, with 48 h of lifestyle standardization to exclude any acute effects on transcriptional changes. **RESULTS:** An up-regulation in mammalian target of rapamycin (mTOR) gene expression was shown in CHO-P

(+46%; $p=0.025$) relative to CHO (+4%) following the intervention. Mitochondrial transcription factor A (TFAM) up-regulation was shown in CHO-P group (26%) when compared with CHO (13%), albeit this did not reach statistical significance ($p=0.07$). No changes in the expression of other mitochondrial, lipid/carbohydrate metabolism, mitogenic signaling genes were observed between groups ($p>0.05$). **CONCLUSION:** post-exercise protein supplementation up-regulates the expression of mTOR in skeletal muscle over six-weeks of treadmill-based endurance exercise training, indicating that post-exercise protein supplementation may have a potential role in accentuating skeletal muscle adaptations to endurance exercise training. Funder: Health Sciences Research Center, Lifestyle & Health Research Center (LHRC), Princess Nourah bint Abdulrahman University.

429 Board #245 May 27 9:30 AM - 11:00 AM
Varying Postprandial, Postexercise Nutrient Timing: Effects On Substrate Oxidation And Protein Retention In Resistance-trained Men

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Dietary protein and/or carbohydrate consumption augments postexercise recovery by facilitating the rebuilding of damaged contractile tissues and restoring energy reserves, particularly in a postabsorptive state. It is unclear how altering postexercise nutrient timing when in a postprandial state affects the shift towards fat utilization and changes in net protein retention after a resistance training bout. **PURPOSE:** To examine the effects of immediate versus delayed postexercise nutrient intake on substrate oxidation and protein retention during recovery. **METHODS:** In a single-blinded, crossover design, resistance trained (≥ 1 y) men ($n=10$, 22 ± 2 y, 83 ± 10 kg) consumed a mixed, eucaloric meal 2 hours before performing resistance exercise (3 sets of 6 whole body exercises, 2-3 minutes rest). Participants then consumed one of three postexercise beverages: immediate consumption of a whey protein concentrate (0.35 g/kg) and dextrose (1.0 g/kg) beverage (IMM), delayed consumption (2 h) of a whey and dextrose beverage (+2H), or placebo (flavoring with water) (PLA). Participants recovered (3 h) while expired carbon dioxide and oxygen were analyzed. Carbohydrate and fat oxidation was determined and body protein breakdown was investigated via analyses of salivary cortisol and urinary nitrogen excretion. **RESULTS:** Nitrogen balance in PLA (-0.02 ± 0.01 g) was significantly lower than +2H (5.21 ± 0.63 g, $p<0.001$, $ES=11.61$) and IMM (5.21 ± 0.64 g) ($p<0.001$, $ES=11.59$) during the three-hour recovery. There were no significant differences in nitrogen balance between IMM and +2H ($p=1.0$). Carbohydrate oxidation in IMM was significantly higher than +2H at 60 minutes postexercise (0.21 ± 0.13 g/min vs. 0.11 ± 0.12 g/min, respectively; $p=0.014$). Fat oxidation was higher in IMM at minute 90 ($p>0.05$, $ES=0.60$), minute 120 ($p>0.05$, $ES=0.40$), and minute 150 ($p>0.05$, $ES=0.50$). There were no significant differences in salivary cortisol among groups (all $p=1.0$). **CONCLUSION:** In the postprandial state, +2H promoted higher fat utilization than IMM, whereas IMM promoted greater carbohydrate oxidation earlier in the recovery period. Both interventions resulted in similar net protein retention. Thus, postponing postexercise nutrient intake when in a postprandial state may be implicated in body composition improvements.

430 Board #246 May 27 9:30 AM - 11:00 AM
Walking Or Body Weight Squats May Improve Muscle Dietary Amino Acid Sensitivity During Prolonged Sitting

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Low physical activity (e.g. reduced daily steps) reduces the ability of dietary amino acids (AA) to support muscle protein synthesis, leading to eventual muscle loss. Interrupting prolonged sitting with short bouts of intermittent exercise can improve carbohydrate and lipid metabolism, however its ability to sensitize skeletal muscle to dietary AA has yet to be investigated. **PURPOSE:** To determine the ability of interrupting prolonged sitting with practical 'activity snacks' to enhance the postprandial incorporation of dietary AA into myofibrillar protein. **METHODS:** As a subset of a larger study, twelve participants (7 males and 5 females; ~ 23 y; ~ 40.0 mlO₂/kg/min; ~ 25.1 kg/m²; ~ 4676 steps/d) completed three 7.5 hr trials in a randomized order consisting of prolonged sitting (SIT), sitting with intermittent walking (WLK; 2 min at 3.1mph every 30 min) or sitting with intermittent squatting (SQT; 15 'chair stands with calf raise' every 30 min). Mixed-macronutrient meals ($\sim 55:30:15\%$ carbohydrate:fat:protein) were provided at 20% (breakfast) and 30% (lunch) of daily energy requirements to be consistent with Western feeding patterns. Meals were

enriched to 15% with ring-^{[2}H₂]phenylalanine or ring-^{[13}C₆]phenylalanine to model the metabolic fate of dietary AA. Muscle biopsies taken at the end of each trial as well as at the beginning of trial 2 were used to determine change in AA enrichment (LC/MS/MS) in the myofibrillar protein fraction (Δ Myo). **RESULTS:** Δ Myo was 0.032 ± 0.004 MPE in SIT and tended to be greater with SQT (0.038 ± 0.003 ; $P=0.10$) and WLK (0.047 ± 0.006 ; $P=0.06$) according to a *prior* comparisons (paired one-tail T-test). Relative to SIT, effect sizes were large for WLK ($ES=0.88$; 95% CI $-0.30 - 2.07$) and moderate for SQT ($ES=0.55$; 95% CI $-0.60 - 1.71$). **CONCLUSION:** Interrupting prolonged periods of sitting with intermittent bouts of body weight-dependent activity has the potential to improve the utilization of dietary AA for *de novo* muscle protein synthesis in young healthy adults. Our results add to the evidence that reducing sedentary time through 'activity snacks' may help maintain muscle mass and quality. Future research should determine whether at risk populations (e.g. aging, obese) may obtain a greater benefit from this simple lifestyle modification. Supported in part by an ACSM Research Endowment Grant.

431 Board #247 May 27 9:30 AM - 11:00 AM
Measured Versus Predicted Resting Metabolic Rate In Overweight Men And Women Following Weight Loss

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Abstract: The multiplicity of resting metabolic rate (RMR) prediction equations indicates that many variables affect RMR, making it difficult to adopt a single equation for all individuals who wish to lose, gain or maintain weight. **PURPOSE:** To improve the accuracy of RMR prediction equations for obese individuals and to construct a new formula to evaluate RMR after weight loss (WL). **METHODS:** This study examined the RMR gap in 21 men (M) and 18 women (W), 25-60 yrs, with $27 < BMI < 40$ kg/m² and 10-20% WL after at least three months in a structured weight reduction program with a customized diet and professionally tailored exercise prescription. At entry and at follow-up visits participants' RMR, weight, height, fat-free mass (FFM), fat mass (FM), were measured with reliable instruments to ascertain the RMR change relative to FFM and FM. Pre and post RMR measurements were compared to calculated RMR using existing Harris and Benedict (HB), Ravussin and Bogradus (RB) and Johanness et al. (J). T-test, ANOVA and χ^2 test comparisons were analyzed using SPSS 19.0, significance level $P>0.05$. To improve accuracy new prediction equations were constructed through stepwise linear regression based on before (RMR_b) and after (RMR_a) RMR measurements: M: $RMR_b = 132.82 + 28.37(W) - 250.595(H) + 9.464(FFM) - 2.871(A) - 25.932(FM)$ M: $RMR_a = 1862.68 - 7.779(W) + 1716.697(H) + 18.091(FFM) + 1.964(A) + 14.972(FM)$ W: $RMR_b = 553.971 + 16.601(W) + 1033.839(H) - 13.734(FFM) - 10.930(A) - 19.668(FM)$ W: $RMR_a = 552.850 + 7.288(W) + 340.730(H) + 8.932(FFM) - 5.064(A) - 5.015(FM)$. **RESULTS:** In M and W there was a significant difference in WL (M: 104 ± 13 vs. 87 ± 11 ; W: 88 ± 10 vs. 75 ± 8 , $P\leq 0.01$), BMI (M: 33 ± 3 vs. 28 ± 3 ; W: 32 ± 4 vs. 27 ± 3 , $P\leq 0.01$) and FM in kg (M: 37 ± 7 vs. 26 ± 9 ; W: 40 ± 9 vs. 27 ± 8 , $P\leq 0.01$); M only in FFM (65 ± 9 vs. 63 ± 9 , $P=0.02$); W only in RMR (1802 ± 176 vs. 1684 ± 176 , $P=0.04$). Calculated RMR before and after WL using the J equation was closest to measured RMR in M and W before and in W after WL (M: -337 ± 223 ; W: -57 ± 256 , vs. -69 ± 128); but only accurate was W before WL ($P=0.351$). RMR calculations with the new equations were more accurate and closest to measured RMR before and after WL in M (-0.05 ± 154 vs. 0.03 ± 197) but only after WL in W (-30 ± 116). **CONCLUSION:** The study illuminates the need to adopt different equations for assessment of individuals' RMR before and after weight loss.

A-51 Free Communication/Poster - Behavioral Aspects, Correlates and Predictors of Exercise

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

**432 Board #248 May 27 10:30 AM - 12:00 PM
Do Genetic Variations Predict Physical Activity Response To Lifestyle Intervention Among Obese Adults With Diabetes?**

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PURPOSE: Those who are prone to high physical activity (PA) in natural environments may respond better to a PA promotion intervention than those who are prone to low PA. A genome-wide association study (GWAS) and a candidate gene study identified 4 single nucleotide polymorphisms (SNPs) related to PA: rs978656 near *DNAPT6*, rs10887741 near *PAPSS2*, rs7279064 near *C18orf2*, and rs6265 near *BDNF*. We hypothesized that the 4 SNPs will predict greater change in PA phenotypes in response to a lifestyle intervention.

METHODS: This is a secondary analysis of Look AHEAD, a multi-center randomized controlled trial among participants who are overweight/obese and have type 2 diabetes (ages 45-76). Look AHEAD is designed to test the health benefits of an intensive lifestyle intervention (ILI), combining calorie restriction and PA promotion for weight loss, as compared to diabetes support and education alone. We examined the moderating effects of the 4 SNPs individually and in a weighted genetic score (GS). Of the 3649 participants who were successfully genotyped for all the 4 SNPs, we examined only those cases that also completed Paffenbarger PA questionnaire (PPAQ) and cardiorespiratory fitness (CRF) measures at baseline, year 1, and year 4 (n=2675). We used linear mixed effects models to regress PA phenotypes (PPAQ and CRF) on genetic variations, time, intervention, as well as interactions between the three. Models controlled for age, sex, body mass index, ancestry principal components (for population stratification), and study sites and included a Bonferroni correction for multiple testing. Additive, recessive, and dominant models were tested.

RESULTS: None of the individual SNPs or the GS were associated with baseline CRF or PPAQ. The rs978656 interacted with time (year1) and intervention (p=0.04), such that the main effect of the intervention on CRF was significant (p=0.04) only among A allele carriers (less-PA-prone) at year 1; however, this finding did not persist following Bonferroni correction (alpha<0.006). GS was not predictive of change in CRF or PPAQ. Individual SNPs were not predictive of change in PPAQ.

CONCLUSIONS: The ILI may have a more salient effect on CRF among A allele carriers of rs978656. Future intervention studies on the genetic basis of PA change are recommended to include more GWAS-identified SNPs.

**433 Board #249 May 27 10:30 AM - 12:00 PM
Motives And Barriers To Initiation And Exercise Adherence In A Fitness Club Setting.**

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(No relevant relationships reported)

PURPOSE: Worldwide, about 183 million adults are fitness club members and there is a need of more understanding why some individuals adhere to exercise, and others drop-out. The main aims of the present study were to examine proportions reporting regular exercise, non-regular exercise and drop-out, as well as identify motives and barriers to exercise throughout the first year of fitness club membership. In addition, we wanted to compare motives between those who reported regular exercise at three, six and 12 months, with those who did not (irregular exercise or drop-out).

METHODS: New fitness club members (<four weeks membership) were followed for one year. At onset (n = 250), and after three (n = 224), six (n = 213) and 12 (n = 187) months, participants completed an electronic questionnaire (including background variables, exercise involvement, motives and barriers to exercise), and 184 answered at

all time-points. According to exercise involvement, participants were categorized into: *Regular exercise:* ≥two sessions/week, and *non-regular exercise:* ≤one session/week, exercise relapse or drop-out. Cochran's Q test, independent t-tests or χ^2 were used as appropriate.

RESULTS: Of 184 participants, 37.0% reported regular exercise throughout the follow-up. At three, six and 12 months; 23.0%, 28.3% and 34.8% reported exercise drop-out. At all follow-up, positive health (79.1% to 85.5%), increase in mobility (59.4% to 70.7%), and strength/endurance (58.3% to 66.3%) were reported as most important exercise motives. Among exercise drop-out, priority (60.9% to 71.7%) was perceived as most important barrier throughout one-year follow-up. Other barriers were reported by <20.0%. The intrinsic motives enjoyment and challenge were perceived as more important among regularly exercisers compared with non-regular exercisers (p = ≤0.05) throughout the first year of fitness club membership.

CONCLUSIONS: A total of 63.0% reported non-regular exercise throughout the first year of fitness club membership. Extrinsic motives and internal barrier were perceived as most important. Regular exercisers rated the intrinsic motives enjoyment and challenge higher than non-regular exercisers.

**434 Board #250 May 27 10:30 AM - 12:00 PM
Heart Rate Variability Mediates Fatigue And Motivation Throughout A High-intensity Exercise Program.**

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(No relevant relationships reported)

PURPOSE: High-intensity exercise programs are often promoted as a time-efficient public health intervention to combat chronic disease. Increased physical effort, and subsequent fatigue, can be barriers to long-term maintenance of these exercise programs. The purpose of the present study was to determine if heart rate variability (HRV) mediates state traits related to exercise program adherence. We hypothesized that exercise-induced, temporary shifts in resting HRV would significantly affect daily fatigue and motivation. **METHODS:** Fifty-five healthy men and women (ages 19-35 years) used a commercially-available smartphone application to monitor daily HRV status throughout a six-week high-intensity exercise intervention. Participants were randomly assigned to either control (CON) (n = 29, 24.1 ± 4.1 years, 41.4% male) or treatment (TREAT) (n = 26, 23.7 ± 4.5 years, 53.8% male) groups. Within CON, exercise intensity was completed as prescribed while intensity within TREAT was modulated in response to observed shifts in daily HRV. Participants reported state motivation to exercise and global physical fatigue immediately prior to each exercise session. **RESULTS:** Prevalence of temporary shifts in resting HRV were 37.6 and 38.7% for the CON and TREAT conditions, respectively. Within CON, shifts in HRV resulted in less motivation (mean diff. = -4.00%; 95%CI = -7.56, -0.44; F = 4.86, p = 0.028) and more physical fatigue (mean diff. = 4.79%; 95%CI = 1.85, 7.74; F = 10.24, p < .001). Spectral domain metrics (i.e., LF:HR ratio) were significantly lower (mean diff. = -0.14 au; 95%CI = -0.27, -0.01; F = 4.715, p = .030) during HRV shifts. Within TREAT, shifts in HRV resulted in no change in motivation (mean diff. = 2.58%; 95%CI = -6.54, 1.38; F = 1.63, p = .202) with reduced physical fatigue (mean diff. = -5.94%; 95%CI = -9.56, -2.32; F = 10.40, p = .001). Within TREAT, LF:HF ratio was higher (mean diff. = 0.13 au; 95%CI = 0.23, 0.24; F = 5.59, p = .018) during HRV shifts. **CONCLUSIONS:** These data establish a link between expected shifts in heart rate variability throughout high-intensity exercise programs with motivation to participate and physical fatigue. Additionally, modulation of training volume, in response to these shifts, can optimize adherence-related behavioral responses during high-exercise programs.

**435 Board #251 May 27 10:30 AM - 12:00 PM
AUTONOMY AND VARIATION IN HIGH-INTENSITY INTERVAL TRAINING: IMPACTS ON POST-EXERCISE ENJOYMENT, SELF-EFFICACY, AND INTENTION**

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Benefits associated with high-intensity interval training (HIIT) are established and research demonstrates that HIIT is well-tolerated in a variety of populations, protocols, and modalities. However, relatively little is known about the impact of variation and self-selection of work intervals on post-exercise perceptions. **PURPOSE:** The purpose of this study was to determine the impact of autonomy and variation on exercise enjoyment and both self-efficacy for and intention to repeat HIIT exercise. **METHODS:** Twenty-one physically active participants (12 male, 9 female; mean BMI = 27 ± 3; mean age = 28 ± 6) completed three, 20-minute HIIT trials after

completion of maximal testing. All experimental trials included a total of 10 minutes of work and 10 minutes of recovery. Work and recovery were conducted at 90% and 10% of peak work, respectively. Trials included: a standard interval bout with repeating 60-sec work and recovery segments (Traditional), an interval bout with a mix of predetermined 30-, 60-, 90-, & 120-second segments (Varied), and a bout with a self-selected number of 30-, 60-, 90-, & 120-second segments (Autonomous). In-task affective valence and enjoyment were measured four times during work and recovery. Data was analyzed using dependent t-tests. RESULTS: Enjoyment measured via questionnaire post-exercise revealed no significant differences between the three trials ($P > 0.05$) suggesting similar levels of enjoyment for all trials. All three trials were deemed to be enjoyable exercise sessions (scores ranging from 95-100 on the 18-126 scale). Self-efficacy for completing HIIT (measured on a 0-100 scale) was greater for the Autonomous trial compared to the Varied trial (77% vs. 70%; $P < 0.05$) and intention to exercise (measured on a 1-7 scale) was not different across trials, but there was a trend towards Autonomous HIIT producing stronger intentions than Varied HIIT (4.3 vs. 3.7; $P < 0.10$). CONCLUSIONS: Findings indicate that each trial of HIIT was enjoyable and produced relatively positive ratings for exercise self-efficacy and intention. These findings suggest that provision of autonomy during HIIT exercise sessions can produce more desirable psychological responses for self-efficacy and possibly exercise intention.

436 Board #252 May 27 10:30 AM - 12:00 PM
Perceived And Actual Motor Competence And Physical Activity In Children With And Without Asthma

Indica Sur, Katherine Q. Scott-Andrews, Lexie R. Beemer, Tiwaloluwa A. Ajibewa, Leah E. Robinson, FACSM, Toby C. Lewis, Rebecca E. Hasson, FACSM. *University of Michigan, Ann Arbor, MI.* (Sponsor: Rebecca Hasson, FACSM)
 (No relevant relationships reported)

Motor competence (MC) and perceived motor competence (PMC) are important determinants of physical activity participation and may contribute to the lower physical activity levels and fitness previously observed in children with asthma.

PURPOSE: The purpose of this study was to compare MC, PMC, and moderate-to-vigorous physical activity (MVPA) levels in children and adolescents with and without asthma, and to determine whether motor skills predict lower MVPA in children with asthma compared to their healthy peers.

METHODS: Eleven children with persistent asthma (age=11.1±0.7 years; 54.5% female; BMI percentile=53.4±9.8) and 20 children without asthma (age=11.1±0.6 years; 50.0% female; BMI percentile=60.3±6.2) participating in the Exercises for a Healthy Asthma Lifestyle and Enjoyment (EXHALE) study have been analyzed to date. Asthma diagnosis was verified by the child's physician. MC was measured using the Movement Assessment Battery for Children-2. PMC was measured using the Athletic Competence domain from the Self-Perceptions Profile for Children. MVPA was assessed via accelerometry.

RESULTS: Children with asthma reported lower PMC than children without asthma (2.5±0.1 vs. 2.9±0.1, $p=0.04$) with no significant differences in MC between groups (7.0±0.9 vs. 7.6±0.5, $p=0.55$). Children with asthma engaged in 16 fewer minutes of MVPA per day compared to their healthy peers (27.7±5.5 vs. 44.1±22.3, $p=0.06$), however, in preliminary analyses, this difference was not statistically significant. MC and PMC were not significant predictors of MVPA (MC: $\beta=0.95\pm 1.70$, PMC: $\beta=-14.6\pm 9.3$; $p>0.05$), and there were no differences by asthma status ($p>0.05$).

CONCLUSIONS: Children with asthma reported lower self-perceptions of motor competence and engaged in fewer minutes of health-enhancing physical activity compared to their healthy peers. Motor skills, however, were not significant predictors of physical activity engagement. Additional research is needed to better understand the factors contributing to lower physical activity levels and fitness previously observed in children with asthma. As the EXHALE study proceeds, we will be able to reexamine these relationships further and examine asthma characteristics that may influence these relationships.

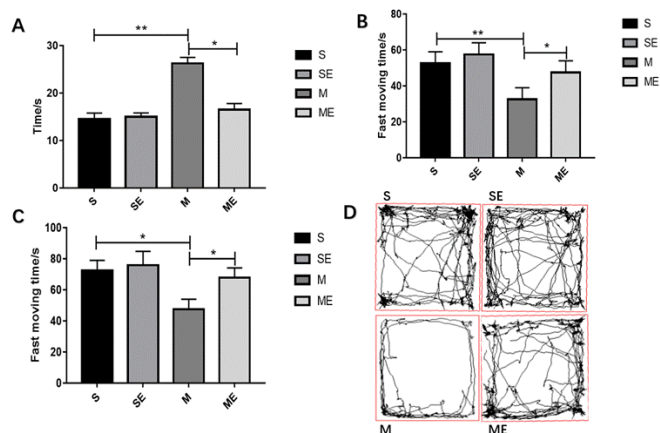
437 Board #253 May 27 10:30 AM - 12:00 PM
Aerobic Exercise Enhances Behavior Features In Model Of Parkinson'S Disease Mice Via Pink1/parkin Pathway

Jianshe Wei, Baozhu Fan, Riffat Jabeen, Chunlei Guo, Bright Anyomi, Solomon Agegnehu, Mengjie Han, Yuling Zhang, Yuling Zhang, Ke Wang, Hui Zhang, Juan Cen, Xinying Ji. *Institute for Brain Sciences Research, Henan University, Kaifeng, China.*
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 (No relevant relationships reported)

Oxidative stress in the brain of Parkinson's patients leads to impaired mitochondrial function, while exercise can improve mitochondrial function, but the mechanism is unclear. There are two mechanisms of mitochondrial function: autophagy and transport function. **PURPOSE:** To detect the expression of mitochondrial autophagy protein

PINK1/Parkin in MPTP-induced Parkinson's (PD) mice by treadmill exercise, and to explore the effect of aerobic exercise on mitochondrial function. **METHODS:** 32 C57BL/6J male mice were divided into 4 groups: Saline group (S), Saline+ Exercise group (SE), MPTP group (M), and MPTP + Exercise group (ME). M and ME mice were injected with MPTP to construct a PD model. SE and ME mice were subjected to 8 weeks treadmill training. Behavioral tests were performed after exercise; immunofluorescence and histochemistry, and Western Blot to detect molecular indicators. **RESULTS:** (1) The time of passing the balance beam, M group was longer than the S group ($P<0.01$), and the ME group was shorter than the M group ($P<0.05$) (Fig1A); In the forced swimming test (Fig1B) and the open field experiment (Fig1C&D) the mouse fast moving time, M group was shorter than the S group ($P<0.05$), while the ME group was longer than the M group ($P<0.05$). (2) The expression of α -Syn was up-regulated in the M group ($P<0.01$), but in the ME group was decreased after exercise ($P<0.05$) (Fig2). (3) The expression of Tyrosine hydroxylase (TH)(Fig3), TOM-40(Fig4) in group M was lower than that in group S ($P<0.05$), while ME group was higher than that M group ($P<0.05$). (4) The protein of Parkin and PINK1 were increased after exercise ($P<0.05$) (Fig5). **CONCLUSION:** Exercise can enhance the mitochondrial autophagy ability, improve the mitochondrial transport function, promotes behavior features in PD mice.

Key words: aerobic exercise; mitochondria; autophagy; Parkinson's disease
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438 Board #254 May 27 10:30 AM - 12:00 PM
Age Differences For Relationships Between Perceived Health, Exercise Motivation And Self-efficacy Factors After HIFT

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Reported Relationships: K.M. Heinrich: Consulting Fee; I received payment for consulting on two outside legal cases regarding the same exercise program as used in my abstract.

Health benefits are a frequent exercise motive, despite mental and fitness improvements occurring sooner. Key cross-sectional participation motives in high intensity functional training (HIFT) have included mental (e.g., enjoyment), social (e.g., affiliation), and fitness (e.g., nimbleness) factors, which vary by age and are related to self-efficacy (SE). However, no research has examined relationships between changes in these variables after HIFT participation. **PURPOSE:** To investigate how perceived changes in health and motivation related to SE changes by age. **METHODS:** Data were from an ongoing program evaluation study at a university HIFT gym. Participants ($n = 35$; 52% female, 97% white, 26.5 ± 26.6 months HIFT experience) were emailed two online surveys (2-6 months apart) including demographics, general health status, exercise motivation, and 12 SE mental, social, and fitness factors including HIFT adherence. Participant age ranged from 20-76 years; three age cohorts (C) were used for analysis: C1 (20-34 years, $n = 10$), C2 (35-64 years, $n = 13$), and C3 (65+ years, $n = 10$). Difference scores were compared using bi-variate correlations. **RESULTS:** No C1 participants reported changes in health; a slight decrease in motivation (-0.4 ± 1.0) was not correlated with changes in any SE factors. For C2 participants, the slight improvement in health (0.2 ± 0.4) was significantly correlated with SE for adherence ($r = 0.68$, $p = .011$), describing fitness goals/weaknesses ($r = 0.81$, $p = .001$), and recognizing strengths/weaknesses in different situations; a slight increase in motivation (0.3 ± 1.0) was not correlated with any changes in SE factors. Although C3 participants averaged a slight decrease in health (0.2 ± 0.4), improved health was correlated with SE for adherence ($r = 0.78$, $p = .008$); and a slight motivation increase (0.4 ± 1.5) was correlated with SE for adherence ($r = 0.65$, $p = .04$)

and agility ($r = 0.78, p = .006$). **CONCLUSIONS:** Perceived health improvements for participants ages 35+ increased SE for adherence, as well as mental factors for middle-age participants, while increased motivation was only related to increased SE for adherence among older adults. Age differences must be considered for HIFT program design and delivery, and future research might examine these relationships in comparison to other fitness programs.

439 Board #255 May 27 10:30 AM - 12:00 PM
Physical Activity, Sedentary Behavior, And Social Media Use In College Students

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 (No relevant relationships reported)

There is currently a gap in the literature regarding the relationship between physical activity (PA), sedentary behavior, and social media use. It is unclear if hours per day of social media use is associated with activity patterns of college students. Additionally, it is unclear if type of social media accounts followed influence activity patterns. **Purpose:** To examine the relationship between PA, sedentary behavior, and social media use in college students. **Methods:** College students completed a one-time online questionnaire. PA and sedentary behavior were assessed using the International Physical Activity Questionnaire-Short Form. **Results:** Two-hundred ninety-two students provided informed consent and were eligible to participate in the study. Activity patterns were self-reported [median (25th, 75th percentile)]. Participants reported 120 (80, 240) min/wk of moderate intensity PA, 240 (120, 360) min/wk of vigorous intensity PA, and 250 (165, 360) min/wk of sedentary behavior. Only 30.8% of the sample engaged in a minimum of 150 of moderate intensity activity each week, and 61.4% in the recommended minimum of 75 minutes of vigorous intensity PA. Furthermore, 31.6% of participants did not report any engagement in moderate intensity PA, and 27.9% did not report any engagement in vigorous intensity PA. In this sample, 97.9% of students reported using social media daily, with 41.38% and 43.1% reporting 1-2 hours and 3-4 hours of social media use each day, respectively. Social media use was not associated with moderate or vigorous intensity physical activity ($p > 0.05$); however, hours per day of social media use was associated with sedentary behavior ($r = 0.156, p = 0.009$). Additionally, following health/fitness social media accounts was significantly associated with BMI ($r = -0.129, p = 0.029$), sedentary behavior ($r = 0.128, p = 0.031$), and reaching the vigorous intensity PA guidelines minimum recommendation ($r = -0.194, p = 0.001$). **Conclusion:** While there is an increased interest in utilizing social media as an intervention strategy to promote behavior change, results from this study indicate that social media may have a undesirable relationship with vigorous intensity PA and sedentary behavior. Future studies should examine the longitudinal influence of social media on PA and use objective PA monitoring.

440 Board #256 May 27 10:30 AM - 12:00 PM
Influence Of Resistance-exercise Training On Total Physical Activity In Gulf War Veterans With Chronic Pain

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Nearly 30% of US military Veterans of the Persian Gulf War are currently suffering from debilitating multisymptom illnesses. A primary complaint among these individuals is chronic widespread musculoskeletal pain (CMP). Previously our lab has observed lower levels of total physical activity (PA) in civilian CMP patients compared to their healthy peers. In general, CMP patients with lower levels of PA are at risk for greater disability. While exercise-training interventions may have demonstrated benefits for fitness and health related outcomes, their influence on total PA, particularly in CMP patients, is an open question.

PURPOSE: To quantify the influence of a 16-week resistance exercise training (RET) trial on self-reported and actigraphy measures of total PA in Gulf War Veterans (GV) with CMP.

METHODS: Fifty-five GV with CMP were randomly assigned to 16 weeks of RET (n=28) or a wait-list control (n=27). The RET consisted of twice weekly sessions with a personal trainer, initiated at a low intensity (25-35% 1 RM) with progression as tolerated. At baseline, 6 weeks, 11 weeks, and 17 weeks, all participants completed the International Physical Activity Questionnaire (IPAQ) and wore a waist-mounted actigraphy monitor (ACTI) for 7 d during waking hours. Total PA was defined for the IPAQ as the summative total score (MET-min/week) and for the ACTI as total counts per day relative to wear time (counts/d/min). Analyses were limited to GV with valid

measures at baseline and at least one additional time point. Data were log transformed and extreme outliers (> 3 SD) were excluded. Separate linear mixed models with group and time point as fixed effects were computed for the IPAQ and ACTI measures, using baseline values as a covariate to control for initial differences.

RESULTS: GV assigned to RET completed 88% of training sessions and exhibited strength increases of $>20\%$ for 7 of 8 lifts. Estimates for the fixed effects and their interaction were not significant for either measure (IPAQ: $F_G = 0.17, F_{TP} = 0.02, F_{G \times TP} = 0.09, p < 0.05$; ACTI: $F_G = 0.47, F_{TP} = 0.09, F_{G \times TP} = 0.22, p < 0.05$).

CONCLUSION: Although 16 weeks of RET were well attended and resulted in improvements in fitness for GV with CMP, total PA level, outside of the exercise sessions, did not appear to be impacted.

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441 Board #257 May 27 10:30 AM - 12:00 PM
Acute Effects Of Intermittent Physical Activity On Psychological Stress And Insecurity In Children And Adolescents With And Without Asthma

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Intermittent physical activity (PA) may be a novel strategy to promote PA in children and adolescents with asthma, potentially averting the physiologic changes associated with exercise-induced bronchoconstriction that occurs during longer bouts of exercise. Yet, the psychological impact and acceptability of intermittent PA have not been rigorously evaluated in this clinical population. **PURPOSE:** To examine acute changes in psychological stress and insecurity in children and adolescents with and without asthma while performing five exercise conditions in a laboratory setting. **METHODS:** Thirty-one children and adolescents between the ages of 8-15 years (35% with asthma; 52% female; mean age: 11.1 ± 0.4 years; BMI_{50ile}: 57.8 ± 5.2) were recruited from Southeast Michigan to participate in the Exercises for a Healthy Asthma Lifestyle and Enjoyment (ExHALE) Study. Participants completed 5 exercise conditions in the following order: i) 6-minute walk test, ii) 5-minute resistance circuit, iii) 5-minute activity video, iv) 5-minute gamified obstacle course, and v) the YMCA Three-Minute Step Test. Heart rate (HR) and rating of perceived exertion (RPE) were measured to objectively and subjectively assess exercise intensity using HR monitoring and the children's OMNI Perceived Exertion Scale, respectively. Psychological stress and insecurity were self-reported using a Visual Analog Scale pre- and post-activity. **RESULTS:** Mean HR was significantly different across all conditions ($p < 0.01$), with the highest HRs observed during the obstacle course and the lowest HRs during the activity video (gamified obstacle course: 167.2 ± 2.4 bpm; step test: 146.0 ± 3.5 bpm; walk test: 122.4 ± 4.1 bpm; resistance circuit: 113.8 ± 2.9 bpm; activity video: 105.7 ± 2.5 bpm). There were no differences in HR by asthma status ($p > 0.05$). RPE followed the same trend as HR but there were no significant differences in RPE ($p = 0.05$), psychological stress or insecurity across conditions or by asthma status ($p > 0.05$). **CONCLUSIONS:** Intermittent PA of varying intensity and duration did not increase psychological stress or insecurity in children and adolescents with and without asthma. These findings provide preliminary evidence in support of using intermittent PA to promote PA participation among children and adolescents with asthma.

442 Board #258 May 27 10:30 AM - 12:00 PM
Psychological Responses To Intermittent Physical Activity In Children With And Without Asthma

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BACKGROUND: Knowing *how* children feel during physical activity and what *type* of activities they enjoy can provide insight regarding their motivation to participate in future activity. These factors may be especially important for children with asthma who experience many barriers to maintaining an active lifestyle. **PURPOSE:** To compare psychological responses (physical activity enjoyment and mood) during intermittent activities of varying intensity and durations in children with and without asthma. **METHODS:** Thirty-one children (asthma: n=11, 45% male, mean age: 11.1 ± 0.7 years, BMI_{50ile}: 53.4 ± 9.8 ; non-asthma: n=20, 50% male; mean age: 11.1 ± 0.6 years; BMI_{50ile}: 60.3 ± 6.2) participated in the Exercises for a Healthy Asthma Lifestyle and Enjoyment (ExHALE) Study. Participants completed 5 conditions in the following order: 1) Six-minute moderate-intensity walk test, 2) 5-minute moderate-intensity resistance circuit, 3) 5-minute moderate-intensity activity video, 4) 5-minute high-intensity gamified obstacle course, and 5) the YMCA three-minute high-intensity step test. Enjoyment was assessed via the Physical Activity Enjoyment Scale following

each condition. Mood was assessed via the Feeling Scale at the midpoint of each condition. **RESULTS:** There was a significant effect of condition on mood across activities ($p < 0.02$) with lower mood reported during the step test compared to the walk test, resistance circuit, and activity video (step test: 2.1 ± 0.3 vs. walk test: 3.6 ± 0.3 , resistance circuit: 3.2 ± 0.3 , activity video: 3.4 ± 0.3 , all p 's < 0.01). There was no effect of condition on enjoyment with children reporting high levels of enjoyment across activities (walk test: 3.6 ± 0.1 , resistance circuit: 3.9 ± 0.1 , activity video: 3.9 ± 0.1 , obstacle course: 3.9 ± 0.1 , step test: 3.7 ± 0.2 ; $p > 0.05$). There were no differences by asthma status on mood or enjoyment across activity conditions (all p 's ≥ 0.05). **CONCLUSIONS:** Participants reported lower mood during the higher intensity tempo-paced activity, but similar levels of enjoyment for all activities. These findings suggest intermittent activity of varying intensities and durations is an enjoyable form of exercise for both children with and without asthma.

443 Board #259 May 27 10:30 AM - 12:00 PM
Alcohol, Tobacco And Marijuana Use In A Population Of Ultramarathon Runners

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Purpose: It is well accepted that routine low to moderate intensity physical activity leads to decreased cardiovascular (CV) morbidity and mortality. However, recent observational studies suggest that athletes who exercise at the highest doses (frequency x duration x intensity) may exhibit a reverse J-shaped dose-response with respect to mortality and development of CV disease. Our objective was to determine the prevalence of alcohol and marijuana use in ultramarathon runners and whether these behaviors were associated with CV risk factors.

Methods: This was a pilot survey involving 2018 John F. Kennedy 50 Mile ultramarathon race participants held in Hagerstown, MD. Predefined CV risk factors included current or prior history of smoking, diabetes, hypertension, dyslipidemia, and obesity (BMI > 30). Health behaviors included use of alcohol and marijuana. **Results:** Of the 868 registered runners, 292 (34%) completed the survey. 106 (36.3%) runners had at least one CV risk factor and 15 (5.2%) had known CV disease. Overall, 1.4% of runners reported being a current smoker, 25.3% were prior smokers, 31.3% lived with a smoker, 2.8% consumed alcohol during ultra events, 45.7% consumed alcohol after ultra events, 13.8% were told they drink too much, and 12.4% regularly used marijuana. Runners with at least one CV risk factor were more likely to have consumed alcohol during ultra events ($p = 0.025$) and were told they drink too much ($p < 0.001$). Using marijuana was marginally associated ($p = 0.082$) with having at least one CV risk factor.

Conclusions: These findings suggest that use of alcohol may be associated with increased CV risk in this unique population. Further study is required to explore whether elevated CV risk is the result of extreme doses of exercise, lifestyle habits (alcohol and marijuana use), or a combination of both factors that have not been accounted for in large observational studies.

444 Board #260 May 27 10:30 AM - 12:00 PM
Perceived Barriers And Motivators For Physical Activity In Women With Perinatal Depression

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Physical activity (PA) may help reduce severity of depressive symptoms in women with perinatal depression (depression during pregnancy or postpartum). However, less than one third of pregnant and postpartum women meet national PA recommendations, and PA is likely even lower in women with perinatal depression. Barriers and motivators for PA among women with perinatal depression are not well understood. **PURPOSE:** The aim of this study was to identify barriers and motivators for PA among women with perinatal depression. **METHODS:** Pregnant and postpartum women with perinatal depression were identified using Kaiser Permanente Northern California's universal perinatal depression screening program. We conducted 8 focus groups totaling 35 women with prenatal ($n = 15$) and postpartum depression ($n = 20$). Focus groups were analyzed using an inductive approach. **RESULTS:** Pregnant women were, on average, 27 weeks gestation (range: 11-37) with mild to moderately severe depressive symptoms (Patient Health Questionnaire (PHQ)-8 mean: 10; range:

4-19). Postpartum women were, on average, 12.5 months postpartum (range: 8.5-16.5) with no to moderately severe depressive symptoms (PHQ-8 mean: 7; range: 0-16). Perceived barriers to PA identified by pregnant and postpartum women included low energy and mood, limited time due to other priorities, feeling discouraged when comparing to pre-pregnancy self, and limited geographic accessibility and high cost of group exercise classes. Unique barriers identified by pregnant women were physical discomfort and fear of judgement from others. Postpartum women identified lack of childcare as an additional barrier. Motivators for PA identified by pregnant and postpartum women included self-care ("me time"), improved mood after PA, making progress toward goals, being strong and fit to keep up with their children, and having a social support system. **CONCLUSIONS:** Interventions to increase PA in pregnant and postpartum women with perinatal depression should include components addressing motivation, time, geographic accessibility, and cost barriers. Interventions can also increase PA by promoting potential mood benefits, fostering a sense of accomplishment, and leveraging social support as motivators in pregnant and postpartum women with perinatal depression.

445 Board #261 May 27 10:30 AM - 12:00 PM
Exercise Interests, Identity, And Motivations Across Levels Of Activity And Exercise Preferences: What Moves You?

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Despite numerous benefits of engaging in adequate moderate-to-vigorous physical activity (MVPA), nearly half of US adults do not meet activity guidelines. Exercise motivations have been positively associated with MVPA; however, little research has investigated exercise interests and identity across levels of MVPA and exercise mode preferences. **PURPOSE:** To determine differences in exercise identity, interests, and motivations across levels of MVPA and exercise mode preferences. **METHODS:** US adults ($n = 170$; age 34.1 ± 13.9 y) completed a survey consisting of the Exercise Identity Scale, Behavioral Regulation in Exercise Questionnaire, and Exercise Interest Scale. Demographic information, MVPA and exercise preferences were also reported. Data were analyzed using one-way ANOVA to determine differences across quartiles of MVPA and exercise mode preferences. **RESULTS:** Exercise identity was significantly lower in Q1 (35.3 ± 12.6) than Q3 (48.8 ± 10.5 , $p < 0.001$) and Q4 (53.2 ± 10.7 , $p < 0.001$). Exercise interests were different across quartiles with Q1 reporting lower scores in the challenge ($p < 0.01$) and creativity ($p < 0.05$) subscales. Intrinsic motivations ($p \leq 0.001$) were different across quartiles of MVPA with higher motivations with increased MVPA. Exercise interests differed across exercise preference, specifically in the outdoor ($p < 0.001$), competition ($p = 0.001$), social ($p = 0.04$), and challenge ($p = 0.02$) subscales. People who prefer outdoor exercise had significantly higher outdoor interest scores (14.1 ± 1.9) compared to those who prefer group (11.3 ± 3.0), individual (11.4 ± 2.9), or sport activities (11.8 ± 2.7 ; $p \leq 0.005$ for all). Further, people who prefer sports had higher competition interest (11.1 ± 2.9) than group (8.1 ± 3.0), individual (8.6 ± 2.9), or outdoor activities (8.4 ± 3.4 ; $p \leq 0.006$ for all). There were no differences in exercise motivation or identity across exercise mode preferences ($p > 0.05$). **CONCLUSIONS:** Our findings suggest exercise identity, interests, and intrinsic motivations may play an important role in MVPA engagement. Further, exercise preference could be determined using the Exercise Interest Scale. Future research should investigate the association between exercise interests, identity and motivations and long-term adherence to MVPA in previously inactive individuals.

446 Board #262 May 27 10:30 AM - 12:00 PM
The Effects Of Frequency Framing On Fitness Center Commitment Contracts

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 (No relevant relationships reported)

Research from the field of behavioral economics indicates that different frames of similar or equal situations can impact decision making. Rather than only focusing on maximizing utility, decision-makers are influenced by other, nonrational factors, such as the way choices are presented. **PURPOSE:** The purpose of this study was to analyze if the framing effect applied to the context of fitness center commitment contracts. **METHODS:** 145 adults (mean age [SD]: 36 [11] years; 88 men, 56 women) in the United States completed an online survey in which they were randomized to one of two frames. In the Twice/Week group, participants were asked to consider a commitment contract in which attending a fitness center twice per week for one year would result in a 50% membership reimbursement. Participants in the 104/Year group were asked to consider a commitment contract in which attending the fitness center 104 times in one year would result in a 50% membership reimbursement. Both commitment contracts were identical in terms of total commitment and total number of required fitness center visits (i.e., 104 times per year, or twice per week for 52 weeks [$2 * 52 = 104$]) but framed to emphasize either short-term intervals (weekly) or long-

term (yearly). Participants responded to questions about the likelihood of signing up for the promotion, the perceived effectiveness of the promotion for changing exercise behavior, and the perceived effectiveness of the promotion for getting new members to join the fitness center. **RESULTS:** Independent t-tests indicated no difference in reported likelihood of signing up for the promotion ($p = .434$), no difference in the perceived effectiveness for changing exercise behavior ($p = .144$), and no difference in the perceived effectiveness for getting new members to join the fitness center ($p = .324$). **CONCLUSIONS:** In the context of hypothetical fitness center memberships and commitment contracts, different frames of visit frequency did not impact the likelihood of signing up for the promotion, perceived effectiveness for changing exercise behavior, or perceived effectiveness for recruiting new members. The usually robust framing effect may not translate to this situation. These data were about hypothetical commitment contracts; therefore, real-world data are needed to replicate these findings.

447 Board #263 May 27 10:30 AM - 12:00 PM
An Examination Of Mental Toughness And Physical Activity Among College Students

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(No relevant relationships reported)

Despite the abundance of literature examining the effects of mental toughness (MT) on increased athletic performance, challenge appraisal, and motivation within the context of sport, there is a paucity of literature examining mental toughness within the context of physical activity (PA). Furthermore, studies that have examined mental toughness within the context of PA only included athletes in their samples.

Purpose: To examine MT and PA among college students enrolled in a mid-Western university. **Methods:** Participants ($N = 273$) completed online questionnaires regarding age, sex, race, athlete status, MT, and PA. The Mental Toughness Questionnaire-48 (MTQ48) was used to measure MT while the International Physical Activity Questionnaire – Short Form (IPAQ-SF) was used to measure PA. Pearson's Product-Moment Correlations were used to assess correlations between MT and PA. Independent samples *t*-tests were used to determine whether MT and PA varied according to sex (male vs female), race (White vs non-White), or athlete status (athlete vs non-athlete). **Results:** There were no significant correlations between overall MT, total PA, VPA, MPA, and meeting PA guidelines. Of the six subscales of MT, only challenge showed significant correlations with overall PA, $r(273) = .133, p < .05$; VPA, $r(273) = .199, p < .05$; and meeting PA guidelines, $r(273) = .119, p < .05$. Scores on the challenge subscale of MT were higher for athletes compared to non-athletes (3.68 ± 0.37 vs $3.55 \pm 0.43, p < .05$). Furthermore, overall PA was higher for athletes compared to non-athletes (688.65 ± 734.82 vs $324.80 \pm 511.70, p < .05$), as was VPA (444.15 ± 389.63 vs $191.73 \pm 269.78, p < .05$). Additionally, PA was higher for males compared to females (329.57 ± 16.44 vs $220.31 \pm 323.72, p < .05$). No significant differences were found between any form of MT and PA behaviors when regarding age and race. **Conclusion:** Mental toughness was not correlated with PA among college students. However, differences in MT and PA according to sex, race, and athletic status should be examined further.

448 Board #264 May 27 10:30 AM - 12:00 PM
Do Race, Physical Activity, Body Mass Index, And Sleep Quality Affect Mental Toughness?

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Physical activity (PA) has been linked to health and quality of life benefits. Differences in race and body mass index (BMI) may contribute to health-related disparities. Sleep quality (SQ) has been associated with both PA and health, influencing each other in a two-way interaction. Variations in PA are linked to differences in mental toughness (MT). MT is linked to lower SQ and increased PA, but the influence of race and BMI on MT is still under investigation. **PURPOSE:** To characterize the association and the effects of PA, race, BMI, and SQ on MT. **METHODS:** Sixty-two participants (age 25.4 ± 6.0 SD) completed surveys related to PA, race, BMI, SQ, and MT. Main and interaction effects of the responses analyzed using factorial ANOVA. Significance was set at $p < 0.05$. All analyses were performed using SPSS[®]. **RESULTS:** PA was positive correlated ($r = .246, p = .027$) and SQ was negatively associated with MT ($r = -.470, p = .000$). Race was negatively associated with MT ($r = -.234, p = .033$). SQ had a main effect on MT ($F_{31,1} = 18.568, p = .000, \eta^2 = .382$). PA and BMI interaction had an effect on MT ($F_{31,2} = 5.572, p = .009, \eta^2 = .271$). The interaction of race and BMI had an effect on MT ($F_{31,1} = 2.805, p = .043, \eta^2 = .272$). **CONCLUSION:** As previously reported, poor quality sleepers are mentally tougher compared to good quality sleepers. When PA and BMI are combined, PA and overweight individuals are mentally tougher, followed by the non-PA and underweight ones. When race and BMI are combined, White-overweight and other-normal BMI individuals are the mentally

toughest. Followed by Hispanic-overweight, and Asian underweight and obese I, II, III, with African Americans underweight and overweight having similar values. Health care professionals may find this information valuable when they are trying to address health-related issues that pertain to race, PA, BMI, SQ, and MT.

449 Board #265 May 27 10:30 AM - 12:00 PM
FUNCTIONAL FITNESS LEVELS REFLECT COGNITIVE HEALTH STATUS

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Alzheimer's disease currently affects 5.8 million people in the US and the number is projected to triple by 2050. As the baby boomer population ages, it is important to identify measures that correlate with cognitive decline. Measures that show a relationship with cognitive decline can serve as early indicators that a person is in need of a cognitive evaluation. **PURPOSE:** The purpose of this evaluation was to determine if functional fitness tasks could accurately discriminate between older adults with and without mild cognitive impairment. **METHODS:** Adults 60+ years participated in the present investigation ($n = 107$). Each participant completed demographic questionnaires; completed two stationary cognitive tasks: Montreal Cognitive Assessment (MoCA) and visual paired comparison (VPC); and completed four functional cognitive assessments: dual-task maximal speed (DTMS), dual-task habitual speed (DTHS), sit-to-stand power, timed up and go test (TUG). Participants with MoCA scores ≥ 23 were classified as cognitively intact (CIN), whereas participants with MoCA scores < 23 were classified as cognitively impaired (CIM). A one-way ANOVA determined if there were significant differences between groups for each cognitive task. **RESULTS:** Eighty CIN and twenty-three CIM subjects completed all assessments. The CIN group had higher scores on the VPC task ($p = .02$), while exhibiting faster times to complete DTMS ($p < .001$), DTHS ($p = .002$), and TUG ($p = .02$) compared to the CIM group. No significant differences were found between the cognitive groups in sit-to-stand power variables: peak power ($p = .08$), average power ($p = .07$), and average velocity ($p = .08$). **CONCLUSIONS:** Functional fitness assessments distinguished between CIN and CIM groups. As these results indicate, functional fitness may be an indicator of cognitive status. Future investigations should longitudinally track both functional fitness and cognitive function to further elucidate this relationship.

450 Board #266 May 27 10:30 AM - 12:00 PM
Do Perceptions Of Physical Environment Predict Physical Activity Intention Among International College Students?

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(No relevant relationships reported)

Purposes: International college students were at higher risk of being sedentary compared to domestic students (Yan et al., 2015). Physical environmental factors, such as accessibility and environmental safety, were previously found to predict physical activity (Strand et al., 2010). However, it is not clear whether environmental factors would have an impact on international college students given the fact that most universities have accessible recreation centers and other facilities. This study aimed to examine whether the perceptions of environmental safety and accessibility to physical activity are associated with the physical activity intention among international college students.

Methods: Participants were 249 international college students from a public university in Southern US (48.2% female; $M_{age} = 27.48, SD = 6.12$). The perception of the environmental safety and accessibility to physical activity were measured by a validated scale adapted from Yan (2012). Exemplar question was "It is safe to walk or jog alone where I live during the day". Physical activity intention was measured by three questions on a 7-point Likert scale (Blanchard et al., 2003; Trost et al., 2002). Gender and age were also measured.

Results: The independent T-test showed that males perceived the environment safer than females to do physical activity, $t(245) = 1.94, p = .05$. No gender difference in the perception of physical activity accessibility, $t(245) = .64, p > .05$. The multiple regression model on intention, controlling gender and age, was significant. Perception of environmental safety significantly predicted the physical activity intention ($\beta = .48, P < .001$), but not the environmental accessibility ($\beta = .13, P > .05$).

Conclusion: Compared to accessibility to physical activity, perception of environmental safety is more important for international college students to participate in physical activity. Colleges and universities should make sure the campus and community are safe for international college students to engage in physical activity.

451 Board #267 May 27 10:30 AM - 12:00 PM

The Desire To Move And Rest: Trait Or State? Crave Scale Validation Across 2 Years

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Purpose

The CRAVE (Cravings for Rest and Volitional Energy Expenditure) Scale measures the intrinsic desire or want for movement and sedentary behaviors, as assessed "right now". The purpose of the current study was to test the reliability of the CRAVE Scale: a) at 6-month intervals over 24-months and b) over 2 time points within the same test day.

Methods

The CRAVE Scale was administered to 127 subjects (57% non-Caucasian, 47% female) at 0, 6, 12, 18 and 24-months and at two time points (Point 1; Point 2) within the same lab session. CRAVE description: 13-items (7-Rest & 6-Move), 1-10 Likert scale. A Linear Mixed Effects (LME) Model was used for the analyses of test-retest reliability of the CRAVE across months and within each day. In addition, an LME was used to test gender and race/ethnic interactions with CRAVE.

Results

The CRAVE Scale showed greater reliability within each day (Table 1) than across months.

Within-day Move scores correlation: $r's = .74-.95$. Within-day Rest scores correlation: $r's = 0.73-0.89$. Move Score correlations across 0-24 months: $r = .49$ for point 1 and $r = .40$ for point 2 (p -values $< .05$). Rest Score correlations across 0-24 months: $r's = 0.37$ for measurements at both points (p -values $< .05$). Therefore, CRAVE scores taken within the same day were more closely associated than scores across 0-24 months. Race/ethnicity, but not gender, had a significant interaction with the CRAVE. Specifically, Asian individuals wanted to move more than Caucasians and African-Americans at 0-months, 6-months and 18-months and Hispanic individuals at 0 months only (p -values $< .05$).

Table 1. Means, standard deviations and correlations for Move and Rest Scores within the same test day (session points 1 and 2)

Time (months)	Move (Point 1)	Move (Point 2)	Move Scores (r)	Rest (Point 1)	Rest (Point 2)	Rest Scores (r)
0	32.7 ± 15.2	35.9 ± 12.8	0.95	25.1 ± 13.9	20.9 ± 11.9	0.89
6	28.4 ± 12.9	26.7 ± 14.5	0.74	24.3 ± 14.2	24.3 ± 16.7	0.73
12	30.6 ± 13.7	28.8 ± 13.6	0.79	24.4 ± 14.6	23.9 ± 15.8	0.82
18	29.0 ± 13.0	29.4 ± 13.1	0.86	28.0 ± 15.9	24.5 ± 15.2	0.76
24	29.9 ± 11.6	28.0 ± 11.7	0.82	26.4 ± 16.0	25.4 ± 16.3	0.84

Conclusion

These findings suggest that the desire (or want) to either move or rest has state-like properties. Individuals' desire to move/rest is does not vary by gender but may by race/ethnicity.

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Understanding College Students' Motivation In Virtual Reality-Based Exercise: An Expectancy-Value Approach

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With technology advances, virtual reality (VR)-based exercise has been widely used in clinical and rehabilitation training applications. Given the fact that numerous Kinesiologists have investigated the potential benefits of VR-based exercise among college students, it is needed to understand college students' motivation in VR-based exercise in order to promote their health and well-being.

PURPOSE: To investigate college students' motivation in VR-based exercise and exercise intention from the expectancy-value model perspective (Eccles et al., 1983), which includes expectancy-related beliefs and three task-values (i.e., attainment value, intrinsic value, and utility value).

METHODS: Participants were 72 college students ($Mage = 20.72$, $SD = 1.66$; Male = 54.2%) from a public university in the U.S. Among them, 94.4% of the participants reported "never" or "rarely" played VR-based exercise before. They played the VirZoom Arcade (stationary bike game) requiring moderate-to-vigorous pedaling and leaning their body to the left and right for at least 5 minutes. After attending the VR-based exercise session, participants completed VR-based expectancy-value questionnaires adopted from previous studies, which was developed for measuring students' motivation and intention for future participation in VR-based exercise.

RESULTS: The correlation analysis indicated the positive associations among the study variables. A multiple regression analysis revealed a statistically significant effect, $F(3,68) = 30.162$, $p < .001$, $R^2 = 57.1\%$. The utility value ($\beta = .409$), attainment value ($\beta = .296$), and intrinsic value ($\beta = .269$) were three significant predictors of students' intention for future participation in VR-based exercise, but the expectancy-related belief was not a significant predictor of students' intention for future participation in VR-based exercise.

CONCLUSIONS: The findings indicated that VR-based exercise is useful, important, and interesting that can enhance college students' intention to participate in VR-based exercise in the future. VR technology could be considered as an efficient motivational tool to promote exercise, but further research is needed to examine the effects of VR-based exercise on college students' health outcomes using an experimental research design.

453 Board #269 May 27 10:30 AM - 12:00 PM

Determining The Influence Of The Conative Modus Operandi On Physical Fitness

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PURPOSE: Using the Kolbe ATM Index, this study measured observable behaviors produced from striving instincts to determine the influence of the conative modus operandi on physical fitness changes during a 15-week wellness course. **METHODS:** Thirty-four volunteers participated in this study. Participants' height, body weight, percent body fat, aerobic capacity, muscular endurance, muscular strength, and flexibility were measured during week one and week 15. After pre-assessments, the Kolbe A Index was administered. A one-way ANOVA was used to compare the mean gain scores between conative modus operandi groups, and to compare the mean gain scores between the Zones of Operation of Initiating Action, ReActing, and CounterActing for each Kolbe Action ModeTM. Cohen's d effect sizes were calculated to quantify the effect the conative modus operandi group or Zone of Operation had on changes in physical fitness measures. A Pearson product-moment correlation was used to examine the relationship between the conative modus operandi numbers ranging from 1-10 for each Kolbe Action Mode and gain scores. **RESULTS:** Physical fitness gain scores did not differ between conative modus operandi groups. When comparing Zones of Operation, the ReActing Quick Start zone gained a greater amount of weight than the CounterActing (1.59, 95% CI [-0.01, 3.19], $p = .052$, Cohen's $d = 0.90$) and Initiating Action zones (1.99, 95% CI [-0.20, 4.18], $p = .081$, Cohen's $d = 1.34$). The Initiating Action Follow Thru zone reported greater improvements in aerobic capacity than the ReActing zone ($F(1, 29) = 4.593$, $p = .041$, Cohen's $d = 0.87$). The Initiating Action Fact Finder zone improved in number of sit-ups, and the ReActing zone completed fewer sit-ups (12.70, 95% CI [0.285, 25.12], $p = .044$, Cohen's $d = 1.04$). The values of correlation between the conative modus operandi numbers for Quick Start and gain scores in body fat were significant at the 0.05 level (2-tailed). **CONCLUSION:** No statistically significant differences between conative modus operandi groups and physical fitness changes were found; Zones of Operation influenced physical fitness changes to some degree. Therefore, measuring and understanding Zones of Operation may help practitioners promote and encourage changes in physical fitness.

454 Board #270 May 27 10:30 AM - 12:00 PM
The Role Of Motivation On Physical Activity And Screen Time Among Parent-adolescent Dyads: The Flashe Study

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Behavioral theories may inform the development of lifestyle interventions to address low participation in physical activity (PA) and high volumes of screen time (ST). Self-determination theory (SDT) has been shown to explain intrapersonal factors influencing behavior such as self-efficacy for PA or ST and self-regulation of motivation (e.g. intrinsic vs extrinsic). However, less is known about the value of extending SDT into a dyadic context. Actor-partner (i.e. parent-adolescent) interdependence models (APIMs) allow for testing of these dyadic relationships. **PURPOSE:** The purpose of the cross-sectional Family Life, Activity, Sun, Health, and Eating (FLASHE) Study was to evaluate health risk behaviors (including PA and ST) in parent-adolescent dyads. **METHODS:** Parent-adolescent dyads provided responses to online surveys addressing PA and ST behaviors in the context of environmental and family interactions. We examined the influence of SDT-based constructs (observed variables for self-efficacy and a latent construct for motivation) on PA and ST in 1,228 dyads who provided complete data. Structural equations were used to estimate APIMs in STATA 15.1. **RESULTS:** Models specified a priori provided a reasonable fit to the data; however, fit statistics (CFI:0.90, RMSEA:0.09; SRMR: 0.06) suggested that estimates from parent-adolescent models were less robust than those from parent- or adolescent- only models (PA & ST). For both PA and ST, adolescent self-efficacy was a stronger predictor of adolescent motivation than parent self-efficacy for parent motivation ($\beta = 0.40$ vs. 0.25 , $p < .001$). Parent's and adolescent's motivation did predict each other's motivation ($p < .001$) and their own behaviors but not the PA and ST of their dyad partners. **CONCLUSIONS:** Although SDT explains intrapersonal effects, it may not extend adequately to a dyadic setting. Motivational self-regulation of parents and adolescents are related; however, longitudinal studies conducted to evaluate whether changes in SDT variables are associated with change in parent-adolescent PA and ST patterns over time are needed.

455 Board #271 May 27 10:30 AM - 12:00 PM
Self-perception Differences Between Crossfitters And Other Recreational Exercise Participants

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Improved mental health is an important benefit of physical activity participation. However, understanding the benefits that might occur based on different modes of recreational exercise is not often examined. **PURPOSE:** To compare physical activity levels and self-perceptions of CrossFit participants and participants of other exercise modes. **METHODS:** 103 female participants with various exercise habits took an online survey that consisted of questions about subject demographics and the following scales of physical activity, personality and mental health: The Preference for and Tolerance of the Intensity of Exercise Questionnaire, Aerobics Center Longitudinal Study Physical Activity Questionnaire, Multidimensional Body-Self Relations Questionnaire (MBSRQ), Satisfaction with Life Scale (SWLS), Rosenberg Self-Esteem, and the Physical Self-Efficacy Scale. **RESULTS:** Correlation analyses revealed that total mets performed was significantly correlated with tolerance, perceived physical ability, appearance evaluation, fitness evaluation and orientation, health evaluation and orientation, and body area satisfaction ($p < 0.05$). CrossFitters ($n=11$) scored significantly higher than those who participate in other modes of exercise ($n=102$) in total METs of physical activity, preference, tolerance, fitness orientation, health orientation, body area satisfaction, and self-esteem ($p < 0.05$). **CONCLUSIONS:** Participants of all modes of exercise who performed more physical activity exhibited more positive self-perceptions and approach to exercise. Those who participate in CrossFit are more likely to perform more exercise overall, be more satisfied with the size and appearance of their bodies, and have greater self-esteem. They also demonstrate greater preference and tolerance of higher intensity exercise and are more oriented toward living a healthy and fit lifestyle than their alternate exercise counterparts.

456 Board #272 May 27 10:30 AM - 12:00 PM
The Desire To Move And Rest: Validation Of The Crave Scale Using A Treadmill Test

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Purpose
 The CRAVE (Cravings for Rest and Volitional Energy Expenditure) Scale measures the intrinsic desire (or want) for movement and sedentary behaviors, as measured "right now". The purpose of this study was a) to evaluate changes in and the construct validity of the CRAVE Scale before and after maximal exercise and b) assess relationships between these desires and with perceptions of energy and fatigue.

Methods
 The CRAVE Scale is made up of 7-Rest & 6-Move questions (1-10 Likert scale). Fatigue and energy were measured with visual analogue scales. The CRAVE was administered to 21 undergraduate students in physical activity classes (ages 19-24 years; 57% non-Caucasian; 58% female). Participants were given the CRAVE within a minute of starting and again within two-minutes of finishing a maximal treadmill test. Changes were assessed with paired t-tests. Correlations were calculated to assess relationships between the CRAVE and mental energy (ME), mental fatigue (MF), physical energy (PE), and physical fatigue (PF).

Results
 Desire to move significantly decreased (39.9 ± 9.6 vs. 29.5 ± 10.7 , $p < 0.01$) while desire to rest significantly increased (17.8 ± 12.3 vs. 29.1 ± 18.1 , $p < 0.01$) from pre- to post-treadmill test. Desire to move pre- was significantly associated with desire to move post- ($r = 0.63$, $p = 0.002$). Baseline desire to rest was significantly associated with desire to rest post- ($r = -0.48$, $p = 0.027$) and with the post-test change in desire to move ($r = 0.53$, $p = 0.014$). Change in desire to move was inversely associated with change in desire to rest ($r = -0.73$, $p = 0.002$).

Baseline desire to move was significantly associated with the post PE ($r = 0.45$, $p = 0.041$). Change in desire to move had a negative association with change in PF ($r = -0.52$, $p = 0.019$), but not with change in PE ($r = 0.31$), ME ($r = -0.10$) or MF ($r = -0.17$). Change in desire to rest had an inverse correlation with change in PE ($r = -0.64$, $p = 0.003$) and a positive correlation with change in PF ($r = 0.53$, $p = 0.016$). It was not correlated with change in either ME ($r = 0.06$) or MF ($r = 0.20$).

Conclusion
 Desires to move and rest change with an exercise stimulus, with desire to move decreasing and rest increasing. Furthermore, these findings suggest that the desire to move and rest are moderately associated with feelings of physical energy/fatigue but not mental energy/fatigue.

457 Board #273 May 27 10:30 AM - 12:00 PM
Relationships Between Confidence To Adhere To Crossfit, Enjoyment, Motivation, And Ability To Do Various Exercise- And Sport- Related Tasks

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High intensity functional training (HIFT) is a mode of exercise where participants exercise at their perceived high-intensity and perform both aerobic and resistance exercises with emphasis on multi-joint movements modifiable and scalable to all ability levels. This may benefit older adults who are recommended to participate in concurrent exercise training to improve functional capacity. Low-self efficacy (SE) (i.e., belief in ability to accomplish a task) is a barrier to exercise for many older adults. **Purpose:** To investigate how one's SE for participation in HIFT is related to enjoyment, motivation, and SE for performing various exercise tasks in older adults. High values in self-efficacy for participation in HIFT was expected to positively correlate with self-efficacy values for performing various exercise tasks. **Methods:** Data were from an ongoing program evaluation study including a cohort of 13 older adults (age $M = 69.1 \pm 7.1$ years, 62% female) participating in a functional fitness and mobility class with workouts modified to fit their needs and abilities. Participants completed an online questionnaire that included demographics, social, and mental measures. Participants assessed their ability to continue HIFT exercise, rated enjoyment and motivation, and assessed their confidence level on a scale of 1 "I cannot do this activity at all" to 10 "I am certain that I can do this activity successfully" for 11 sport and exercise-related tasks. **Results:** SE to continue HIFT was significantly correlated to general exercise motivation ($r = .85$, $p = .000$), 'I can recognize my strengths and weaknesses in different situations' ($r = .80$, $p = .002$), 'I enjoy doing

exercise' ($r = 0.65, p = .017$), and 'I can do physical exercises that require resistance' ($r = 0.59, p = .036$). **Discussion:** SE for continued HIFT participation was positively related to exercise enjoyment and motivation as well as SE for self-awareness and resistance exercises, which can influence group class design. Older adults who have these attributes will have the confidence and knowledge to gauge their intensity appropriately and participate in exercises that may push their functional limits. Future research should analyze if continued HIFT adherence positively influences SE and functional capacity.

458 Board #274 May 27 10:30 AM - 12:00 PM
The Role Of Academic, Cultural, And Language Stresses On Physical Activity Among International College Students
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There were 1.09 million international college students in the U.S. as of 2018 (Institute of International Education). Previous studies showed that many international students experienced academic stress, as well as language and cultural stresses (Yan & FitzPatrick, 2015). Further, previous studies also indicated that the U.S. cultural may facilitate participation in physical activity for international students (Yan & Cardinal, 2013). It is unclear whether those different types of stresses and time in the U.S. would be associated with their participation in moderate-to-vigorous physical activity (MVPA). **PURPOSE:** The present study aimed to examine whether academic, cultural, and language stresses, as well as time in the U.S. would predict MVPA among international college students. **METHODS:** Participants were 249 international college students (48.2% female; $M_{age} = 27.48, SD = 6.12$) enrolled in a public research university in Southern U.S.. MVPA was measured by the International Physical Activity Questionnaire (Craig et al., 2003). Previously validated scales were used to measure students' perceived academic stress (e.g., "I worry about my academic performance"); cultural stress (e.g., "It's hard for me to develop opposite-sex relationships here"); and language stress (e.g., "My English embarrasses me when I talk to people"). Time in the U.S. was measured by asking how many months they had been in the U.S.. Finally, gender and BMI were also measured. **RESULTS:** The independent T test showed that males participated significantly more MVPA than females (Male: $M = 293.71$ METs; Female: $M = 241.79$ METs); $t(245) = 3.09, p < .01$. The multiple regression model with gender and BMI controlled was statistically significant, $F(6,242) = 3.37, p < .01, R^2 = 7.7\%$. Cultural stress significantly predicted MVPA ($\beta = -.21, p < .01$), with higher cultural stress was associated with lower MVPA. Language stress, academic stress, and time in the U.S. did not predict MVPA. **CONCLUSION:** The results indicated that cultural stress was related to MVPA among international college students. However, it is unclear whether experiencing more cultural stress discourage MVPA or participating MVPA helps international students manage their cultural stress. To answer this question, qualitative studies and interventional studies are needed in the future.

459 Board #275 May 27 10:30 AM - 12:00 PM
An Executive Function Benefit Persists For Between 30- And 60-min Post-exercise: Evidence From Task-switching
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A single-bout of aerobic exercise produces a short-term 'boost' to executive function. For example, recent work by our group has shown that the high-level executive function of 'switching' between different tasks is improved following a 20-min single-bout of moderate-intensity aerobic exercise. Notably, previous work examined immediate exercise-related task-switching benefits and it is therefore unknown how long the benefit to executive function persists. **PURPOSE:** Here, we employed an AABB task-switching paradigm involving stimulus-driven (SD) saccades (i.e., saccade at target onset) and their executive mediated minimally delayed (MD) counterparts (i.e., saccade at target offset). MD saccades require active response suppression of a SD saccade and are mediated via an extensive frontoparietal network. Further, a SD saccade completed following a MD saccade results in an increase in reaction time (RT), whereas the converse switch does not (i.e., the unidirectional switch-cost) - a result attributed to a task-set inertia within executive networks. **METHODS:** SD and MD saccades were completed prior to and immediately, 30-min and 60-min after a 20-min single-bout of aerobic exercise (via cycle ergometer) at a moderate intensity (80% of HR_{max}). **RESULTS:** The pre-exercise oculomotor assessment revealed a reliable unidirectional switch-cost (22 ms, $SD=18$) ($p < .001$) and the magnitude of this cost decreased at the immediate (9 ms, $SD=12$) and 30-min (11 ms, $SD=15$) post-exercise assessments ($ps < .01$). At the 60-min assessment, a switch-cost (20 ms, $SD=22$) on par

to the pre-exercise assessment was observed. **CONCLUSION:** Accordingly, a single-bout of aerobic exercise provides a boost to the executive function of task-switching that persists between 30- and 60-min post-exercise.

460 Board #276 May 27 10:30 AM - 12:00 PM
Examining The Socioecological Correlates Of Physical Activity Among Middle-aged And Older Women
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Physical activity (PA) is the well-known lifestyle behavior determining individual health. However, public health concerns exist regarding the low level of PA, particularly among middle-aged and older women, with limited understanding of its modifiable determinants at individual and environmental levels. **PURPOSE:** The purpose of this study was to examine the socioecological factors explaining PA among middle-aged and older women, with specific focuses on subjective social status (SSS) and perceived neighborhood characteristics. **METHODS:** The survey data were collected from a total of 588 women (mean ages: 56.79). The International Physical Activity Questionnaire was used to assess PA levels in leisure-time (LTPA). Individuals were categorized into the three PA groups (i.e., no-LTPA and low-/upper-LTPA groups based on 50th percentile of LTPA levels). Perceived neighborhood characteristics were measured using the Neighborhood scale consisting of 31 items with the Likert scale across seven environmental dimensions (e.g., walkability, safety, social cohesion). SSS was assessed using a 10-rung ladder ranking with higher rungs indicating higher SSS in their neighborhood. A multinomial logistic regression model was established to examine the associations of perceived neighborhood characteristics and SSS with LTPA, after controlling for study covariates including demographic characteristics (i.e., age, race, marital status), objective social status (i.e., education, household income), and health conditions (i.e., body mass index, number of chronic diseases). **RESULTS:** Overall, neighborhood walkability was the environmental characteristic significantly associated with greater odds of being low- (OR = 1.43; 95% CI = 1.10, 1.86) and upper-LTPA (OR = 1.76; 95% CI = 1.34, 2.31), when compared to no-LTPA. Additionally, women with higher SSS demonstrated greater odds of being low- (OR = 1.72; 95% CI = 1.09, 2.71) and upper-LTPA (OR = 1.88; 95% CI = 1.18, 2.99). **CONCLUSIONS:** The present study identified perceived walking environment within a neighborhood as a potential ecological factor determining PA levels in middle-aged and older women. Further, it is suggested that SSS has a unique impact on PA levels, independent of objective social status indicators.

461 Board #277 May 27 10:30 AM - 12:00 PM
The Effects Of Acute Mental Imagery Training On Force Output In College-age Students
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 (No relevant relationships reported)

Mental imagery training can be an effective tool to enhance endurance and skill-based sport performance, especially long-term mental imagery training. The effects of mental imagery on muscular force production, especially in the field of resistance training, are not as well researched. The effects of acute mental imagery training are also not well studied. **PURPOSE:** To determine the effects of acute mental imagery training on handgrip strength in college-age participants. **METHODS:** A repeated measures design was utilized. 34 participants (17 men, 17 women, 173.3 cm \pm 8.9 cm, 77.0 kg \pm 16.2 kg, 20.2 yrs \pm 1.3 yrs) over two sessions, separated by 48 hours. Handgrip dynamometry was used to assess maximal and average force production over three consecutive trials following a control treatment (passive sitting) or a 10-minute mental imagery treatment. Mental imagery consisted of learning about imagery and practicing with a premade imagery script. **RESULTS:** Average force production was higher overall (38.17 kg \pm 13.03 kg vs. 35.65 kg \pm 13.52 kg; $t(33) = 4.158; p = 0.000; d = 0.190$), for men (48.80 kg \pm 8.55 kg vs. 46.01 kg \pm 10.00 kg; $t(16) = 3.549; p = 0.003; d = 0.3004$), and for women (27.54 kg \pm 6.08 kg vs. 25.28 kg \pm 7.00 kg; $t(16) = 2.388; p = 0.030; d = 0.3445$) after acute mental imagery training. Maximal force production was higher overall (40.08 kg \pm 13.10 kg vs. 38.14 kg \pm 13.85 kg; $t(33) = 3.007; p = 0.005; d = 0.140$) and for men (50.98 kg \pm 8.35 kg vs. 49.02 kg \pm 9.98 kg; $t(16) = 2.352; p = 0.032; d = 0.2135$) following mental imagery training. Women experienced greater maximal force production after mental imagery training, but not significantly greater than the control treatment (29.18 kg \pm 5.65 kg vs. 27.25 kg \pm 6.65 kg; $t(16) = 1.898; p = 0.076; d = 0.3118$). **CONCLUSION:** Acute mental imagery training improves handgrip force production. Mental imagery training may be effective in short term settings and for resistance training and strength and power athletes.

462 Board #278 May 27 10:30 AM - 12:00 PM
Relating Lifestyle Factors To Adolescent Non-Prescription Steroid Use
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No study has examined multidimensional factors associating with non-prescription anabolic steroid use within a large representative sample of US adolescents.

PURPOSE: The purpose of this study was to examine the cognitive, psychosocial, lifestyle, and activity-related correlates of non-prescription steroid use among US adolescents from data collected using the 2017 National Youth Risk Behavior Survey. **METHODS:** A multi-stage cluster sampling procedure yielded a representative sample of US adolescents in 2017. The number of sampled adolescents with usable data was 14,765. Weighted logistic regression was used to examine the associations between cognitive, psychosocial, lifestyle, and activity-related variables and non-prescription steroid use among US adolescents adjusting for age, sex, BMI percentile, and race/ethnicity. **RESULTS:** The lone cognitive factor relating with non-prescription steroid use was a history of concussion (OR=2.06, 95%CI:1.37-3.13, $p = 0.001$). The psychosocial variable relating with non-prescription steroid use was feelings of sadness and/or hopelessness (OR=2.47, 95%CI:1.72-3.56, $p < 0.001$). Lifestyle factors relating with non-prescription steroid use included cigarette smoking (OR=2.06, 95%CI:1.10-3.84, $p = 0.023$), smokeless tobacco use (OR=2.33, 95%CI:1.19-4.56, $p = 0.015$), and alcohol consumption (OR=4.54, 95%CI:2.69-7.68, $p < 0.001$). No activity-related variables (daily physical activity, sports participation, muscular strength exercising) associated with anabolic steroid use. **CONCLUSIONS:** Salient cognitive, psychosocial, and lifestyle factors relate with non-prescription steroid use among a representative sample of US adolescents. Multidimensional health educational and health behavioral approaches may be needed to properly inform and prevent adolescents from non-prescription steroid use.

463 Board #279 May 27 10:30 AM - 12:00 PM
The Relationship Between Mental Toughness And The Ergogenic Effects Of Music During Exercise
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PURPOSE: Previous research has found that both music and mental toughness (MT) may affect exercise performance; however, no study has examined the relationship between MT and music on exercise performance. Therefore, the purpose of this study was to examine the associations among MT, aerobic fitness, and music during exercise. **METHODS:** Thirty-one recreationally-active individuals (22.13±2.11 yrs, 25.15±2.94 BMI, 42.89±5.31 mL·kg⁻¹·min⁻¹; 65.5% male) were recruited for this study. Participants completed a MT questionnaire and performed a VO_{2max} test on the treadmill. Participants then completed two counterbalanced, experimental trials consisting of exercise with: 1) no music; and 2) self-selected music from a personalized playlist. For each experimental trial, participants performed a time-to-exhaustion (TTE) run at 80% VO_{2max}, separated by at least 48 hours. Independent sample t-tests were used to examine differences between the two trials, while Pearson correlations were conducted to examine the associations among aerobic fitness, MT, and TTE for both music (TTE_M) and non-music (TTE_{NM}) conditions. Linear regression was used to investigate relationships between MT and change in exercise performance (ΔTTE) between music conditions. **RESULTS:** There were no significant differences between minutes for TTE_{NM} (12.23±5.24) and TTE_M (14.18±4.79). Moderate to strong correlations with VO_{2max} were observed for TTE_M ($r=.39$, $p=0.030$), TTE_{NM} ($r=.52$, $p=0.003$), and MT ($r=.40$, $p=0.024$). Linear regression revealed that a higher MT score was associated with a smaller change between the two performance trials ($F_{1,29}=4.42$, $r=-.63$, $p=0.040$), irrespective of order effect or aerobic fitness. **CONCLUSIONS:** Associations existed between aerobic fitness, MT, and exercise performance for both music and non-music trials. Participants with greater MT experienced less of a change between performance trials, suggesting that individuals with greater MT may demonstrate consistent patterns of performance, irrespective of aerobic fitness or the presence of external factors. Understanding the relationship between MT and music during exercise may allow exercise professionals to better tailor their training programs to each individual, increasing exercise performance and adherence.

464 Board #280 May 27 10:30 AM - 12:00 PM
Effects Of Exercise Desks On Activity And Reading Skills In Youth With Neurodevelopmental Disorders
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Physical activity improves cognitive function and academic achievement, although many youth remain sedentary during school. Exercise desks may be advantageous to improving physical activity as it does not require any teacher education and does not jeopardize time spent on academic instruction. **PURPOSE:** The purpose of this study was to determine the effect of exercise desks on levels of physical activity and classroom performance in 4th and 7th grade students with neurodevelopmental disorders. **METHODS:** Thirty-five children (N=13 4th grade; N= 21 7th grade) were monitored with an Actigraph accelerometer (wGT3X-BT) worn on the non-dominant wrist during school hours. Derived variables were time (minutes) in sedentary, light, and moderate intensity using published cut points. Using a repeated measures cross over design, students attended school in two different environments for 8 weeks each: traditional school with chairs and desks and a classroom designed with exercise desks composed of pedaling, a stand and spin, and accordion chairs. Students reading skills were assessed using two curriculum-based measurements: Maze Reading Comprehension and Oral Reading Fluency. **RESULTS:** Weight significantly correlated with time spent in sedentary ($r = .43$; $p<0.001$), light ($r = .37$; $p<0.001$) and moderate ($r = -.46$; $p<0.001$) activity. There was a significant main effect of the activity desks on decreasing sedentary activities with a proportional increase in moderate activity once controlling for weight. A main effect for grade showed that 4th graders participated in significantly less sedentary activity and greater moderate activity compared with 7th graders. Compared to the traditional classroom, the kinesthetic classroom significantly increased reading skills in both grades although there was a trend for a slightly greater increase in 7th graders. **CONCLUSIONS:** Exercise desks improved reading skills and decreased time spent in sedentary activities in youth with neurodevelopmental disorders. The greater decline in sedentary activity and concomitant increase in physical activity among fourth graders may suggest that older youth are less inclined to use the exercise desks.

465 Board #281 May 27 10:30 AM - 12:00 PM
Compulsive Exercise And Physical Activity Among Early Adolescents.
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PURPOSE: The aim of this study was to examine compulsive exercise and associations with physical activity and psychosocial health among early adolescents. **METHODS:** Four municipalities with 15 secondary schools in Telemark County, Norway, were recruited into participate in this cross-sectional study. A total of 644 pupils (age 13.9±0.3 yrs) participated in the study (response rate: 79%). Information about weight regulation and body dissatisfaction was obtained. Instruments included Actigraph GT3x, Behavioural Regulation of Exercise - Questionnaire (BREQ), KIDSCREEN-27, Subjective Vitality Scale (SVS), and Compulsive Exercise Test (CET). High CET score was identified as total CET score ≥ 15 . **RESULTS:** Only 36.5% of the adolescents were sufficiently physically active. Boys had higher total CET score compared to girls (9.97 vs. 9.35, $p=0.046$), and 7% of the respondents had high CET score. A total of 3.5% showed both high CET score and low levels of physical activity, indicating exercise obsessions without compulsions. There was a positive correlation between total CET score and use of exercise mobile apps ($r=.12$, $p=0.003$), and between total CET score and number of weight reduction attempts the past year ($r=.22$, $p=0.02$). No correlation was found between total CET score and physical activity, or between total CET score and sedentary time. A regression analysis showed introjected regulation ($p<0.001$), identified regulation ($p=0.03$) and extrinsic motivation ($p=0.04$), but not intrinsic motivation, amotivation, SVS, KIDSCREEN-27 domains, gender or physical activity level, as significant predictors of total CET score. **CONCLUSIONS:** Total CET score is associated with weight regulation behavior, and predicted by introjected, identified and extrinsic regulation of physical activity. These findings indicate needs for increased understanding about the complexity of cognitions concerning exercise, and not only exercise behaviour per se.

466 Board #282 May 27 10:30 AM - 12:00 PM

The Desire To Move And Rest: Assessing Reliability And Validity Of The CRAVE Scale

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Purpose

The CRAVE (Cravings for Rest and Volitional Energy Expenditure) Scale measures the intrinsic desire for movement and sedentary behaviors as assessed "right now". The purpose of this investigation was to evaluate reliability and construct validity of the CRAVE scale before, during and after a university lecture.

Methods

The CRAVE Scale and Thayer Activation-Deactivation (AD) Checklist were administered to 41 students (mean age 22.5±5.1 years; 26.8% non-Caucasian; 24.4% female) around a 50-minute lecture. CRAVE: 13 items (7-Rest & 6-Move), 1-10 Likert scale, given pre-, mid- and post-lecture. AD Checklist: 20 items, 1-10 Likert Scale, measures perceived energy, tiredness, tension and calmness, only assessed pre-lecture. Lectures were at either 9AM, 12PM or 3PM. A linear mixed effects model was used to compare pre-, mid- and post-lecture CRAVE Scores across the day. Correlations were calculated to evaluate CRAVE and AD Checklist relationships.

Results

Desire to Move: significantly higher post-lecture compared to pre (32.2±2.0 vs. 27.5±2.0, $p=0.007$) and higher than mid (28.5±2.0, $p=0.034$). Desire to Rest: lower post-lecture compared to pre (28.3±2.8 vs. 33.4±2.8, $p=0.016$) and lower than mid (33.1±2.8, $p=0.019$). Cronbach alpha coefficients for pre-, mid- and post-lecture (desire to Move: 0.90, 0.94, 0.93, respectively; Rest: 0.89, 0.94, 0.93). Inter-class correlations: Move=.85; Rest=.90.

The desire to move pre- and mid-lecture were similar at different times of the day. The post-class desire to move was significantly higher at 3PM compared to 9AM (44.0±16.6 vs. 28.11±12.2, $p=0.019$). There were no differences in desire to rest based on time of day. Desire to move at baseline was significantly associated with energy ($r=0.38$, $p=0.018$) and calmness ($r=-0.47$, $p=0.003$). Desire to rest at baseline was significantly associated with energy ($r=-0.38$, $p=0.026$), tiredness ($r=0.48$, $p=0.003$). Tension was unrelated to either move or rest.

Conclusion

The desire to move significantly increased while the desire to rest significantly decreased across a lecture period. Desires to move/rest were correlated with energy (positively and negatively), but move was most strongly associated with calmness and rest with tiredness. Finally, the CRAVE Scale showed high internal consistency.

467 Board #283 May 27 10:30 AM - 12:00 PM

Children's Motivation For Physical Activity

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The establishment of physical activity (PA) routines in childhood is critical to form life-long PA habits. Children are motivated for activities that they enjoy but research is scarce on motivational factors for PA in children younger than eight years old. **PURPOSE:** To explore why children enjoy or do not enjoy physical activities to gather their underlying motivation. Additionally, physical activity and perceived motor competency data were collected to describe the participants. **METHODS:** A mixed-methods study design was employed. Participants ($n=16$) were 2nd and 3rd grade students at two YMCA afterschool programs. Each child wore an accelerometer on the right hip for seven consecutive days and data were converted to min in PA intensities. They also completed Harter's perceived motor competency survey and took part in focus groups. There were two 2nd grade and two 3rd grade focus groups, which consisted of 3-5 participants each. Descriptive analyses were performed on PA and perceived motor competency data. Focus group data underwent thematic analysis using an inductive approach. **RESULTS:** PA data revealed that the majority of participants (57%) met PA recommendation with an average of 63.8±25.4 minutes of moderate to vigorous PA per day. Additionally, the average perceived motor competency score was 3.0±0.6 (out of 4). Information from the focus groups was used to create four over-arching themes which included 1) PA is sport, 2) social influence, 3) perceived competence, and 4) PA characteristics. Within the social influence theme, peers,

parents, siblings, and gender norms appear to make important contributions to this theme. The PA characteristics theme included roughness and danger, movement and action, teammates and competition (enjoyment only), and rules (unenjoyment only). It appears that the social influence, perceived competence, and PA characteristics had overlap on one another, suggesting perhaps all three have a reciprocal interaction that may relate to the enjoyment or unenjoyment of physical activities. **CONCLUSIONS:** Results suggest exposing children early to wide varieties of physical activities may help minimize activities they dislike and build their perceived competence and social bonds, which may be crucial to establishing and continuing PA behaviors.

468 Board #284 May 27 10:30 AM - 12:00 PM
Exploring The Influence Of Pregnancy And Physical Activity Involvement On Physical Activity Levels And Knowledge Exploring The Influence Of Pregnancy And Physical Activity Involvement On Physical Activity Levels And Knowledge

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Little is known about how women's physical activity (PA) involvement and pregnancy status influence their PA levels and knowledge of PA guidelines specific to pregnancy. **PURPOSE:** The purpose of this study was to explore the relationship between pregnancy status, PA involvement, knowledge of appropriate PA behaviors during pregnancy, and PA levels. **METHODS:** Women who were currently pregnant ($N=72$, Mean Age = 31.89 +/- 4.23 years) and not pregnant ($N=196$ and 36.90 +/- 9.22 years) completed a questionnaire which included the physical activity (PA) Involvement Scale (Modified Involvement Scale), and questions pertaining to the appropriateness of PA during pregnancy (ACOG agreement) and their current PA levels (International PA Questionnaire). **RESULTS:** Pregnant women reported significantly higher levels of ACOG agreement ($Z=-2.095$, $U=5909.00$, $P<.005$, $r=.13$) and significantly lower levels of PA ($Z=-2.418$, $U=4459.50$, $P<.005$, $r=-.16$) compared to non-pregnant women. There were no significant differences in ACOG agreement scores between high PA involvement, moderate PA involvement, and low PA involvement ($P>.05$). Women with high PA involvement report significantly more PA participation compared to women with both moderate and low PA involvement ($P<.005$). **CONCLUSION:** Educating mothers and their social network on appropriate PA during pregnancy might be helpful in limiting the amount of misguided information a pregnant woman receives throughout her pregnancy. Public health interventions might improve PA levels by focusing on enhancing a woman's feeling of self via PA (identity affirmation) and desire to engage in PA (attraction). For example, to improve a woman's identity affirmation, health providers should focus on helping women create attitudes and self-perceptions of being a physically active person (i.e., increasing the saliency of this identity). To increase attraction to PA, public health providers can help women identify PA modalities they enjoy and emphasize the importance of PA for the health of themselves, their baby, and their families. Public health interventions that focus on how psychosocial health (e.g., improving PA identity affirmation and attraction) can increase PA during pregnancy are necessary for improved health of pregnant women and their babies.

469 Board #285 May 27 10:30 AM - 12:00 PM
The Maternal Factor: Associations Between Maternal Health Characteristics And Child And Family Health Habits.

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Childhood physical activity (PA) is important for adequate growth and development. Child PA is influenced by family health habits, such as encouragement and active involvement. Mothers are of central importance within the family unit, as their personal and supportive behaviors can alter the health-promoting home environment. To better understand the dynamics of family health behavior, maternal characteristics associated with child and family PA must be explored. **PURPOSE:** Determine associations between maternal health characteristics (anthropometrics and PA) with child and family health habits. **METHODS:** Mother-child dyads (children aged 5.0-7.9 years) were recruited. Mother and child height and weight were measured

objectively and body mass index (BMI) was calculated (age- and sex-specific percentiles for children). Mothers completed the International Physical Activity Questionnaire - Short Form to evaluate maternal PA; MET hours PA/week were calculated. Child PA was measured using accelerometry-determined counts per minute. Mothers completed the Family Nutrition and Physical Activity Questionnaire to evaluate family PA participation score, which was the sum of two survey items; higher scores indicate higher frequency of PA practices including family encouragement and involvement. The association between maternal PA and BMI with child PA and family PA participation was assessed using linear regression, and adjusted for maternal age, child hours away from home, household income, and child BMI percentile. **RESULTS:** Fifty-two mother-child dyads participated. On average, mothers were 82.7% Caucasian, 67.3% employed full-time, 46.2% normal weight, and obtained 44.8±48.4 MET hours PA/week. Children averaged 1159.8±262.8 CPM and mothers reported average family PA participation score of 6.2±7.4 (max. score 8). Maternal BMI was not related to child or family outcomes ($p>0.05$). Maternal PA was associated with more frequent family PA participation score ($p=0.028$). **CONCLUSIONS:** In this sample, maternal characteristics were related to beneficial family health habits, rather than individual child PA. Mothers may influence the collective behavior more so than individual behavior. Future research should seek to study the mechanisms driving association between maternal and family PA.

A-52 Free Communication/Poster - Behavioral Aspects of Sport

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

470 Board #286 May 27 10:30 AM - 12:00 PM Motivational Language Used By Strength And Conditioning Coaches: Are They Developing Their Athletes' Psychological Capital?

Bradley J. Cardinal, FACSM, Dakota B. Dailey, Alexandra Szarabajko, N. Emmanuel Ughelu, Jake D. Wambaugh. *Oregon State University, Corvallis, OR.*
(No relevant relationships reported)

PURPOSE: On the basis of critical discourse analysis, we sought to understand the verbal language of strength and conditioning coaches. Their language was deconstructed and interpreted using the eight developmental dimensions (i.e., goals and pathways design, implementing obstacle planning, experiencing success or modeling others, persuasion and arousal, building assets or avoiding risks, affecting the influence process, building efficacy or confidence, and developing positive expectancy) of the Psychological Capital Model (PCM). These are the conduits through which hope, efficacy, resiliency, and optimism are developed. **METHODS:** Ten "Mic'd up" videos were acquired vis-à-vis YouTube. The videos purposively included both men's and women's sports (i.e., basketball, football, hockey, softball, and volleyball), with half featuring men coaching men and half featuring men coaching women. Every coaches' statement was transcribed verbatim by two coders. Statements were then reviewed by the five-person research team and classified into one of the developmental dimensions. **RESULTS:** The videos were published between 2012 and 2018 ($M = 2015.70$, $SD = 1.94$) and ranged in length from 1:00 min. to 6:20 min. ($M = 2:04$, $SD = 1:35$). A total of 178 statements were recorded. No differences were observed in the use of the developmental dimensions between sports or context (i.e., all $p>0.05$). Three of the PCM developmental dimensions accounted for 136 (76.4%) of the total observations (i.e., experiencing success/modeling others [$n = 54$, 31.2%], building efficacy/confidence [$n = 48$, 27.8%], and implementing obstacle planning [$n = 34$, 19.7%]). Relative to the theoretical model, these were overrepresented (i.e., standard residuals ranging from +2.76 to +7.10). The other five dimensions were underrepresented (standard residuals ranging from -2.23 to -4.18). **CONCLUSIONS:** On the basis of this set of observations, strength and conditioning coaches appear to be employing a limited range of psychological strategies with their athletes. Efforts to develop resiliency among athletes were notably underused. Resiliency relates to the ability to cope with hardship, setbacks, and stress. An outcome of this study has been the development of a catalog of appropriate statements across the eight developmental dimensions of the PCM.

471 Board #287 May 27 10:30 AM - 12:00 PM Acute Effects Of Dumbbell Exercise On Oxygenated Hemodynamic Concentration Of Cerebral Activation: A Fnrirs Study

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(No relevant relationships reported)

Purpose. To examine cerebral cortical activation in the reigns of the prefrontal cortex and parietal lobe during the performance of two types of dumbbell exercise.

Methods. A total of 22 young healthy male adults (mean age = 23.8 ± 2.05 years, height = 1.75 ± 0.06m, weight = 71.4 ± 8.80kg) participated in a crossover design study that involved two experimental exercise conditions: momentum dumbbell and conventional dumbbell. Participants' task performance included 10 10-second sets of single-arm dumbbell exercise, with a rest interval of 60 seconds between sets and a 5-minute washout period between conditions. Primary outcome was oxygenated hemoglobin (HbO₂) concentration in the prefrontal cortex and parietal lobe assessed with functional near-infrared spectroscopy. Secondary outcome measures were upper-limb muscle activation measured by surface electromyography. Outcome data were ascertained during exercise.

Results. A significant difference in HbO₂ was observed in the prefrontal - parietal regions with a high level of brain activation observed during the momentum dumbbell exercise relative to the conventional dumbbell exercise ($p<0.05$). Compared to conventional dumbbell exercise, momentum dumbbell exercise also showed a higher level of muscle activation in the anterior deltoid and posterior deltoid of the upper arm and in the flexor carpi radialis and extensor carpi radialis longus of the forearm ($p<0.05$). No between-condition differences were found, however, in biceps brachii and triceps brachii ($p>0.05$).

Conclusion: A dynamic dumbbell exercise, compared with a conventional dumbbell exercise, resulted in higher hemodynamic responses and greater upper-limb muscle activation in young healthy adults. The new resistance-based training exercise may be suited as a stand-alone exercise modality aimed at promoting brain health. Supported by the Shanghai City Committee of Science and Technology Key Project (17080503200) and National Natural Science Foundation of China (31701041).

472 Board #288 May 27 10:30 AM - 12:00 PM Can You Dig It: The Acute Psychological Responses To Volleyball Participation

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(No relevant relationships reported)

Exercise is one of the most beneficial daily habits to increase overall health and wellness. However, failure to enjoy exercise programs has often been cited as a primary reason to cease/not engage in said programs. Among adults, participation in recreational sporting activities is often overlooked as a potentially more enjoyable mode of exercise. **PURPOSE:** Explore the acute effects of recreational sports on affective states. **METHODS:** Participants [$N = 24$, 18 males; age ($M \pm SD$); 29.0 ± 6.8 yrs; BMI ($M \pm SD$); 24.0 ± 4.1] completed three games of recreational volleyball over a one hour duration. Affective states (Activation-Deactivation Checklist: AD ACL) and state anxiety (SAI) were assessed before (pre), immediately (post0) and ten minutes (post10) after activity. Data was analyzed using SPSS 24.0.0, utilizing repeated measures analysis of differences for main outcome measures. **RESULTS:** Participants reported a significant increase in Energy ($M_{diff} \pm SE$); 4.4 ± 0.75 [Cohen's $d = 1.34$] and Tension ($M_{diff} \pm SE$); 2.3 ± 0.57 [Cohen's $d = 1.06$], while reporting a significant decrease in Tiredness ($M_{diff} \pm SE$); 3.0 ± 0.83 [Cohen's $d = 0.88$] and Calmness ($M_{diff} \pm SE$); 4.0 ± 0.62 [Cohen's $d = 1.49$] from pre to post0. However, affective states were not different at post10 relative to pre (all $p's \geq 0.5$). While SAI significantly decreased from post0 to post10 ($M_{diff} \pm SE$); 3.2 ± 0.74 [Cohen's $d = 0.90$], it was not different at post10 relative to pre ($p=0.52$). **CONCLUSION:** While participants experienced significant increases in Energy and Tension, while showing decreases in Tiredness and Calmness consistent to previous literature immediately post exercise, none of these improved affective states were expressed at post10. Additionally, no significant changes in state anxiety were observed 10 minutes post exercise. It is possible that the psychological effects of sport related physical activity differ from more traditional cardiovascular exercise effects. Future work on the psychological responses to recreational activities is needed to further explore these phenomenon.

- 473** Board #289 May 27 10:30 AM - 12:00 PM
Relationship Between Sleep Parameters, Perceived Recovery And Aerobic Performance In Runners
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Sleep is considered fundamental for the physical recovery process, being related to the compensation process due to the residual effect of training. In addition, sleep seems to be related to performance in cognitive activities. However, little is known about the relationship of sleep to performance and recovery in long-distance runners. **PURPOSE:** To verify the relationship between sleep parameters, perceived recovery and aerobic performance of runners. **METHODS:** Eight long-distance runners (age, 30.3 ± 5.5 years; maximum oxygen consumption, 59.4 ± 3.4 ml.kg.min⁻¹), classified as good sleepers (Pittsburgh Index Quality <5), had their sleep monitored for six days a priori from a race to exhaustion. Pulse actigraph was used for 15 days to verify sleep parameters (total sleep time, sleep efficiency, number of awakenings and sleep latency). Perceived recovery was assessed by the Total Recovery Quality Scale (TQR) prior to the running session. The run-to-exhaustion session was performed at the anaerobic threshold, determined by the ventilatory equivalent, and presented as the time limit until exhaustion (tLIM). **RESULTS:** Runners had a sleep efficiency of 87.4 ± 9.6%, total sleep time of 350.4 ± 55.9 min (minutes), number of awakenings of 33.8 ± 25.5 min, sleep latency 13.8 ± 18.1 min on the night before the race and on the day of running run, the tLIM was 46 ± 15.3 min. There was a significant association between TQR and number of awakenings ($r = 0.928$; $p = 0.001$) and between TQR and sleep efficiency ($r = -0.844$; $p = 0.008$). In addition, tLIM was associated with sleep efficiency ($r = -0.817$; $p = 0.012$), WASO ($r = 0.773$; $p = 0.021$) and TQR ($r = 0.736$; $p = 0.019$). **CONCLUSION:** These results indicate who running time to anaerobic threshold exhaustion and perceived recovery are associated with sleep parameters of the night before the race.
 Supported by CEPE/UFMG, FAPEMIG, CAPES and CNPQ.

- 474** Board #290 May 27 10:30 AM - 12:00 PM
Is Karate Training Effective In Improving Social Skills And Executive Functions In Children With Autism?
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Medicine and Science in Sports and Exercise, Volume 51, Supplement 1 S5
Is Karate Training Effective in Improving Social Skills and Executive Functions in Children with Autism?

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 Limited research exists exploring recreational activities (e.g. sport) as an integrative approach to therapy to bring benefits in social skills and executive functions. **PURPOSE:** This study examined the effects of 12-week traditional Shotokan Karate training on social-emotional skills and executive functioning of children (8-11 years) with diagnosed autism spectrum disorder. **METHODS:** Twenty-eight children were matched into pairs based on age, gender, and autism severity, and randomly allocated into an intervention ($n = 14$) or waitlist control group ($n = 14$). The intervention group performed Kata techniques training two times per week (45 min). The intervention included typically-developing children that helped facilitate the social skills, and activities targeted to train specific domains of executive functions, namely behavioral inhibition, working memory, and cognitive flexibility. At baseline and after 12 weeks, parents assessed social skills and executive functioning respectively through the Social Skills Improvement System Rating Scale and Behaviour Rating Inventory of Executive Function. **RESULTS:** Findings suggest that intervention group showed significantly greater socio-emotional skills ($\Delta 8.9 \pm 3.1$, $p < 0.001$, $d = 2.85$) and lesser behavioral problems ($\Delta -8.0 \pm 3.1$, $p < 0.001$, $d = 2.64$) than the control group, and decreased the behavioral ($\Delta -3.6 \pm 2.7$, $p < 0.001$, $d = 1.36$), emotion ($\Delta -3.5 \pm 2.1$, $p < 0.001$, $d = 1.63$) and cognitive ($\Delta -2.3 \pm 1.5$, $p < 0.001$, $d = 1.54$) regulation indexes, and the Global Executive Functioning Composite ($\Delta -3.2 \pm 3.3$, $p = 0.003$, $d = 0.97$). **CONCLUSION:** After 12 weeks, children with ASD showed a greater socio-emotional competence such as communication, cooperation and engagement, a better executive functioning ability such as cognitive flexibility, inhibitory control and working memory and a lower aggressiveness, sadness, anxiety and hyperactivity. Since ASD is a broad economic and societal problem that affects individual, family, and community levels.

- 475** Board #291 May 27 10:30 AM - 12:00 PM
Goal Orientation And Beliefs About Success In Age Group Swimmers
 Nathan Rhea, Courtney Jensen, J. Mark VanNess. *University of the Pacific, Stockton, CA.*
 (No relevant relationships reported)

Determining a swimmer's goal orientation and what they believe makes them successful can help coaches create better workouts and outcome measures in young athletes. **PURPOSE:** Goal orientation (task vs ego) and success beliefs (effort, deception, ability and external factors) were examined in age group swimmers to determine if achievement theory differed by age. **METHODS:** Eighty ($N=80$), 11-18 year old USA Swimming club members, completed the Task and Ego Orientation in Sport Questionnaire (TEOSQ) and the Beliefs About the Causes of Sport Success Questionnaire (BACSSQ). Parent consent and child assent was obtained. Regression and multivariate analyses were used to examine differences between age groups. **RESULTS:** Athletes with Ego orientation had significant positive relationships with ability and deception as beliefs about the causes of sport success (Wilks' $\Lambda = 0.010$, $F(6, 69) = 1.195$, $p < 0.001$ and $p < 0.05$ for age categories, subsequent post hoc tests reached $p < 0.05$ for significance). Those with Task orientation had a positive relationship with higher effort and negative relationship with deception as a belief about the cause of sport success. Age comparisons showed 13-14 and 15-18 year old age groups had significantly higher ego orientation than the 11-12 age group, the 15-18 age group having a significantly lower task orientation than both the 11-12 and 13-14 age groups. The 13-14 age group attributed deception to success in swimming significantly more than the 11-12 age group. **CONCLUSION:** Older swimmers develop a higher ego orientation and lower task orientation due to more visible differences in ability and an increased focus on performance.

- 476** Board #292 May 27 10:30 AM - 12:00 PM
Ironic Process Theory In Softball Pitching: How Knowing Information About An Opponent's Strengths Affects Performance
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 (No relevant relationships reported)

INTRODUCTION: As athletic competition and college athletics continue to grow and flourish, there is an increased emphasis on game preparation. Collegiate softball pitchers are expected to handle an immense amount of pressure, perform with precision, and incur few errors. **PURPOSE:** Examine the Ironic Process Theory related to fast pitch softball pitching and to determine how knowing information about an opponent's strengths affects experienced pitcher's performance under pressure. **METHODS:** Experienced college softball pitchers ($n = 12$) were recruited as subjects. Each pitcher was randomly instructed through two 30 pitch phases (a high and low pressure phase) with two different conditions: black target only condition (BOTC) or black and red target condition (BRTC). Subjects were asked to aim and hit the black target and avoid the red target. The black target represented the weakness of the opponent and the red target represented the strength of the opponent. Performance pressure was measured before each phase using the Mental Readiness Form (MRF-3) (Krane, 1994). **RESULTS:** Pre-MRF-3 reached statistical significance across the between-subjects factor of pressure, [$t(22) = 3.102$, $p = 0.005$] with a mean difference of 4.75 (95% C.I. 1.57 to 7.92) indicating that the pressure situation induced an increase in perceived anxiety and stress. ANCOVA did not reach statistical significance on the main effects of black targets hit nor the interactions terms for black targets hit by MRF-3 and black targets hit by Pressure. This finding asserts that there was no difference in performance between BRTC and BOTC across pressure after adjusting for perceived anxiety. There was no statistically significant difference of red target hit between the high pressure and low pressure situations, $d = 0.25$ (95% C.I. -0.463 to 0.963), $t(22) = 0.723$, $p = 0.963$. **DISCUSSION:** Practically speaking, the pitchers in this study did perform more effectively in the high pressure situation. Although different from previous Ironic Theory research, it is important to note this increased ability for pitchers to hit a desired target while under pressure. Even if not statistically significant, this can help pitchers and coaches understand the link between pressure and performance more effectively, and add training components to improve in stress situations.

477 Board #293 May 27 10:30 AM - 12:00 PM
The Effect Of Random And Blocked Practice In Volleyball Attack Learning

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Several practice methods have been used by coaches in order to improve athletes' performance through the permanent changes in movement performance. Two of the widely used practice tasks are blocked and random schedule. In random schedule, the practice target is unpredictable for the athletes. On the other hand, in blocked practice, the athlete executes the same motor movement repeatedly before moving to the next skill. **PURPOSE:** The purpose of the present study was to examine the effect of contextual interference (random, blocked practice) on improving the volleyball attack (spike). **METHODS:** Thirty six (36) amateur volleyball players ranging in age from 18 to 25 years old volunteered to participate in the study. The participants were randomly assigned into three experimental conditions: (a) random practice, (b) blocked practice, and (c) control group. The intervention program lasted 6 weeks, and each participant underwent two 90 minute training sessions per week. During the training, each participant performed a total of 40 blows per training session. Three measures were applied: The first measure (pre-test) performed just before the commencement of the intervention program, one immediately after its end (post-test), and the third measure a week after the program completion (follow-up). **RESULTS:** The results indicated a significant improvement in the random schedule experimental group in the post-test compared to the pre-test ($p < .001$) as well as in the follow-up measure ($p < .01$). The blocked schedule group showed also an improvement in the post-test and follow-up measure compared to the pre-test ($p < .05$, $p < .05$). Additionally, the random group was significant better than blocked and control group in the post-test ($p < .01$, $p < .05$). **CONCLUSIONS:** Practice schedule differentiates the improvement of skill acquisition, indicating that the random practice participants revealed higher improvement and retention of the performed activity.

478 Board #294 May 27 10:30 AM - 12:00 PM
Effect Of Bodybuilding Calisthenics Training On Executive Ability In Old Women Adults

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The interest in research on the exercise ways to improve executive ability has grown rapidly in the last decade due to the aging global population. The exercise programs were mainly involved in walking, swimming and Tai Chi. However, there is little report about the bodybuilding calisthenics training efficiency in improving executive ability of old women adults.

PURPOSE: To examine the effect of bodybuilding calisthenics training on executive ability in old women adults.

METHODS: One hundred and twenty-seven old women adults (Age: 70.2 ± 7.6 yr., Height: 158.2 ± 4.9 cm, Mass: 59.4 ± 8.5 kg) were recruited from local newspaper advertisement, whose Mini-Mental Status Examination scores were above 25. All subjects were randomly divided into experimental group (EG, $n = 75$) and control group (CG, $n = 52$). The EG conducted bodybuilding calisthenics training 2 times a week, 45 minutes each, for 25 weeks, and the CG continued to follow normal daily activities. The Trail Making Test A and B (TMT-A, TMT-B) and Tapping Test were used to evaluate the executive ability, which were measured before and after intervention. Two-way (group vs. time) repeated measures ANOVAs were performed for each of the outcome parameters. Tukey's HSD tests were employed for post-hoc comparisons. The alpha level was set at $p < 0.05$.

RESULTS: 1. There were statistically significant group by time interactions for TMT-A ($F_{(1,124)} = 6.90$, $p < .001$), TMT-B ($F_{(1,124)} = 6.64$, $p < .005$) and Tapping Test ($F_{(1,124)} = 3.99$, $p < .05$). 2. The main effect for time was significant for TMT-A ($F_{(1,129)} = 29.48$, $p < .001$), TMT-B ($F_{(1,125)} = 22.09$, $p < .001$) and Tapping Test ($F_{(1,125)} = 9.35$, $p < .005$). The main effect for group was significant for TMT-A ($F_{(1,125)} = 4.77$, $p < .01$), TMT-B ($F_{(1,125)} = 4.74$, $p < .05$) and Tapping Test ($F_{(1,125)} = 3.14$, $p < .05$).

CONCLUSIONS: bodybuilding calisthenics training helped improving executive ability for old women adults.

479 Board #295 May 27 10:30 AM - 12:00 PM
Grit And Ultramarathon Running

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Ultramarathons consist of any race that is longer than 26.2 miles (42 km). Grit is the tendency to pursue long-term challenging goals with perseverance and passion. It has been assumed that ultramarathon runners have a high level of grit because of the challenges they must overcome to run such a long distance. **PURPOSE:** The purpose of this study was to investigate the association between ultramarathon running and grit-perseverance and grit-passion. **METHODS:** A total of 153 ultramarathon runners (age = 40.5 (9.0) years) participated in this study. The ultramarathon runners completed a demographic survey and the 12-item grit survey via Google Forms. The grit scale is comprised of two major components (a) consistency of interest (passion), and perseverance of effort. The ultramarathon runners were recruited through emails from race directors, facebook groups, and email invitations from the primary investigator. Statistical analyses were performed using Pearson product-moment correlations and a one-way ANOVA. Significance was set to $p < 0.05$. **RESULTS:** There was a positive correlation between number of years running and grit-passion ($r = 0.167$, $p = 0.039$). On average, participants had spent 14.4 (9.8) years running and had competed in ultramarathons for 4.3 (3.5) years. A positive correlation was found between the number of miles run per week and grit-passion ($r = 0.217$, $p = .007$). Participants, on average, ran 36.0 (13.3) miles per week. There was no significant difference across categories of ultramarathon distances completed and grit-passion or grit-perseverance. Failure to complete their last ultramarathon was not significantly associated with grit-passion or grit-perseverance. **CONCLUSION:** Grit was not found to be associated with ultramarathon distance or successful completion of an ultramarathon. Grit-passion was correlated with number of years running and weekly miles run. One limitation of this study was that 85% of the study participants were female.

480 Board #296 May 27 10:30 AM - 12:00 PM
The Effect Of Advanced Imagery Training On NCAA Shot Putter Performance

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 (No relevant relationships reported)

Imagery training is practiced with the goal of improving consistency of performance under pressure and to maximize skill execution. A recent model for advanced imagery training incorporates seven areas into the protocol to make it more realistic and vivid for athletes. These include Physical, Environment, Task, Timing, Learning, Emotion, and Perspective (PETTLEP). **PURPOSE:** To investigate the effect of a PETTLEP-based imagery script on college shot put performance as measured by peak force (PF), release angle (RA), release height (RH), release velocity (RV), and distance thrown (DT). **METHODS:** Ten NCAA shot putters ($n=5$ females & $n=5$ males) participated in this study. Each participant created a personal imagery script with personal cues. Imagery was conducted five days per week for three weeks. A pre- and posttest design was used to evaluate the efficacy of PETTLEP-based imagery. Data was recorded using advanced force plate technology, biomechanical sensors, and infrared camera equipment and performance variables recorded included peak force, release angle, height of release, and release velocity. **RESULTS:** While all dependent variables increased in value, results yielded no significant difference in pre- to posttest for PF (Pre: 969.50 ± 185.18 N; Post: 1030.16 ± 201.37 N, $p > 0.05$), RA (Pre: $33.42 \pm 4.62^\circ$; Post: $36.95 \pm 8.08^\circ$, $p > 0.05$), RH (Pre: 2.00 ± 0.11 m; Post: 36.95 ± 8.08 m, $p > 0.05$), and RV (Pre: 10.89 ± 0.97 m/s; Post: 11.29 ± 0.79 m/s, $p > 0.05$). However, a significant difference was found for DT (Pre: 12.49 ± 2.14 m; Post: 11.29 ± 1.67 m, $p < 0.05$). Additionally, release velocity significantly correlated with distance thrown in both the pre- and post-tests ($r = .962$ and $r = .834$ respectively). Findings from the pretest linear regression analysis support using the model for release angle, release height, release velocity, and peak force production as a predictor of distance thrown with a level of confidence ($F(4,5) = 26.29$, $p < 0.001$; R^2 of .918). **CONCLUSION:** While these findings are encouraging, the PETTLEP-based imagery training model employed in the present study needs to be evaluated further to determine its effectiveness for consistently enhancing athletic performance.

- 481** Board #297 May 27 10:30 AM - 12:00 PM
Motivation, Personality, And Trait Self-handicapping In College Club Athletes
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According to Self-Determination Theory (Ryan & Deci, 2017), motivation lies on a continuum from least (amotivation) to most self-determined (intrinsic). Personality traits have been shown to be related motivation in sport (e.g., Brinkman et al., 2016). Trait self-handicapping may be related to less self-determined motivation as athletes who use these strategies often fear failure for an upcoming, evaluative event and wish to control how they are perceived by others (Berger & Tobar, 2019). Despite about two million college students participating in club sports, research on these variables in this population is almost non-existent. **PURPOSE:** To examine the relationship between Big Five personality traits, trait self-handicapping, and motivation in college club athletes. **METHODS:** Data were collected from rugby (12 females, 28 males) and volleyball (15 females, 12 males) club athletes at a D-I university in the Midwest. Participants completed the Big Five Inventory, Self-Handicapping Scale, and Sport Motivation Scale - II. Factorial ANOVA and MANOVA were used to examine gender and sport differences for self-handicapping (SH), personality, motivation [intrinsic (INT), integrated (ITG), identified (IDN), introjected (ITJ), external (EXT), and amotivation (AMT)], and relative autonomy index (RAI). Personality traits and SH were included in stepwise multiple regression analyses to predict each type of motivation and RAI. **RESULTS:** Personality, SH, motivation, and RAI did not differ by gender or sport ($p > .05$). Thus, data were collapsed across gender and sport. Regression analyses revealed that Extraversion was the only significant predictor of INT [$R = .32, p < .01$], ITG [$R = .36, p < .005$], and IDN [$R = .40, p < .001$]. Negative Emotionality predicted ITJ [$R = .29, p < .05$] and SH predicted EXT [$R = .26, p < .05$]. No traits significantly predicted AMT ($p > .05$). Extraversion and SH predicted RAI in the final model [$R = .38, p < .01$]. **CONCLUSION:** Extraversion was related to more self-determined motivations in college club athletes. Athletes with more negative emotionality or who tended to use self-handicapping strategies reported less self-determined motivation. For these athletes, interventions that emphasize the intrinsic value of club sport participation may help decrease distress and self-handicapping behavior.

- 482** Board #298 May 27 10:30 AM - 12:00 PM
Factors Associated With Perceived Safety Norms Within Children's Sports Environments
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 (No relevant relationships reported)

Purpose: Middle school (MS) aged children participate in sports in multiple settings. Parents' perceptions of safety norms in these settings likely influence their decisions regarding children's sport participation. This study looked at factors associated with parents' perceived safety norms (ie. concussion risk) of their MS children's sport settings.

Methods: Randomly-selected US parents (aged ≥ 18 years) of MS children ($n=772$) completed an online questionnaire capturing parent and child characteristics, and parent knowledge, attitudes, and norms regarding concussion and safety. The main outcome, perceived safety norms related to children's sports settings, originated from a pre-validated measure [11 7-point scale items (range: 11-77; higher scores=better norms regarding safety)]. Parent (age, gender, race/ethnicity, education, concussion history, concussion knowledge, concussion care-seeking attitudes) and child characteristics (concussion history, contact level of sports played) served as explanatory variables. Multivariable logistic regressions modelled odds of better safety norms; norms scores were categorized by the median split of the possible score range (i.e., 11-44, 45-77). Separate analyses assessed norms for parents with children in MS sports ($n=617$) and club/rec league sports ($n=581$).

Results: Most respondents were female (60%), white/non-Hispanic (52%), and had at least a bachelor's degree (50%). Parents' mean age was 58 ± 9 years; 31% had a concussion history and 23% had a MS-aged child with a concussion history. Among parents with children in club/rec league sports, higher odds of better safety norms were associated with older age (5-year increase, OR=1.29; 95%CI=1.06-1.58), and higher concussion care-seeking attitudes (10% scale increase, OR=1.33; 95%CI=1.16-1.52). Among parents with children in MS sports, higher odds of better safety norms were associated with higher concussion-related knowledge (10% scale increase, OR=1.25; 95%CI=1.06-1.48) and higher concussion care-seeking attitudes (10% scale increase, OR=1.34; 95%CI=1.18-1.52).

Conclusions: Parental factors associated with safety norms varied based on child specific sport settings. Parents should taking setting into account when making decisions related to their children's sport participation.

- 483** Board #299 May 27 10:30 AM - 12:00 PM
Mental Preparation In High Altitude Mountain Climbers
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Elite athletes use mental strategies to enhance performance. High altitude mountain climbers also require rigorous training to meet physical, and dangerous, demands of climbing. However, little is known about the mental strategies used by this population. **PURPOSE:** The purpose was to pilot test a survey which asked the following: 1) what do mountaineers do to prepare for a climb, 2) what mental strategies are used to overcome obstacles, and 3) do these strategies affect chances of summit success? **METHODS:** Pre-surveys were distributed to clients before mountain climbs on two high altitude peaks in Washington State (Baker and Rainer). Post-surveys were distributed 7 days post-climb via an online form. All clients were on guided trips. **RESULTS:** Males = 39 (78%) and Females = 11 (22%) climbed either Mt Rainer = 33 (66%) or Mt Baker = 17 (34%). 92% of clients had a bachelor's degree or above and 60% identified as White, 24% Asian, 16% other. For 86% of the clients, this was their first attempt on that mountain. All clients (100%) physical trained an average of 4.82 months, 4.16 days/week and 81.8 min/day. 50% mentally trained for 3.26 months, 2.26 days/week and 22.5 min/day. Self-identified mental preparation ranged from researching gear ($n=5$), reading about climbing($n=5$), visualization ($n=3$) and meditation ($n=4$). 23 clients completed post-survey, the summit success rate was 46.2% ($n=12$) reached the summit, 42.3% ($n=11$) did not. **CONCLUSION:** Understanding of mental preparation among mountain climbers appears limited. An intervention that can be delivered to high altitude mountain climbers to implement mental strategies may help increase summit success.

- 484** Board #300 May 27 10:30 AM - 12:00 PM
Examination Of Quality Of Life And Activities Of Daily Living After Sport Participation
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 (No relevant relationships reported)

Context: Athletes often develop positive self-esteem during sport participation but may have negative repercussions once an athlete retires. Preparation for retirement of sport is important in order to prevent negative mental health consequences and decreases in quality of life and activities of daily living.

Purpose: To examine quality of life and activities of daily living in retired athletes. The secondary purpose will examine differences between gender, the type of sport played, and length of time in retirement.

Methods: Cross-sectional study examined retired athletes ($n=180$; ages: 28.5 ± 10.4 years; males: $n=72$; females: $n=107$). Each participant completed at minimum of 4 years of high school sports, or 2 years of collegiate athletics, or 2 years of professional sports. The survey included demographic questions related to activities of daily living (e.g., health status, activity level, basic mood levels, and the Quality of Life Index (QLI)). Basic descriptive, independent samples t-tests, and ANOVAs were used.

Results: No significant differences were found between females and males' total score for sport type and QLI. A significant difference was found between Time in Retirement and QLI total scores ($p=.008$). A significant difference ($p \leq 0.01$) was found between gender and Time in Retirement in the amount of vigorous activities (e.g., running, strenuous exercise, etc.) and mood/nervousness ($p=0.006$) with females between 0-5 years of retirement displaying the highest concern. Majority of participants 84.4% ($n=60$) felt they were healthy for their age and 93.9% ($n=69$) felt their health does not prevent them from working and/or decreases their activities of daily living. Only 13.4% ($n=24$) reported feeling bad in the past 30 days.

Conclusion: While it is suggested that retirement from sport may have negative repercussions on health and quality of life, the overall results indicated the opposite. Individuals reported their quality of life and health did not prevent them from completing activities of daily living. It is important to prepare athletes for retirement and encourage continuation of physical activity and maintenance of their health.

A-53 Free Communication/Poster - Immunology and Endocrinology Across the Healthspan

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

**485 Board #301 May 27 9:30 AM - 11:00 AM
Light Physical Activity Is Associated With Reduced Signs Of Immune Aging In Healthy Older Adults**

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Aging is associated with a progressive accumulation of late differentiated T-cells and increased risk of infection and mortality. A higher level of cardiorespiratory fitness (VO₂ peak) in adults over 65 years old are associated with improved T-cell phenotypic characteristics. However, little is known on the impact of light intensity physical activity (LPA) on the proportions of late differentiated T-cells in sedentary elderly. **Purpose:** We aimed to examine the association of LPA and the age-related accumulation of memory T-cells in an elderly sedentary population. **Methods:** We studied 16 physically inactive, community-dwelling, older adults (70 ±4y) from an on-going exercise intervention (REALPA). At baseline participants performed a VO₂ peak exercise test on a treadmill. Participants also wore a physical activity monitor (Actigraph, GT9X) on their thigh 24-h/d for 7-days to quantify total non-bouted physical activity (PA). Fasted blood was drawn and peripheral blood mononuclear cells were isolated and stained with anti-CD3, CD4, CD8, CD57, and killer cell lectin-like receptor G 1 (KLRG1) monoclonal antibodies. T-cell phenotypes were analyzed by four-color flow cytometry (BD Accuri C6). Pearson's correlation coefficients were used to determine linear correlations between T-cell phenotype and PA. **Results:** Participants VO₂ peak ranged from 12.2 to 29.9 mL/kg/min (20.5 ± 5.1 mL/kg/min) and spent 317.4 ± 56.9 minutes of LPA/day, 22.5 ± 14.3 minutes of Moderate-Vigorous intensity PA (MVPA)/day and accumulated 4,595 ± 1,091 steps/day. The number of pan memory T-cells (CD3+/KLRG1+) were inversely correlated with VO₂ peak (r = -0.51, p=0.045), while the percentage of pan memory T-cells were negatively associated with volume of LPA (r = -0.54, p=0.033), but not with MVPA (p>0.05). Additionally, actigraphy analysis showed that a greater number of daily steps were associated with reduced numbers of memory CD4+ T-cells (KLRG1+/CD57-) (r = -0.53, p=0.035). **Conclusions:** Our data support the benefits of high VO₂ peak on immune aging in a cohort of sedentary elderly adults. More importantly, LPA and increased daily steps are associated with reduced markers of immune aging, even in elderly individuals with moderate-low aerobic fitness. This study was supported by the NIA 5R21AG058181-02.

**486 Board #302 May 27 9:30 AM - 11:00 AM
Work-week Sleep Restriction Modifies Physical Activity But Not Glucose Or Insulin Responses In Overweight Adults.**

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(No relevant relationships reported)

Insufficient sleep and inadequate amounts of physical activity (PA) are common lifestyle behaviors, but there is a paucity of research examining the interaction between insufficient sleep and PA. **PURPOSE:** To establish how sleep restriction affects PA, and the role this plays in sleep restriction-induced insulin resistance (IR) in overweight adults. **METHODS** Thirteen overweight adults, who regularly sleep 7-9 h/night, underwent two study conditions; 5 days of modest sleep restriction (6-h time-in-bed, SR), and 5 days of SR+exercise (SREX), followed by a weekend recovery period (WR). Sleep (Actigraphy) and PA (Actigraph) were monitored for 7 days prior to each condition, throughout each condition, and during WR. Blood samples were collected during a mixed meal tolerance test (MT) after baseline (B), SR/SREX, and WR. Daily exercise, SREX, was 45 minutes of treadmill walking (65% VO₂ peak). **RESULTS** Subjects slept 8.0±0.2 h during B weekdays compared to SR and SREX (5.9±0.1 h; 5.9±0.0 h, respectively) and 7.4±0.2 hours on weekend (7.4±0.3; 8.2±0.4, respectively). Steps were maintained during SR compared to B (B-SR, 8276±622; SR, 7656±676 steps/day) but were increased during SREX (B-SREX, 8550±776; SREX 13182±789 steps/day, p<0.001). Steps during the B weekend period were reduced compared to B (p<0.001) and during WR following SR±EX (SR, p<0.01; SREX,

p<0.001). Subjects performed less light (LT) PA during SR±EX (p=0.001). Sedentary (SED) PA tended to be higher during SR compared to B (p=0.07) but tended to be reduced during SREX (p=0.09). Moderate-vigorous PA (MVPA) was elevated during SREX (p<0.001) and reduced during SR (p<0.05) compared to B. During MT, glucose and insulin response did not differ by condition or across time. Matsuda calculations tended to also show improvements in IR (time, p=0.06), where WR improved compared to B (p<0.05), no differences between B and SR±EX. **CONCLUSION** Overweight adults maintained steps during SR, but reduced time spent performing MVPA. When subjects performed EX daily (SREX), SED was replaced with MVPA with no changes in LTPA observed. Subjects increased SED and decreased LTPA and MVPA during WR compared to B weekend, likely due to the reduced step counts. Modest SR did not induce IR in overweight adults, but despite reduced PA during WR, IR was improved compared to B.

**487 Board #303 May 27 9:30 AM - 11:00 AM
Acute Resistance Exercise Fails To Improve Influenza Vaccine Response In Older Adults**

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Older adults are at elevated risk for morbidity and mortality caused by influenza. Vaccination is the primary means of prophylaxis, but the magnitude and duration of the protective response is often compromised in older adults. As acute eccentric resistance exercise can mobilize immune cells into targeted muscle, it may enhance immune responses to vaccination. **PURPOSE:** To compare immune responses to influenza vaccination in older adults who performed eccentric resistance exercise prior to vaccination to those who did not exercise. **METHODS:** 29 resistance training naive older adults (20 women, 73.9 ± 5.6 years) were randomized to 1 of 3 groups: 1) exercise in the vaccinated arm (EX-S), 2) exercise in the opposite arm (EX-OP) and 3) control (NO-EX). Exercise consisted of 10 sets of 5 repetitions at 85% of each subject's pre-determined concentric one repetition maxima. Lateral raises were alternated with bicep curls, with 15 sec rest between exercises and 30 sec rest between sets. Focus was on the eccentric component of the exercise. NO-EX sat quietly for 20 min. Following treatment (EX or NO-EX), all subjects received the 2018 quadrivalent influenza vaccine (Seqirus Afluria) in the deltoid of the non-dominant arm. Antibody titers against the 4 influenza strains in the vaccine were determined by hemagglutinin inhibition assays at 6- and 24-weeks post-vaccination. Group differences in antibody titers by time were assessed by maximum likelihood linear mixed models; sex was included as a covariate. Fold-changes in antibody titers at 6 and 24 weeks from baseline were compared between groups by Kruskal-Wallis H tests. **RESULTS:** Subjective reports of soreness did not differ between groups. One subject (EX-S) reported flu-like symptoms 18 weeks post-vaccination. No significant group x time effects were found for any strain. Women had greater titers to strain A/Singapore compared to men (F (1,28.12) = 5.85, p=0.022). There was a trend for group differences in fold-increase in antibodies against B/Colorado at 6 weeks (H(2)=4.512, p=0.105) with a mean rank antibody titer of 16.88 for EX-S, 12.29 for EX-OP, and 10.40 for NO-EX. **CONCLUSION:** Acute eccentric resistance exercise of the deltoid and bicep brachii did not significantly influence antibody titers to the influenza vaccine delivered post-exercise in older adults.

**488 Board #304 May 27 9:30 AM - 11:00 AM
EFFECTS OF AEROBIC AND RESISTANCE EXERCISE ON BIOMARKERS OF B-CELL ACTIVATION IN TYPE 2 DIABETES**

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(No relevant relationships reported)

Reduced physical activity and associated chronic low-grade inflammation have long been recognized as risk factors for the development of type 2 diabetes (T2D). Various types of exercise interventions are designed to improve the management of T2D; however, the impact of different modes of exercise training on immune activation in patients with T2D remains unclear. **Purpose:** This study aimed to determine the impact of 9 months of exercise training on Free Light Chains (FLC), a near real-time blood indicator of B-cell activation, in people with T2D. **Methods:** Retrospective analysis was performed on 258 archived plasma samples collected during the HART-D study (NCT00458133) from sedentary individuals with T2D after nine-months of resistance (RT), aerobic (AT), combined exercise (ATRT), or no-exercise control (CON). Aerobic fitness (VO₂ peak) was measured before and after the intervention using a graded treadmill test, and muscle quality was determined by dividing peak torque during concentric isokinetic knee flexion by lean mass using DXA scanner. Samples were

analyzed for total ($\kappa + \lambda$) FLCs and kidney function was estimated by measuring plasma Cystatin C. Linear mixed models were used to analyze changes in FLC in response to the exercise interventions, after controlling for confounding factors. **Results:** At baseline, VO_{2peak} and muscle quality were both negatively correlated with total FLC ($r^2=0.118$, $\beta=-0.312$; $p<0.001$ and $r^2=0.100$, $\beta=-0.220$; $p=0.004$, resp.), even after adjustment for age, sex, ethnic group and HbA1c level. Following 9 months of exercise, changes in VO_{2peak} in CON, AT, RT and COMB were not associated with changes in total FLC ($p>0.05$). Total FLC levels were significantly reduced in those that exhibited improvements in muscle quality ($r^2=0.058$, $\beta=-0.140$; $p=0.047$) in all exercising groups. No significant difference in total FLC were observed between the exercising groups, nor change in kidney in any of the groups. **Conclusion:** Lower physical fitness and muscle quality in people with T2D is associated with elevated FLCs, indicating a heightened state of B cell activation. Exercise-induced improvements in muscle quality corresponded with reduced circulating FLCs and systemic low-grade inflammation in T2D.

489 Board #305 May 27 9:30 AM - 11:00 AM
Abstract Withdrawn

490 Board #306 May 27 9:30 AM - 11:00 AM
MONOCYTE FUNCTION FOLLOWING ACUTE EXERCISE IN BREAST CANCER SURVIVORS BEFORE AND AFTER EXERCISE TRAINING

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Breast cancer therapy impairs immune function that may be attenuated with exercise, though the specific changes that occur remain unclear. **PURPOSE:** 1) To examine monocyte function in breast cancer survivors (BCS) following acute exercise and 2) to determine if this response changes with exercise training. **METHODS:** 9 BCS [Age: 58±8, BMI: 27.9±6.7] completed a cardiopulmonary exercise test (CPET). In a subsequent trial, 45 min of intermittent cycling at 60% of CPET peak wattage was performed. Blood was taken at rest, immediately (0h) and 1h after exercise. Monocyte phagocytosis and oxidative burst were assessed following *E. coli* exposure. Toll-like receptor 2 (TLR2) and 4 (TLR4) expression was determined on CD14⁺CD16⁺ and CD14⁺CD16⁻ monocytes. All assays were performed before (pre) and after (post) 16 wk of combined aerobic and resistance training. Data are presented as mean fluorescence intensity ± SD. **RESULTS:** Phagocytosis increased 1h after acute exercise before (rest: 3396±941 0h: 3257±772, 1h: 3692±824, $p=0.035$) but not after training. There was a trend for greater phagocytosis with training (pre: 3533±815 post: 5027±2039, $p=0.078$). Oxidative burst was unchanged with acute exercise but improved following training (pre: 4264±1061 post: 5446±1287, $p=0.026$). CD16⁺ TLR2 expression decreased acutely at 1h compared to rest and 0h both before and after training (rest: 350±70, 0h: 328±73, 1h: 287±41, both $p<0.05$) while CD16⁺ decreased acutely before training only (pre rest: 355±115 0h: 339±98 1h: 291±87. CD16⁺ TLR4 expression tended to decrease with acute exercise ($p=0.067$) whereas CD16⁺ TLR4 expression decreased across all time points (rest: 140±15, 0h: 135±15, 1h: 123±18, all $p<0.05$) with neither population affected by training. **CONCLUSIONS:** In BCS, monocyte phagocytic capacity of bacteria increased following acute exercise, while training increased both phagocytosis and oxidative burst. Training appeared to mitigate the acute response, possibly due to higher resting function. Expression of TLR2 and TLR4 were progressively reduced with acute exercise that was mostly independent of training. The reduction of monocyte TLR2 and TLR4 may represent an anti-inflammatory response to acute exercise that promotes enhanced elimination of bacteria. Supported by Breast Cancer Research Foundation (New York, NY).

491 Board #307 May 27 9:30 AM - 11:00 AM

Association Between Circulating FGF21 Levels And Physical Activity In Abdominal Obese Adults

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PURPOSE: Circulating fibroblast growth factor 21 (FGF21) is increased with abdominal obesity and may lead to the development of several chronic diseases such as diabetes and cardiovascular disease. Currently, the effect of daily physical activity on circulating FGF21 levels in abdominal obese adults is unclear. This study aimed to examine the cross-sectional association between circulating FGF21 levels and physical activity in abdominal obese adults.

METHODS: This study recruited 207 middle-aged and older adults and classified them as 160 non-obese and 47 abdominal obese adults according to their abdominal circumference (men: ≥ 85 cm, women: ≥ 90 cm). Circulating serum FGF21 levels were evaluated using the ELIZA methods. Daily physical activity levels were objectively assessed using a uniaxial accelerometer and categorized into light-intensity physical activity (LPA) and moderate- to vigorous-intensity physical activity (MVPA).

RESULTS: Abdominal obese adults had a higher median value of serum FGF21 levels when compared with non-obese adults (102 pg/mL vs. 139 pg/mL, $P = 0.006$). Serum FGF21 levels were correlated negatively with the time spent in LPA ($r_s = -0.326$, $P = 0.025$) and MVPA ($r_s = -0.349$, $P = 0.016$) in abdominal obese adults, but not in non-obese adults. When the participants were divided into four groups according to abdominal obesity and physical activity status, the significant interaction was indicated between abdominal obesity and MVPA ($F = 7.386$, $P = 0.007$), but not LPA. Additionally, abdominal obese adults with higher MVPA levels had lower serum FGF21 levels ($P = 0.004$). Furthermore, the association between abdominal obesity, MVPA status and FGF21 levels remained significant after adjusting for age, sex, peak oxygen consumption, blood lipid and glucose, current smoking status, and using medications ($F = 6.229$, $P = 0.013$).

CONCLUSIONS: Lower serum FGF21 concentration was inversely related to higher physical activity levels, particularly in abdominal obese adults. These findings suggest that daily MVPA is effective for decreasing serum FGF21 levels in middle-aged and older adults with abdominal obesity.

492 Board #308 May 27 9:30 AM - 11:00 AM

Diabetes Risk Variants Associate With Impaired Insulin Sensitivity In Healthy Adults Following Bed Rest

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More than 80 genetic variants increase risk for type 2 diabetes. We hypothesized that increased genetic risk for diabetes may increase susceptibility to impaired insulin sensitivity following bed rest. **PURPOSE:** To determine whether type 2 diabetes genetic risk variants in healthy older adults are associated with impaired insulin sensitivity following bed rest. **METHODS:** 37 nondiabetic adults (65.9 ± 7.9 years, BMI 27.1 ± 3.0, 82.2 ± 6.4 mg/dL fasting blood glucose) completed bed rest studies at the University of Texas Medical Branch. The protocol consisted of a 3 day run-in period, 7 days of bed rest and 7 days of rehabilitation. OGTT (75g) were administered before and after bed rest protocol and following rehabilitation. Venous blood was collected at baseline, 0, 30, 60, 90, and 120 minutes, and the Matsuda Insulin Sensitivity Index (Mat-ISI), HOMA-IR, Insulinogenic Index (II), and the Disposition Index (DI) were calculated. DNA from whole blood was used to genotype for MTNR1B (rs10830963), NOTCH2 (rs10923931), RASGRP1 (rs7403531), PROX1 (rs2075423), HHEX (rs1111875), IGF2BP2 (rs4402960), CDKAL1 (rs7754840), SLC30A8 (rs13266634), ZFAND6 (rs11634397), and TCF7L2 (rs7903146) risk variants using TaqMan Assays. Results were collated into an unweighted risk score based on the total number of risk alleles (possible range from 0-20). SPSS version 26 (IBM, Chicago, IL) was used to build a multivariate model including all outcome indices and risk variants. **RESULTS:** Genetic risk scores ranged from 5 to 11. HOMA-IR and II were not associated with risk scores at any point in the study. Higher overall risk scores were inversely associated with the Mat-ISI and the DI only immediately after the completion of the bed rest period ($p = 0.035$ and $p = 0.017$, respectively), but not at baseline or after rehabilitation. Post-bed rest Mat-ISI ranged from 18.1 ± 11.6 for those in the lowest risk group vs. 6.8 ± 0.26 in the highest risk group. Post-bed rest DI was 16.8 ± 12.9 for

those in the lowest risk group and 5.8 ± 3 in the highest risk group. **CONCLUSION:** These results indicate that people with a higher genetic risk for type 2 diabetes may be at increased risk of disuse-related loss of insulin sensitivity. The work was supported by the Claude D. Pepper Older Americans Independence Center (P30 AG024832).

493 Board #309 May 27 9:30 AM - 11:00 AM
Metabolic Effects Of High-intensity Interval Training With Probiotics Supplementation In Obese Women

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The rising of cardiovascular disease and obesity is a pandemic issue over the past years. High-intensity interval training (HIIT) has been shown to improve aerobic capacity, increase metabolic rate, and reduce body fat. Lactobacillus plantarum TWK10, a type of probiotics isolated from Taiwan pickled vegetables, was also found to provide similar performance and metabolic outcome. However, the additive effects of probiotics with HIIT is unclear. **PURPOSE:** To investigate the additive effects of probiotics supplementation in combination with HIIT on cardiopulmonary fitness, body composition and metabolic syndrome blood biomarkers. **METHODS:** The placebo-controlled, double blinded study recruited obese women ($n = 23$, age = 45.8 ± 6.4 y, weight = 62.9 ± 9.2 kg, body fat % = 39.3 ± 3.8 %) and assigned into two groups: probiotics group (TWK10) and placebo group (PLA). Participants in both groups consumed supplements daily before breakfast and participated in a self-monitored HIIT training (treadmill running 7 x 2 minutes at 85-90 % $\dot{V}O_{2max}$ with 1-minute resting interval) for 3 sessions per week for 8 weeks. Cardiopulmonary fitness - $\dot{V}O_{2max}$ and time to exhaustion, body composition - body weight and body fat %, waist and hip circumferences, and blood sugar and lipid profile - fasting blood glucose (FBG), triglyceride (TG), and high-density lipoprotein (HDL) were measured at baseline and after the exercise intervention. Data was analyzed using paired t-test and ANCOVA. **RESULTS:** Time to exhaustion significantly increased in TWK10 ($+11.4\%$, $p = .008$) and PLA ($+8.8\%$, $p = .004$). Hip circumference reduced significantly only in TWK10 group (-2.1% , $p = .018$) and waist circumference increased significantly only in PLA group ($+1.7\%$, $p = .008$). No significant group effects were found in waist and hip circumference respectively. FBG increased significantly in PLA group ($+4.5\%$, $p = .027$) but no significance was found in TWK10 group and between both groups. No significant time and group effects were found in $\dot{V}O_{2max}$, body weight, body fat %, TG, and HDL. **CONCLUSION:** Probiotics supplement in combination with HIIT may only control body circumferences and stabilize FBG over time, but does not have additive benefits in overall cardiopulmonary fitness and metabolic biomarkers.

A-54 Free Communication/Poster - Diabetes/
Glycemic Control

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

494 Board #310 May 27 10:30 AM - 12:00 PM
Hemoglobin A1c, Physical Activity, And Sport Participation Among Children With Type 1 Diabetes

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Children with type 1 diabetes (T1D) should engage in a minimum of 60 minutes of moderate- to vigorous-intensity physical activity (PA) daily, the same as children without T1D; however, care must be taken to prevent or address hypoglycemia or hyperglycemia during and after PA. **PURPOSE:** The purpose of this study was to determine if PA or sport participation predicted hemoglobin A1c (HbA1c) in children with T1D. **METHODS:** This study was conducted within a nationally certified pediatric diabetes care and academic medical center. Patients 7 to 17 years old with T1D presenting for their regularly scheduled pediatric endocrinology appointment were invited to complete a physical activity and sport participation electronic survey. Data were linked to their medical records for age, T1D diagnosis duration, ethnicity, race, gender, insurance type, body mass index (BMI), continuous glucose monitor (CGM) and insulin pump usage, and the primary outcome variable HbA1c. **RESULTS:** Participants consisted of 73 females (47.7%) and 80 males (52.3%), 12.97 ± 2.82 years old, with an average HbA1c of 8.78 ± 1.87 . They were physically active for 60 minutes or more 3.48 ± 1.95 days per week with only 7.9% ($n = 12$) meeting the recommendation of daily PA, yet almost two-thirds played sports within the past year ($n = 98$, 64.1%). A multiple linear regression model indicated that although HbA1c

decreased by .175 for each day a child engaged in PA and decreased .121 for every sport team a child played only the number of days active per week was a significant predictor of better HbA1c ($p < .05$). **CONCLUSION:** Since the number of days active per week was a significant predictor of better HbA1c, it behooves diabetes care teams to encourage PA in addition to sport participation alone. Further investigation should address socioecological barriers to PA and sport participation. This study was made possible by support from the Christensen Family, Children's Hospital Foundation, and University of Louisville Foundation.

495 Board #311 May 27 10:30 AM - 12:00 PM
Effects Of Aerobic And Resistance Training On The Lipoprotein Subclass Profile In Type 2 Diabetics

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(No relevant relationships reported)

Purpose: Type 2 diabetes (T2D) is associated with dysfunctional lipid metabolism in addition to impaired glucose metabolism. Exercise is widely prescribed in the treatment of T2D; however, the effects of exercise on complex lipoprotein traits in T2D are not fully understood. **Methods:** Change in lipoprotein subclass profile was examined in 214 patients with T2D from the HART-D cohort. Patients were randomized to 9 months of either control ($n=33$), aerobic training (AT, $n=62$), resistance training (RT, $n=55$), or combination of aerobic and resistance training (AT/RT, $n=64$). NMR spectroscopy was used to quantify lipoprotein size, total and subclass concentrations of triglyceride rich lipoproteins, low-density lipoproteins, and high-density lipoproteins (TRL-P, LDL-P, and HDL-P respectively). Paired t-tests were used to assess the effects of exercise within each intervention, and general linear models (GLMs) adjusting for group, sex, race, age, baseline BMI, and baseline trait value were used to compare changes in lipoprotein subfractions in exercise groups to changes in control. **Results:** AT resulted in nominal ($p < 0.05$) changes in small HDL-P (H2 (7.8nm): $-0.69 \mu\text{mol/L}$, $p=0.032$, H1 (7.4nm): $0.44 \mu\text{mol/L}$, $p=0.03$), and RT increased medium LDL-P (43.89 nmol/L , $p=0.002$), while AT/RT failed to produce changes in any lipoprotein subclass. Adjusted GLMs revealed the change in H2 HDL-P was less in AT compared control ($p=0.01$). Additionally, despite no training response in large LDL-P subclass concentration following AT, change in large LDL-P was less in the AT group compared to control ($p=0.01$). **Conclusions:** Overall, exercise training resulted in minimal changes in the lipoprotein subclass profile in patients with T2D. Further studies are needed to elucidate the potential effects of exercise dose on lipoprotein subfractions to improve upon the clinical utility of exercise prescription in the treatment of T2D.

496 Board #312 May 27 10:30 AM - 12:00 PM
High Intensity Interval Training Improves Cardiac Autonomic Modulation In Diabetic More Than Moderate Intensity Training

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PURPOSE: The aim of this study was to compare the Heart Rate Recovery (HRR) kinetics and Heart Rate variability (HRV) in diabetic mellitus type 2 (T2DM) after high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) protocols. **METHODS:** Forty-four elderly people diagnosed with T2DM for less than 5 years (BMI = $30.57 \pm 2.56 \text{ kg/m}^2$, age = 56.83 ± 5.73 years) participated in the study, this study has the characteristics of a randomized clinical trial. This project was approved by the ethics committee under number 1,643,562. The participants performed cardiopulmonary exercise testing (CPET) to obtain oxygen uptake ($\dot{V}O_{2max}$). Subsequently, they were allocated to three different groups and used for eight weeks of physical exercise, which were: MICT (14' at 70% of $\dot{V}O_{2max}$), G2:2 (5 - 2' at 100% of $\dot{V}O_{2max}$ with 2' of passive rest) and G30:30 (20 - 30' at 100% of $\dot{V}O_{2max}$ and passive rest). To capture HR, a heart rate monitor (Polar, v800, Finland)

was used. HRV data were analyzed using Kubios HRV software, and exponential data were analyzed using CardioKin software. To compare the protocols, the two-way ANOVA test with repeated measures, $p = 5\%$ was used. **RESULTS:** group x time interaction was observed in the SDNN [F (2.82) = 3.462; $p = 0.036$]. After performing multiple comparisons on SDNN variable, as a function of time, only the HIIT-30:30 group showed a significant difference ($p = 0.025$), the rMSSD variable showed no difference in any evaluation. In the off parameters, group effect was found in the TAUoff variables [F (2.82) = 4.710; $p = 0.012$] time effect for AMPoff was found [F (1.82) = 4.881; $p = 0.030$]. It was also observed group x time interaction in TAUoff [F (2.82) = 3.146; $p = 0.048$]. In the variables in which group x time interaction was observed post hoc to obtain multiple comparisons, the MICT group presented higher TAUoff values when compared to the groups HIIT-30:30 and HIIT-2:2 ($p = 0.001$ and 0.013 , respectively) representing a demonstrated post-exercise sympathetic hyperactivity. **CONCLUSION:** Of all evaluated protocols, the 30:30 protocol was the one that presented the best HR response, and thus, the application of this protocol is effective in improving autonomic control, without greater risk for diabetics.

497 Board #313 May 27 10:30 AM - 12:00 PM
Cardiopulmonary Differences Between Normal And Overweight Diabetics

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Diabetes Mellitus (DM) is one of the most common lifestyle-associated diseases worldwide. DM is often correlated to sedentary lifestyle, poor nutritional behaviors and high body fat. Therefore sedentary and overweight people are at high risk of having DM. However, there are also normal weight diabetics in which these factors may be less strongly correlated. **PURPOSE:** To comprehensively describe differences between normal and overweight patients with DM using cardiopulmonary exercise testing. **METHODS:** As part of two separate exercise trials being run on normoweight (STRONG-D) and overweight (IMPACT) diabetics, patients performed individualised ramp CPET. Results of CPET were compared between the groups using statistics for multiple between group comparisons. **RESULTS:** Besides known demographic and anthropometric differences, the normoweight group also reached significantly ($p < 0.01$) higher workload (17%), higher peak ventilation (11%) and oxygen uptake (12%), higher heart rate recovery (6%), and had lower resting heart rate (11%) and ventilatory efficiency (21%). **CONCLUSIONS:** DM is in itself a risk factor for further cardiovascular disease, but the DM risk profile may be more sensitively identified through examination of exercise performance.

498 Board #314 May 27 10:30 AM - 12:00 PM
Influence Of Fasting Blood Glucose On Cardiopulmonary Responses To Maximal Exercise

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Cardiopulmonary exercise testing (CPET) is used in the diagnosis and prognosis of several chronic diseases. However, the impact of impaired fasting glucose regulation on CPET responses is unknown. **PURPOSE:** To examine the influence of fasting blood glucose status on CPET responses to maximal exercise. **METHODS:** Apparently healthy adults ($n = 3863$) from the Ball State Adult Fitness Longitudinal Lifestyle Study (BALL ST) were examined. Participants were categorized by fasting blood glucose status according to American Diabetes Association guidelines as normal (NORMAL, $n = 2738$, 50% male, plasma glucose 88 ± 9 mg·dl⁻¹), prediabetes (PRE, $n = 938$, 66% male, plasma glucose 107 ± 9 mg·dl⁻¹) or diabetes mellitus (DM, $n = 187$, 60% male, plasma glucose 152 ± 51 mg·dl⁻¹). All participants performed a maximal CPET for the determination of cardiorespiratory fitness (CRF), ventilatory threshold (VT), ventilatory efficiency slope ($V_{E, slope}$), oxygen uptake efficiency slope (OUES), oxygen pulse (O_2 pulse), exercise ventilatory power (EVP), and exercise circulatory power (ECP). Analysis of variance (ANOVA) was used to compare group means. **RESULTS:** Age- and sex-adjusted CRF (expressed as percentiles based on the Fitness Registry and Importance of Exercise National Database (FRIEND)) was inversely related to fasting blood glucose status (NORMAL > PRE > DM; 47 ± 28 , 41 ± 28 , 26 ± 24 percentile, $p < 0.05$ for all) as was VT (NORMAL > PRE > DM; 19.5 ± 8.0 , 17.9 ± 6.8 , 15.1 ± 5.2 ml·kg⁻¹·min⁻¹, $p < 0.05$ for all), EVP was lower ($p < 0.05$) for NORMAL (6.6 ± 1.7 mmHg) compared to PRE (7.1 ± 1.8 mmHg) and DM (7.2 ± 2.8 mmHg). ECP was lower ($p < 0.05$) for DM (4575 ± 1611 mmHg·ml·kg⁻¹·min⁻¹) compared to NORMAL (5498 ± 1986 mmHg·ml·kg⁻¹·min⁻¹) and PRE (5410 ± 1790 mmHg·ml·kg⁻¹·min⁻¹). O_2 pulse was higher ($p < 0.05$) in PRE (15.4 ± 4.5 ml·beat⁻¹) compared to NORMAL

(14.5 ± 5.3 ml·beat⁻¹) and DM (13.9 ± 4.0 ml·beat⁻¹). No differences between groups existed for $V_{E, slope}$ or OUES. **CONCLUSION:** These data demonstrate that impaired fasting glucose regulation is associated with altered CPET responses indicating that CPET may be an additional diagnostic tool in the diagnosis of diabetes.

499 Board #315 May 27 10:30 AM - 12:00 PM
The Effects Of Resveratrol And Exercise Training On Functional Fitness In Elderly With T2dm

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Although resveratrol has potential to be an 'exercise pill', studies that have observed the effects of resveratrol after it was consumed by diabetics, to whom exercise was very important, were limited. In particular, studies that both observed and compared the effects of resveratrol intake and aerobic exercise done at the same time by T2DM elderly women, who tend to lack treatment and care the most, were needed. Thus, in this study, the body composition, aerobic exercise ability and functional fitness effects in T2DM elderly women was observed throughout 8 weeks of treatment. **PURPOSE:** The purpose of this study was to investigate the effects 8 weeks of aerobic training and resveratrol supplementation on body composition, aerobic exercise capacity, and functional fitness in T2DM elderly women. **METHODS:** Fifty T2DM elderly women (70.5 ± 4.4) were randomly assigned to either a combined aerobic training and resveratrol supplementation group (EX+R: $n = 12$), an aerobic training only group (EX: $n = 12$), a resveratrol supplementation only group (R: $n = 13$), or a control group (CON: $n = 13$). The subjects in EX exercised three sessions per week, the subjects in R took in resveratrol for 500 mg·d⁻¹ for 8 weeks, 40 minutes per session for 8 weeks, and the subjects in EX+R participated in both treatment. **RESULTS:** Body composition did not change significantly in all groups. However, aerobic exercise capacity (VO_{2max}) increased significantly in EX+R (38.2 ± 2.9 vs. 42.8 ± 2.5 ml/kg/min, $p < .001$) and R (33.9 ± 7.5 vs. 37.3 ± 7.9 ml/kg/min, $p < .05$). Functional fitness Chair sit-to stand was increased significantly in EX+R (19.1 ± 4.9 vs. 21.4 ± 4.1 reps), EX (19.8 ± 3.3 vs. 22.5 ± 4.3 reps), and R (20.6 ± 4.4 vs. 22.3 ± 3.6 reps). Foot tapping in a sitting down was increased significantly in EX+R (26.6 ± 3.8 vs. 30.3 ± 3.6 reps, $p < .05$) and EX (26.5 ± 5 vs. 31.2 ± 4.2 reps $p < .01$). Also, pegboard increased significantly in EX+R (38.8 ± 4.0 vs. 41.5 ± 3.8 reps, $p < .05$), EX (39 ± 4.5 vs. 41.4 ± 4 reps, $p < .05$) and R (38.3 ± 2.4 vs. 41.2 ± 2.9 reps, $p < .01$), whereas the other functional fitness-related variables showed no significant changes in all groups. **CONCLUSIONS:** It was concluded that the 8 weeks of resveratrol supplementation and aerobic training combined had positive effects on aerobic exercise capacity and functional fitness of T2DM elderly women.

500 Board #316 May 27 10:30 AM - 12:00 PM
No Difference In Heart Rate Recovery During Graded Treadmill Testing In Patients With And Without Nonalcoholic Fatty Liver Disease (NAFLD)

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 (No relevant relationships reported)

Cardiac Mortality is the most common cause of death for nonalcoholic fatty liver disease (NAFLD), which is linked to physical inactivity and obesity. **PURPOSE:** To determine whether individuals with NAFLD show heart rate recovery impairment (iHRR is ≤ 12 beats per minute at 1 minute post-exercise, an independent predictor of mortality) compared to non-NAFLD participants following graded treadmill testing (GTT) to volitional exhaustion. **METHODS:** Non-pharmacological clinical research participants with and without NAFLD were included. All performed symptom-limited, Modified Bruce GTT. Gas exchange captured cardiorespiratory variables and impedance cardiometry assessed heart rate, stroke volume, and cardiac output (CO) continuously during rest, testing, and recovery. Participants completed nutrition, activity, and fatigue questionnaires. Linear regression assessed effects of covariates on HRR. **RESULTS:** 86 participants (48.8% Male, 62.8% Caucasian, 65.8% NAFLD/ NASH, Age 48 ± 13.6 years) were included for analysis. T-test comparisons showed individuals with NAFLD to be older (52 vs 41.4 years, $p = .001$), have higher body mass index (31.2 vs 28.4 kg/m², $p = .007$), and increased body fat percentage, (34.1% vs 28.6% , $p = .006$) but showed no differences for resting pulse, blood pressure, gender, or ethnicity. Per GTT, individuals with NAFLD had reduced oxygen consumption at anaerobic threshold (AT) (12.3 vs 15.6 mL/kg/min) and peak exertion (23.1 vs 31.2 mL/kg/min, $p < .001$) compared to non-NAFLD. The NAFLD cohort also reported reduced maximal and average activity scores compared to the non-NAFLD group (MAS 89.8 vs 81.4 , $p = .001$; AAS 88.1 vs 77.6 , $p < .001$). No group differences were

found for iHRR presence or continuous HRR measure. Stepwise linear regression showed peak CO ($B=0.317$, $p=.041$) and MAS ($B=.348$, $p=.025$) to be significant predictors of HRR for all participants ($R^2=.261$).

CONCLUSIONS: No HRR post exercise differences were found between NAFLD and non-NAFLD individuals. Increased CO and self-reported exercise capacity may indicate lower probability of impaired HRR. AAS and MAS were reduced in the NAFLD group, which may reflect reduced aerobic capacity at peak performance and AT. NAFLD individuals may benefit from exercise participation encouragement to improve tolerance of physical activity.

501 Board #317 May 27 10:30 AM - 12:00 PM
A Simple Smartphone-based Physical Activity Level Did Not Predict Obesity Prevalence In Type 2 Diabetes Patients In Korea

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PURPOSE: Obesity management in patients with type 2 diabetes (T2DM) is very important for improving insulin resistance. One of the factors affecting obesity management is physical activity level (PAL). The purpose of this study was to investigate the relationship between obesity and the daily physical activity level monitored by smart-phones in T2DM patients.

METHODS: A total of 325 patients with T2DM who have enrolled a diabetes self-management App (iCareD, Medical Excellence Inc., Korea) linked to an electronic medical record (EMR) at least for 30 days was enlisted. The daily walking steps were monitored by a 3-axis accelerometer embedded in the smartphone. And 268 patients who walked over an average of 1,000 step/day in 30 days (163 men; 58.1±11.8 yrs, 170.9±5.8 cm, 73.7±11.4 kg, and 25.2±3.5 kg/m², 105 women; 55.3±14.6 yrs, 158.1±5.2 cm, 61.0±11.7 kg, and 24.3±4.0 kg/m²) were selected for the analyses of PAL. The medical record (height, weight, and body mass index: BMI) of those selected subjects were retrieved from the hospital. PAL was divided into quartile, and the obesity prevalence was compared by groups. Statistical software SAS version 9.4 were used and statistical significance was set at $p<0.05$.

RESULTS: The average daily PAL for 30 days was 5,209±3,276 step/day ($n=268$). Those who walked >7,500 step/day were 20.8% ($n=56$). The quartile was divided by 67 patients at ≤2,452, between >2,452 and ≤4,655, between >4,655 and ≤7,009, and >7,009 step/day, for the 1st, 2nd, 3rd, and 4th quartile, respectively. The total obesity prevalence with BMI ≥25 kg/m² was 41.7% ($n=112$). The group obesity prevalence was 47.7% ($n=32$), 44.7% ($n=30$), 40.2% ($n=27$), and 34.3% ($n=23$), in 1st, 2nd, 3rd, and 4th quartile, respectively ($p=0.459$).

CONCLUSIONS: This study revealed a quantification of PAL monitored by smartphones in Korean T2DM patients. The majority of the subjects did not meet the recommended activity level guided by the American Diabetes Association (7,500–9,999 step/day). The low level of PAL may be due by data collection modality such as smartphones. Further studies are required. (study funded by NRF-2014M3A9D7070333).

502 Board #318 May 27 10:30 AM - 12:00 PM
Acute Vs. Chronic Responses To Exercise Training In Type-2 Vs. Pre-diabetic Adults.

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 (No relevant relationships reported)

Exercise is recommended for improving glycemic control yet it remains unclear whether exercise training produces similar acute and chronic adaptations in T2DM vs. pre-diabetic individuals given their varying states of insulin resistance. **PURPOSE:** To compare acute and chronic exercise training adaptations in response to the same exercise training program in T2DM vs. pre-diabetic individuals. **METHODS** 18 male ($n=8$) and female ($n=10$), previously inactive (no planned physical activity), adults with T2DM ($n=10$) or pre-diabetes ($n=8$) completed the same exercise training program (3 days/wk, 8 wks). Before and exactly 72-hr after participants' last exercise session, chronic adaptations in body fat percentage ([BF%]) assessed via dual x-ray absorptiometry), fitness determined by a 6-minute walk test, resting systolic (SBP) and diastolic (DBP) blood pressure, fasting blood glucose (BG), and self-efficacy using the Self-Efficacy for Exercise Scale (SEE) were measured. Participants' SBP, DBP, and BG were also monitored immediately before and 5-min after each exercise session to determine acute responses to exercise. **RESULTS:** A significant improvement in 6MWT was observed for T2DM (1544 ± 82 vs. 1752 ± 80 ft., $p<0.01$) and pre-diabetic

(1414 ± 97 vs. 1624 ± 115 ft., $p<0.01$) participants. No significant chronic or acute changes were observed in SBP for either group. A significant improvement in resting DBP was observed in T2DM (80 ± 2 vs. 75 ± 3 mmHg, $p=0.03$) but not pre-diabetic (75 ± 2 vs. 79 ± 3 mmHg, $p=0.13$) participants yet no acute changes were observed in DBP for either group. No significant changes were observed in fasting BG in either group. Acutely exercise resulted in significantly lower BG in diabetic (172 ± 12 vs. 145 ± 11 mg/dL, $p<0.01$) and pre-diabetic (104 ± 4 vs. 95 ± 3 mg/dL, $p<0.01$) participants. A significant improvement in SEE was observed in diabetic (34.3 ± 9.0 vs. 65.0 ± 9.0 , $p=0.029$), but not pre-diabetic (38.8 ± 12.8 vs. 60.0 ± 12.8 , $p=0.24$) participants. **CONCLUSION:** Despite varying states of insulin resistance, exercise training resulted in similar improvements in fitness and acute improvements in blood glucose in both diabetic and pre-diabetic adults. However, unlike pre-diabetics, diabetic participants experienced additional benefits in resting diastolic blood pressure and exercise self-efficacy.

503 Board #319 May 27 10:30 AM - 12:00 PM
Accuracy Of Continuous Glucose Monitoring During Exercise In Type I Diabetes Patients

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Subcutaneous continuous glucose monitor devices provide a more detailed description of glycemic control. This may be particularly useful as a tool to detect hypo- or hyperglycemia during exercise. Performance of continuous glucose monitor devices, however, is likely to be lower when glucose levels are changing rapidly, such as occurs during exercise. **PURPOSE:** To determine the accuracy of a subcutaneous continuous glucose monitor during exercise in Type I Diabetes patients. **METHODS:** Paired subcutaneous continuous glucose monitor (Freestyle Libre, Abbott Diabetes Care, Witney, UK) and capillary glucose values were collected, from 38 adults (20 women and 18 men; mean ± SD, 45 ± 14 years) with Type I Diabetes, at rest, low- (40%HRR), moderate- (70%HRR), and high-exercise intensity (>85%HRR). Mean Absolute Relative Differences (MARD) was used to determine accuracy. **RESULTS:** The glucose values (mg/dL) for subcutaneous continuous glucose monitor and capillary glucose monitor did significantly differ at low- (mean ± SD; 164 ± 70 vs 144 ± 54) and moderate-exercise intensity (148 ± 61 vs 131 ± 50) ($P < 0.05$), but not at rest (177 ± 72 vs 170 ± 59) and high-exercise intensity (142 ± 53 vs 144 ± 45) ($P > 0.05$). MARD at rest was 4%, while the individuals MARDs were 14%, 13%, and 2% for low-, moderate-, and high-exercise intensity, respectively. **CONCLUSIONS:** Continuous glucose monitoring was not sufficiently accurate to describe glucose levels at low-to-moderate exercise intensities in Type I Diabetes patients and require confirmatory capillary glucose measurements.

504 Board #320 May 27 10:30 AM - 12:00 PM
Influence Of Monetary Incentives On Exercise Compliance & Health Among Hyperglycemic Adults: Preliminary Analysis.

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 (No relevant relationships reported)

A major obstacle in exercise-based rehabilitation is exercise compliance. Monetary incentives are associated with greater exercise compliance and improvements in health, yet an ideal monetary system has yet to be identified. **PURPOSE:** To examine exercise compliance and health outcome measures associated with fixed- vs. incremental-loss monetary systems during an exercise training in a clinical population. **METHODS:** 17 male ($n=7$) and female ($n=10$), previously inactive (no planned physical activity), hyperglycemic (T2DM, $n=9$; pre-diabetes, $n=8$), adults (53±2 yrs.) completed a supervised exercise training program (3 days/wk for 8 wks). All participants started with \$48 (\$6/wk x 8 wks). For the fixed-loss group, \$2 was deducted for each missed exercise session. For the incremental-loss group, progressively more was deducted for each session missed per week: \$1 for the first, \$2 for the second, and \$3 for the third/final session of the week. Exercise compliance, body fat percentage ([BF%]) assessed via dual x-ray absorptiometry), and fitness determined by a 6-minute walk test (6MWT) were assessed before and after exercise training. Similar to cardiopulmonary rehabilitation programs, acute responses to exercise including heart rate (HR), systolic (SBP) and diastolic (DBP) blood pressure, as well as blood glucose were monitored immediately before and 5-minutes after each exercise session. **RESULTS:** Exercise compliance was similar between the fixed- vs. incremental-loss group (90±4% vs. 92±3%, $p=0.63$). No significant differences were observed between groups or in

response to exercise training for BF%. Similar improvements were observed in the 6MWT for the fixed-loss (1534±99 vs. 1799±99 ft., $p < 0.001$) and incremental-loss (1455±93 vs. 1585±93 ft., $p = 0.04$) groups. Similar reductions were also observed in average acute blood glucose response from pre to post-exercise in the fixed- (131±18 vs. 114±11 mg/dL, $p = 0.03$) and incremental-loss (152±23 vs. 132±19 mg/dL, $p = 0.01$) group. No significant differences were detected in acute response to exercise for HR, SBP or DBP. **CONCLUSION:** Regardless of loss system, modest monetary incentives appear to promote high exercise compliance that was associated with meaningful health benefits including improved fitness and blood glucose control for hyperglycemia individuals.

505 Board #321 May 27 10:30 AM - 12:00 PM
Effects Of Progressive Combined Exercise Program On Irisin, C-peptide And Homa Index In Obese Elderly Women With Type 2 Diabetes

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PURPOSE: The purpose of this study was to investigate the effects of progressive combined exercise program on irisin, C-peptide, HOMA- β , HOMA-IR, body composition and physical fitness in obese elderly women with type 2 diabetes.
METHODS: Thirty six obese elderly women with T2DM patients (76.64 ± 6.56 years, %BF 36.09 ± 4.18, HbA1c 7.05 ± 0.85%) were randomly assigned to the combined exercise group (n = 20) and to the control group (n = 16). The 60 minute combined exercise program (outdoor walking + elastic-band resistance exercise) was performed 3 times per week for 12 weeks, and the intensity was progressively increased every four weeks (Outdoor walking RPE 11-14; Band exercise 1-4 weeks: OMNI-RES 3 to 4, 5-8 weeks: OMNI-RES 5 to 6, 9-12weeks: OMNI-RES 7 to 8).
RESULTS: There were significant time × group interactions for irisin ($p < 0.001$), C-peptide ($p = 0.002$), HOMA- β ($p < 0.001$), HOMA-IR ($p = 0.045$), fasting blood glucose ($p < 0.001$), and HbA1c ($p < 0.001$). Result of combined exercise group were as follows; percentage of body fat had significantly decreased, and irisin level had significantly increased. In addition, HbA1c and Glucose were significantly decreased to improve glycemic control, and C-peptide, CPI and HOMA- β levels were significantly increased. Fasting glucose ($r = -0.424$), HbA1c ($r = -0.351$), SBP ($r = -0.397$) and percentage of body fat ($r = -0.423$) changes level showed a negative whereas HOMA- β ($r = 0.411$) and aerobic endurance ($r = 0.355$) changes level had a positive correlation with irisin change level.
CONCLUSIONS: Combined exercise improves irisin levels and regulates percentage of body fat and blood glucose, which improves beta-cell function than non-exercise. Therefore, progressive combined exercise improves body composition, blood glucose and β -cell function by increasing irisin levels in obese elderly women with type 2 diabetes.

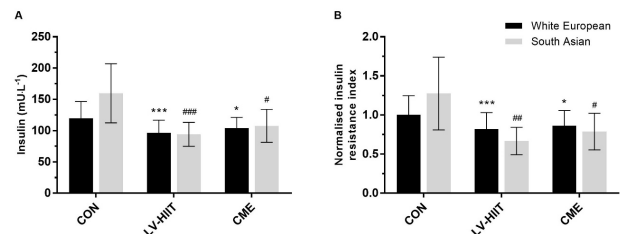
506 Board #322 May 27 10:30 AM - 12:00 PM
Ethnic Differences In Post-prandial Glycemic Control After Acute Moderate-intensity Continuous Or High-intensity Interval Exercise

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PURPOSE: To examine the effects of acute continuous moderate-intensity aerobic exercise (CME) and low-volume high-intensity interval training (LV-HIIT) on glycemic control in white Europeans (WEs) and south Asians (SAs) with impaired glycemic control.
METHODS: 23 participants (WE / SA [M/F]: 13[6/7] / 10[7/3]; median (IQR): age 67 (60–68) years, BMI 30.0 (28.4–32.8) kg/m², waist circumference 100.8 (97.6–109.1) cm, HbA1c 5.9 (5.8–6.1) %) completed three 6 h trials (control [CON], CME, LV-HIIT; randomized order). Participants rested throughout, except for 35 min of CME and 25 min of LV-HIIT (closely matched for external work produced) during corresponding trials. Both CME and LV-HIIT ended at 2 h. Standardized meals were consumed at 0 and 3 h. Plasma glucose and insulin were measured at 0, 0.5, 1, 2, 3, 3.5, 4, 5 and 6 h. Data were analysed as post-exercise time-averaged area under the curve (AUC_{post}), using generalized estimating equations, adjusted for pre-exercise AUC

(also time-averaged), sex and age. Main effects of trial and ethnicity were assessed, with an interaction term fitted to explore if ethnicity modulated responses. Insulin resistance index (IRI) was calculated as $tAUC_{glu} \times tAUC_{ins}^{-1}$.
RESULTS: Glucose was unaffected (all $p \geq 0.28$), but insulin AUC_{post} was reduced in both exercise trials compared to CON (main effect $p < 0.001$; Figure 1A). Furthermore, this effect was modulated by ethnicity ($p = 0.03$), with a greater effect seen in SAs. Notably, insulin AUC_{post} was similar in both ethnicities during exercise trials, despite being higher in SAs during CON (Figure 1A). Results were similar for IRI (Figure 1B).
CONCLUSION: Despite ~30% higher post-prandial insulin responses during prolonged sitting, SAs may benefit more from acute exercise than WEs. Acknowledging that this was an acute-crossover study, these findings warrant further investigation with longer-term exercise training interventions, given the higher cardiometabolic disease risk observed in SAs.

Figure 1 – Post-exercise responses of (A) insulin and (B) insulin resistance index during each trial in each ethnicity group.



Data presented as mean (95% confidence interval); *[#] indicate significant differences from the CON trial within ethnicity group (*[#] $p < 0.05$, **[#] $p < 0.01$, ***[#] $p = 0.001$). Data for insulin resistance index presented normalised to the mean value during the CON trial in the white European group, for ease of interpretation. CME: continuous moderate-intensity aerobic exercise trial; CON: control trial; LV-HIIT: low-volume high-intensity interval training.

507 Board #323 May 27 10:30 AM - 12:00 PM
Motor-assisted And Functional Electrical Stimulation Cycling Impacts Postprandial Glucose In Diabetic Patients With Adl Disability

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Background: Effective glucose management using exercise modalities in older patients with type 2 diabetes and activities of daily living (ADL) disabilities are unknown.
Purpose: The study investigated the acute effects of motor-assisted cycling and functional electrical stimulation (FES) cycling on the 2-h postprandial glucose responses compared with sitting control in older adults with type 2 diabetes and ADL disability.
Methods: The study used a 3×3 crossover study design. Nine participants were randomly assigned to one of the three intervention sequences: ABC, BCA, and CAB. (A, motor-assisted cycling; B, FES cycling; C, sitting control). Linear mixed models (LMM) with Bonferroni post-hoc tests were used to test the mean differences for the 2-h postprandial glucose, estimated by the area under the curve (AUC) and incremental AUC (iAUC), between intervention and control treatments after adjustment for covariates (e.g., age, sex, and race).
Results: There were significant mean differences for iAUC ($p = 0.005$) and AUC ($p = 0.038$) across motor-assisted cycling, control, and FES cycling treatments. The FES cycling had a lower mean of 2-hour postprandial iAUC as compared with sitting control (iAUC 3.98 mmol·h/L vs 6.92 mmol·h/L, $p = 0.006$, effect size [ES] = 1.72) and the motor-assisted cycling (iAUC, 3.98 mmol·h/L vs 6.19 mmol·h/L, $p = 0.0368$, ES = 1.29), respectively. The FES cycling also had a lower mean of the 2-hour postprandial AUC as compared with sitting control (AUC, 18.29 mmol·h/L vs 20.95 mmol·h/L, $p = 0.043$, ES = 0.89), but had an AUC similar to the motor-assisted cycling (18.29 mmol·h/L vs 20.23 mmol·h/L, $p = 0.183$, ES = 0.19). There were no statistical differences in iAUC (6.19 mmol·h/L vs 6.92 mmol·h/L) and AUC (20.23 mmol·h/L vs 20.95 mmol·h/L) between the motor-assisted cycling and sitting control (all $p > 0.05$).
Conclusion: Performing 30 minutes of FES cycling on a motor-assisted bike (40 Hz, 38 rpm, 25-29 mA) significantly decreased the 2-h postprandial glucose levels by 42% in older adults with type 2 diabetes and ADL disabilities. Our findings suggested that FES cycling can be a promising exercise modality for glucose management in diabetic patients with ADL disabilities.

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Value And Challenges Of Investigating Real-world Effectiveness Of Exercise Physiology Services For Type-2 Diabetes

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PURPOSE: The evidence from randomised controlled trials (RCTs) and meta-analyses supports the use of exercise to manage type 2 diabetes (T2D), and most guidelines propose exercise as a cornerstone of clinical management. However, there is a paucity of evidence for how this translates to real-world practices, specifically the effectiveness of exercise in patients with T2D when delivered as part of complex health service models, rather than in tightly controlled research trials. **METHODS:** A collaboration of universities and health clinics in Australia is addressing this evidence gap by investigating the effectiveness of services provided by Accredited Exercise Physiologists on a range of outcome measures in people with T2D. The novelty of this approach is the authenticity of 1) the sample population, which excludes no one who is referred to the service; and 2) the type of intervention, which is whatever the individual clinic, clinician and/or patient deem suitable for each situation, subject to any cost constraints. This study is a preliminary analysis of the challenges encountered with this real-world research approach and of the population presenting for exercise physiology services in this context. **RESULTS:** Key challenges encountered were 1) delays in regional ethics committees, 2) participant recruitment particular to each site, 3) attrition, 4) access to medical records. Sixty-two participants (59% female, 65 ± 10 y.o., HbA1c 7 ± 1%, BP 137/77 including 23% stage 1 and 33% Stage 2 hypertension based on ACC levels) have been enrolled to date. All were on 1 or more hypoglycaemic medication, 88% were on 1 or more cardiovascular medication and 83% were on 1 or more other medication. Of those on additional medications the mean number of medications prescribed was 7.5 per person. **CONCLUSIONS:** The challenges encountered are consistent with similar approaches of translational research. The sample recruited so far is older with more comorbidity and complex polypharmacy, but has relatively good glycaemic control compared to the typical patient population studied in published RCTs. The difficulty in accrual considered alongside the patient characteristics supports the need for more focus on this type of implementation research to inform the real-world evidence for the benefits of exercise, rather than relying only on RCTs.

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Glycemic Effects Of Exercise In Sri Lankans Adults With Type 2 Diabetes Mellitus

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The prevalence of type 2 Diabetes Mellitus (T2DM) is rising in South Asia. Although exercise training is recommended for its management, the effects of exercise training on glycemic control in Sri Lankans with T2DM has not been studied. **PURPOSE:** To examine the effects of aerobic training (AT) and resistance training (RT) on glycemic control in Sri Lankan adults with T2DM. **METHODS:** 86 Sedentary Sri Lankans (50.1±8.7 years, 53% women) diagnosed with T2DM within last 6 years were randomized into AT (n=28), RT (n=28) or control (CN, n=30). Supervised exercise training was performed for 75 minutes per session, 2 days/week for 12 weeks. RT targeted 7 (i.e., 3 upper body, 3 lower body, 1 core) exercises. AT included brisk walking, stepping and stationary cycling at an intensity of 60-75% heart rate max. Fasting blood glucose (FBG), HbA1c, and fasting insulin (FI) were measured at baseline and post intervention. **RESULTS:** Baseline mean BMI, HbA1c, FBG and FI were 26.4 kg/m²±4.0, 8.2±1.7%, 146.9 ±54.1 mg/dl and 13.3±8.5 micIU/ml, respectively. Subject characteristics were similar among groups, except the CN group had higher mean HbA1c level (8.9 ± 1.7%). Absolute mean change in HbA1c was not

significant across groups; RT 0.6 % (95% CI; 1.16% to -0.01%, p=0.8), AT 0.74 % (95% CI; 1.25% to -0.24 %, p=0.5) or CN 0.52% (95% CI, 1.1% to 0.03%, p= 0.8). Absolute mean change in FBG significantly improved in RT (-3.8 mg/dl [95% CI, 4.9 to -12.6 mg/dl; p=0.02]) and CN (25.6 mg/dl [95% CI; 48.5 to 3.0 mg/dl, p= 0.04]), but not AT (20.1 mg/dl [95% CI, 39.6 to 0.6 mg/dl, p= 0.5]). Absolute mean change in FI did not significantly increase in RT (0.2 micIU/ml [95% CI, (2.9 to -2.4 micIU/ml, p = 0.1)] or AT (0.2 micIU/ml [95% CI; 2.9 to -2.5 micIU/ml, p = 0.1]) but did in the CN group (3.0 micIU/ml [95% CI, 0.8 to -8.3 micIU/ml, p=0.00]). **CONCLUSION:** To our knowledge this is the first randomized controlled trial to study the effects of AT and RT on glycemic control in Sri Lankan diabetics. Intervention showed mixed effects in improvement in chronic glycemic control (HbA1c) and in short term glycemic control (FBG). FI did not increase in intervention groups which demonstrated reduced disease progression. Future studies with larger sample sizes are need for definitive conclusions.

510 Board #326 May 27 10:30 AM - 12:00 PM
Improvement In Insulin Sensitivity With Four Weeks Of Neuromuscular Electrical Stimulation In Overweight/obese Sedentary Adults

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Most U.S. adults (80%) do not meet minimum exercise recommendations by ACSM (CDC, 2015). Using an *in vitro* primary cell culture model, we and others have shown that muscle contraction induced by electrical stimulation results in increased glucose transporter 4 (GLUT4) protein, glucose uptake and mitochondrial content. Neuromuscular electrical stimulation (NMES) is a novel alternate strategy to induce muscle contraction, using electrical impulses. However, effectiveness of NMES induced muscle contraction to improve insulin sensitivity and energy expenditure is not clear.

PURPOSE: To investigate the effects of four weeks of NMES on insulin sensitivity in a sedentary overweight/obese population.

METHODS: Sedentary overweight/obese participants (n=8; age: 37.0 ± 3.6 years; BMI= 30.9 ± 1.1 kg/m²) were randomized into either a control or NMES group. All participants received bilateral quadriceps stimulation (12 sessions, 30 minutes/session, 3 times/week) either using low intensity sensory level (control) or at high intensity neuromuscular level (NMES) for four weeks (50Hz and 300µs pulse width). Insulin sensitivity was assessed by three-hour oral glucose tolerance test (OGTT) at baseline and after four weeks of NMES intervention.

RESULTS: Control and NMES group had comparable fasting blood glucose (Control 106.1 ± 3.1; NMES 107.9 ± 3.9 mg/dL; p=0.74) and glucose tolerance (Control 430.73 ± 20.23; NMES 469.97 ± 28.03 AU; p=0.30) at baseline. Four weeks of NMES resulted in significant improvement in insulin sensitivity measured by OGTT, whereas no change was observed in control group (Control 430.73 ± 20.23 to 418.36 ± 15.13 AU; p=0.62; NMES 469.97 ± 28.03 to 423.97 ± 31.53 AU; p=0.04). Additionally, blood glucose level measured after 2 hours of glucose drink consumption trended to be lower after 4 weeks of NMES treatment (154.38 ± 8.71 to 140.25 ± 9.46 mg/dL, p=0.052) whereas no change was observed in control group (151.75 ± 6.14 to 139.75 ± 9.03 mg/dL, p=0.33).

CONCLUSION: NMES is a novel and effective strategy to improve insulin sensitivity in an at-risk overweight/obese sedentary population.

511 Board #327 May 27 10:30 AM - 12:00 PM
Exercise Prescription Is An Effective Action To Achieve 3B Targets In T2DM

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(No relevant relationships reported)

PURPOSE: To explore the effects of exercise prescription on the effect of achieve blood glucose, blood pressure and blood lipid(3B) targets of T2D patients.

METHODS: T2D patients aged from 18 years to 75 years were assigned to the exercise prescription group (ExRx), 10000-steps group (Steps), or education group (Edu). CPT, anthropometric and blood test was assessed at baseline and after 12 weeks intervention in all participants. Participants were asked to achieve moderate exercise (50%-60% V_{O2}max, self-monitored heart rate) for a minimum of 30min/d, 5d/week for ExRx group, or achieve 10,000 steps a day as pedometer monitored, at least 5d/week for Steps group, or receive exercise education every 4 weeks but not make exercise records for Edu group. Follow-up was performed every four weeks. The primary outcome was the improvement of fitness and glucose control of T2D; secondary outcomes were the achievements of 3B targets of T2D.

RESULTS: A total of 298 subjects with a mean age of 55 years (154 men, 144 women) entered the final analysis. After 12 weeks of intervention, the $\text{VO}_{2\text{max}}$ were significantly increased by 2.49 ± 5.92 METs in ExRx group compared with Steps group (0.53 ± 1.23 METs) and Edu group (-0.54 ± 4.82 METs) ($P < 0.001$); FPG decreased 0.39 ± 1.79 mmol/L ($P < 0.001$), no intergroup difference; HbA1c were significantly decreased $0.37 \pm 0.92\%$ in ExRx group compared with Steps group ($0.12 \pm 1.05\%$) and Edu group ($-0.05 \pm 1.09\%$) ($P < 0.05$). After intervention for 12 weeks, the proportion of patients who achieved 3B targets increased from 10.5% to 17.0%, while $\text{VO}_{2\text{max}}$ increased 0.74 ± 3.34 METs for all participants. Participants who achieves the three targets got an improvement of 1.03 ± 3.60 METs in $\text{VO}_{2\text{max}}$ after 12 weeks intervention compared with others (0.39 ± 2.59 METs).

CONCLUSION: 12 weeks exercise intervention improved fitness and blood glucose control of T2D patients, exercise prescription is more effective than other two methods. 12 weeks exercise intervention increased the proportion of patients who achieved 3B targets from 10.5% to 17.0%, exercise prescription group increased 11.2% which was better than other two groups. Participants who achieves the 3B targets got an improvement of 1METs in $\text{VO}_{2\text{max}}$ after 12 weeks intervention. Exercise prescription is an effective action to achieve 3B targets in type 2 diabetes patients.

512 Board #328 May 27 10:30 AM - 12:00 PM
Association Between Physical Activity Intensity And Glucose Variability Among Athletes With Type 1 Diabetes.

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 (No relevant relationships reported)

All children are encouraged to engage in a minimum of 60 minutes of moderate to vigorous physical activity (PA) per day. However, when it comes to the long-term health implications of daily PA, there is an added benefit for those managing type 1 diabetes (T1D). Studies have consistently shown improvements in daily glucose and hemoglobin A1c (HbA1c) for both type 1 and type 2 diabetes. A limitation with prior investigations is that they only tested this relationship in adult populations. Whether or not similar results would be observed in a pediatric population with T1D is unknown. **PURPOSE:** The purpose of this investigation was to test the relationship between glucose variability and intensity of PA and determine if duration of activity is predictive of changes in glucose variability in a sample of teenagers with T1D. **METHODS:** Data for this investigation were used from an ongoing study at a local pediatric Diabetes Center. Participants who wore a continuous glucose monitor (CGM) and Fitbit consecutively for a period of two weeks or more were included in the data analysis. Glucose variability was determined using 2-weeks of CGM data and PA intensity time was retrieved through Fitabase. Pearson's correlation and a simple linear regression were used for final analysis with a p-value of 0.05 to determine significance. **RESULTS:** Minutes of daily moderate intensity activity had a significant inverse relationship ($r = -0.59$; $p = 0.04$) with glucose variability, whereas moderate and vigorous PA (MVPA) combined showed a stronger inverse relationship ($r = -0.86$; $p = 0.03$). When placed in a simple linear regression only MVPA significantly predicted changes in glucose variability ($\beta = -0.12$, $p = 0.03$). **CONCLUSION:** These data show that not only is duration of PA an important factor when it comes to managing diabetes, but that more attention should be paid to the time spent at various intensity levels. Even though more research still needs to be completed in this area it would be of great benefit for children with T1D to incorporate an activity monitor into their daily routine to share with their diabetes care team and better understand how PA levels impact their blood glucose. Funded by Children's Hospital Foundation, Christensen Family, Norton Children's Hospital, and University of Louisville.

A-55 Exercise is Medicine®/Poster - EIM: HIIT, Exercise with the Elderly and Parkinson's Disease

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

513 Board #329 May 27 9:30 AM - 11:00 AM
Influence Of High-intensity Interval Training On Fatigue, Depression And Anxiety In People With Multiple Sclerosis

Marit Lea Schlagheck¹, Niklas Joisten¹, Annette Rademacher¹, Sebastian Proschinger¹, Max Oberste¹, Alexander Schenk¹, Jan Kool², Wilhelm Bloch¹, Jens Bans², Philipp Zimmer¹. ¹German Sport University Cologne, Cologne, Germany. ²Kliniken- Valens, Valens, Switzerland.
 (No relevant relationships reported)

Sport and Exercise have been described to promote positive effects on psychosocial symptoms of multiple sclerosis (MS) such as fatigue, depression and anxiety. However, detailed recommendations for intervention programs in the rehabilitation of MS have not been proposed yet.

PURPOSE: The present study aims to compare the influence of high intensity interval (HIIT) on fatigue, depression and anxiety in people with relapsing remitting and secondary progressive MS.

METHODS: Within the framework of a single- blinded randomized controlled trial, 73 patients with MS conducted 3x/week for three weeks either HIIT (5x1.5 minutes at 95-100% of participants' maximal heart rate (HR_{max})) or moderate continuous aerobic exercise (MC) (24 minutes continuous cycling at 65% of HR_{max}) on a bicycle ergometer. Before (t0) and after (t1) the training period, fatigue, depression and anxiety were assessed using the multidimensional fatigue scale for motor and cognitive functions (FSMC) and the Hospital and anxiety scale (HADS). Effects of within (t0 vs. t1) - and between (HIIT vs. MC, relapsing remitting type vs. secondary progressive type) - subjects have been analyzed by baseline- adjusted analysis of variance (ANCOVA).

RESULTS: At the time of allocation, 68 patients were identified to have mild fatigue (sum score ≥ 43) and were included in the analysis of FSMC. ANCOVA revealed significant time effects for the FSMC sum score ($F(1) = 7.188$, $p = .009$). While people with relapsing remitting type of MS improved in both HIIT ($p \leq 0.001$) and MC ($p = .012$), no alterations were observed for people with secondary progressive type of MS. However, neither significant group nor interaction effects were revealed for all FSMC outcomes. Regarding HADS, 38 patients with mild depression or anxiety (HADS-TS ≥ 8) at the time of allocation were analyzed. No significant time, group and interaction effect for any outcome was observed.

CONCLUSION: There are no differences in the impact of HIIT vs. MC on fatigue, depression and anxiety in people with MS. However, people with relapsing remitting MS tend to react more sensible for positive effects of aerobic exercise in general regarding fatigue than people with secondary progressive MS. Nonetheless, results need to be taken with caution, since no main effect for group and MS type was detected.

514 Board #330 May 27 9:30 AM - 11:00 AM
High-intensity Interval Training In Inflammatory Rheumatic Disease Patients: Treatment By Man Or Machine?

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Reported Relationships: H. Haglo: Other (please describe); My employer (Myworkout AS) is the developer of the application used in this study.

High-intensity interval training (HIIT) is documented to counteract the reduced maximal oxygen uptake ($\text{VO}_{2\text{max}}$) and poor cardiovascular health associated with inflammatory rheumatic disease (IRS). However, supervised HIIT is resource demanding.

PURPOSE: This study sought to investigate if guidance by a smartphone application (APP: Myworkout GO) could yield similar HIIT-induced effects as supervision by healthcare professionals. **METHODS:** Thirty-four adults (27 females, 50±11 yrs; 7 males, 52±10 yrs), diagnosed with rheumatoid arthritis, spondyloarthritis or systemic lupus erythematosus were randomized to a supervised group (SG) or an APP group (AG). Both groups performed 4x4 minute intervals with an intensity corresponding to 85-95% of HR_{max} twice a week for 10 weeks. Treadmill $\text{VO}_{2\text{max}}$ and health-related quality-of-life (HRQoL), measured using SF-36, was assessed before and after the exercise period. **RESULTS:** $\dot{\text{V}}\text{O}_{2\text{max}}$ increased ($p < 0.001$) in both groups, revealing

3.6±1.4 (SG) and 3.7±1.5 mL·kg⁻¹·min⁻¹ (AG) improvements, with no between-group differences apparent. Improvements in the following HRQoL dimensions; bodily pain, vitality, social functioning and emotional wellbeing were observed for both groups (all p<0.001–0.05). Again, with no between-group differences detected. **CONCLUSION:** HIIT increased $\dot{V}O_{2max}$ and HRQoL, contributing to the patients' reduced cardiovascular disease risk, improved health, performance, and enhanced quality of life. Similar improvements were observed if IRS patients were guided by healthcare professionals or an APP, suggesting that utilization of the APP may be excellent in reducing the costs of HIIT as a treatment strategy in this patient population.

515 Board #331 May 27 9:30 AM - 11:00 AM
**High-intensity Interval Training Reduces Symptom-
 And Disability-associated Inflammation Marker In
 Persons With Multiple Sclerosis**

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The inflammation marker neutrophil/lymphocyte ratio (NLR) receives increased attention in various diseases and can be influenced by acute exercise. In persons with multiple sclerosis (PwMS), the NLR is elevated and associated with disability and symptom severity. High-intensity interval training (HIIT) may induce larger benefits in PwMS than moderate continuous training (MCT).

Purpose: To explore acute and chronic effects of HIIT vs. MCT on NLR and cardiorespiratory fitness (chronic only) in PwMS.

Methods: An interim analysis of a randomized controlled trial comparing 3-weeks of HIIT vs. MCT during inpatient rehabilitation was conducted. 60 PwMS (mean age 49.7 yrs, EDSS 3-6) with relapsing remitting (n=38) and secondary progressive (n=22) subtype were included. The HIIT group performed 5×1.5 min intervals at 95–100% of their maximum heart rate (HR_{max}) with active breaks for 2 min in between. The MCT group exercised 24 min continuously at 65% HR_{max}. Both groups exercised 3×/week. An incremental exercise test with spirometry was conducted before and after the intervention. To assess chronic effects on NLR, blood samples were collected before (T₀) the first exercise session and after the intervention period (T₁) during resting conditions. To assess acute effects on NLR, samples were also collected immediately (T₂) and 3 hours (h) (T₃) after the first exercise session. NLR was calculated from blood panels. Baseline-adjusted ANCOVAs with Bonferroni post-hoc test were performed.

Results: Relative $\dot{V}O_{2peak}$ increased in HIIT (mean difference (MD)=2.47 mL·kg⁻¹·min⁻¹, p<.001) and MCT (MD=1.5 mL·kg⁻¹·min⁻¹, p=.004), but no group differences were found. The increase in realtive peak power was larger in HIIT than in MCT (MD=.17 watts·kg⁻¹, p=.031). NLR decreased after the intervention period (T₁) within HIIT only (MD=-.27, p=.01). NLR was greater in HIIT 3 h after the first exercise session (T₃) compared to MCT (MD=1.6, p=.05).

Conclusion: Despite the short intervention period, cardiorespiratory fitness improved in both exercise modalities, whereas HIIT may induce greater enhancements. Only HIIT chronically reduced the NLR, thereby potentially contributing to symptom alleviation in PwMS. This chronic response might be due to repetitive inflammatory states after each HIIT session as reflected by the acute effects.

516 Board #332 May 27 9:30 AM - 11:00 AM
**High-intensity Interval Training In Older Adults: A
 Scoping Review**

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High-intensity interval training (HIT) is an increasingly popular form of aerobic exercise which includes bouts of high-intensity exercise interspersed with periods of rest. The health benefits and risks as well as the optimal design of HIT are still unclear. Further, most of the research on the effects and benefits of HIT has been done in young and middle-aged adults and as such, the tolerability and effects in senior populations is less well-known. **PURPOSE:** To characterize HIT research that has been done in older adults including protocols, feasibility and safety as well as to identify gaps in the current knowledge. **METHODS:** Five databases were searched with variations of the search terms, "high-intensity interval training, high-intensity exercise" and "elderly, older adults." These searches identified 3377 potential studies which were reviewed for inclusion. Studies were included if they were randomized controlled trials published

in English in or after 2009, if the mean age of a treatment group was 65 years or older, and if the exercise protocols being tested were exclusively high-intensity or high-intensity interval training. **RESULTS:** Of 3377 papers identified in the initial search, 86 met the inclusion criteria. The HIT protocols used varied widely and ranged from a single session of HIT to a year-long program. These studies included both healthy and clinical populations. The greatest number of studies examined HIT in healthy subjects, followed by subjects with cardiac or vascular disease (heart failure, coronary artery disease, hypertension), metabolic dysfunction (Type-2 Diabetes Mellitus, obesity), and chronic obstructive pulmonary disease. Sample sizes ranged from 5 to 618 with 90% of studies including less than 70 subjects. The most common primary outcomes identified in the studies included changes in cardiorespiratory fitness as well as feasibility and safety of the protocols in the target populations. **CONCLUSIONS:** With a few exceptions, most studies had small sample sizes and many included non-clinical populations. Larger studies are needed to further evaluate the clinical effects of HIT in older adults. Additionally, there is much variety in the modes of exercise as well as the HIT protocols being used. Despite this, HIT was generally reported to be well-tolerated and safe in older populations.

517 Board #333 May 27 9:30 AM - 11:00 AM
**Use It Or Lose It: What Happens To Bone When High-
 Intensity Exercise Ceases Or Continues?**

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Reported Relationships: **B.R. Beck:** Ownership/interest/stock; Owner & Director, The Bone Clinic, Australia.

The LIFTMOR trial was the first to show a high-intensity resistance and impact training program (HiRIT) was safe and efficacious for improving bone and physical function in postmenopausal women with low to very low bone mass. While results were promising, the long-term efficacy and safety of HiRIT outside an RCT setting was unknown. **PURPOSE:** The primary aim of the current study was to evaluate the effects of continuing or ceasing HiRIT on bone mineral density (BMD) and physical function of LIFTMOR trial participants. **METHODS:** We report a retrospective observational study of LIFTMOR trial participants. Three years after completion of the LIFTMOR trial, participants in the HiRIT arm of the trial underwent a single testing session. Participants were allocated to one of two groups according to either ongoing HiRIT participation (compliance >25%; HiRIT-HiRIT), or cessation of HiRIT (HiRIT-CON) after LIFTMOR. The LIFTMOR testing protocol was employed, including; BMD at the lumbar spine (LS) and femoral neck (FN), back extensor strength (BES), lower extremity strength (LES), functional reach test (FRT), timed up-and-go test (TUG), five times sit-to-stand (FTSTS) and maximal vertical jump (VJ). Data were analysed using repeated measures ANCOVA comparing final LIFTMOR outcomes to 3 year outcomes. **RESULTS:** Twenty-three women (HiRIT-HiRIT, n = 7; 64 ± 4 yr, 159.4 ± 6.5 cm, 67.0 ± 7.2 kg and HiRIT-CON, n = 16; 65 ± 4 yr, 161.8 ± 5.9 cm, 61.9 ± 9.5 kg) participated in follow-up testing 3.2 ± 0.6 yrs post-LIFTMOR. There were no characteristic differences between the follow up sample and the LIFTMOR sample at baseline. Significant ongoing gains in BMD were apparent in HiRIT-HiRIT compared with HiRIT-CON at the LS (8.63 ± 5.29% vs 2.18 ± 5.65%, p = 0.042) and FN (3.67 ± 4.45% vs 2.85 ± 5.79%, p = 0.014), while the HiRIT-CON group maintained BMD benefits from the LIFTMOR intervention. Between-group differences in functional outcomes favoured HiRIT-HiRIT but did not reach significance. No injuries were reported. **CONCLUSION:** Postmenopausal women with low bone mass continuing HiRIT over a 4 year period continued to improve bone mass, while those ceasing HiRIT maintained the gains achieved from 8 months of HiRIT 3 years previously. HiRIT exercise appears to be a highly effective therapy to reduce risk of osteoporotic fracture by improving bone mass.

518 Board #334 May 27 9:30 AM - 11:00 AM
**Effect Of Continuous Versus High-intensity Interval
 Training In The Management Of Adolescent Overweight**

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(No relevant relationships reported)

Physical activity (PA) is a widespread strategy for weight management. Yet, the majority of the adolescents with overweight present low levels of PA. PA type and structure may influence not only energy expenditure, but also PA adherence. **PURPOSE:** To analyze: a) the effectiveness of two distinct exercise protocols (continuous- CT versus high intensity interval training- HIIT) on BMI z-score (main outcome) and other anthropometric/clinical outcomes in adolescents with overweight; b) the participants' compliance with both exercise protocols. **METHODS:** Anthropometric and clinical data from 60 adolescents (Control, n=20; CT, n=21; HIIT, n=19) with overweight (BMI ≥ p85 - WHO reference) recruited for the non-

randomized controlled trial PAC-MAN (Clinicaltrials.gov/NCT02941770), were assessed at baseline and at 6 months. Participants in both exercise groups were invited to attend two exercise sessions/week (≈ 60 min/session) during six months on top of a set of appointments with a Pediatrician, Nutritionist and Exercise Physiologist. Control group participants had appointments only with a Pediatrician and Nutritionist. All groups attended three appointments (three months apart). Paired Sample *t*-tests were used to analyze outcomes variation within each group. ANOVA and Independent sample *t*-test were used to analyze differences between groups. **RESULTS:** HIIT was the only group showing a significant decrease in BMI z-score (-0.19 ± 0.23 , $p = .002$) and Waist/Height Ratio (WHtR) (-0.02 ± 0.03 , $p = .018$); and an increase in Fat-and-bone free-mass ($0.8 \pm 1.1\%$, $p = .041$) and $\dot{V}O_2$ max (148.2 ± 122.0 ml/min, $p = .001$) compared to baseline. Compared with Control and CT groups, HIIT group showed a higher decrease in BMI z-score ($d = 1.16$, $p = .004$; $d = 0.72$, $p = .029$) and WHtR ($d = 1.18$, $p = .013$; $d = 0.77$, $p = .019$); and a higher increase in $\dot{V}O_2$ max ($d = 1.47$, $p = .026$; $d = 1.07$, $p = .011$), MPA ($d = 2.10$, $p < .001$; $d = 0.66$, $p = .044$), MVPA ($d = 2.15$, $p < .001$; $d = 0.70$, $p = .031$). Time in MVPA during exercise sessions was also higher in the HIIT group compared to CT ($d = 1.46$, $p = .004$). Attendance of the exercise sessions was significantly higher among the HIIT participants (57.9 vs 38.1%). **CONCLUSION:** Compared to CT, HIIT showed to be associated with better health-related outcomes and higher compliance.

519 Board #335 May 27 9:30 AM - 11:00 AM
Influence Of High-intensity Training On Quality Of Life And Daily Activity Performance In Multiple Sclerosis

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Persons with multiple sclerosis (pwMS) report lower health-related quality of life (HRQoL) as compared to general and other chronic disease populations. High-intensity interval training (HIIT) has been shown to improve certain physical and cognitive measures more effectively than moderate training in pwMS. **PURPOSE:** To determine the influence of HIIT vs. moderate training over three weeks on HRQoL and motor/processing performance of activities of daily living (ADL) in pwMS with light-to-moderate disability status. **METHODS:** The intervention group (INT; $n = 36$) cycled at 95-100% of HR_{max} during 5 \times 1.5-min high-intensity intervals, whereas the control group (CON; $n = 36$) cycled for 24 minutes at 65% of HR_{max} . Performance of ADL was quantified by the Assessment of Motor and Processing Skills. Physical and mental HRQoL were assessed using the Patient-Reported Outcome Measurement Information System short form Global-10. Between-subject and within-subject effects (baseline vs. post intervention) were analyzed by ANCOVA (Bonferroni corrected). Baseline measures were used as covariates.

RESULTS: Results are presented as MEAN baseline \pm MEAN change at post. No significant group interaction for either outcome measure was observed. Physical HRQoL improved significantly in both groups (INT: 12.662 ± 1.256 [SE=.290], $p < .0001$; CON: 12.662 ± 0.773 [SE=.290], $p = .01$), whereas mental HRQoL only improved in CON (13.647 ± 1.247 [SE=.336], $p < .001$). Significant improvements in motor (INT: 1.437 ± 0.203 [SE=.075], $p = .009$; CON: $1.437 \pm .210$ [SE=.081], $p = .012$) and processing (INT: 1.111 ± 0.110 [SE=.053], $p = .042$; CON: 1.111 ± 0.145 [SE=.057], $p = .014$) performance of ADL have been observed in both groups.

CONCLUSIONS: Compared to moderate training, HIIT over three weeks does not show superior effects on HRQoL and ADL measures. However, both HIIT and moderate training seem to have profound clinical impact by improving overall HRQoL and performance of ADL in pwMS. Trial registration NCT03652519

520 Board #336 May 27 9:30 AM - 11:00 AM
High-intensity Interval Versus Moderate-intensity Continuous Heated Water-based Exercise On Cardiovascular Variables In Hypertensive Older Individuals

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PURPOSE: To evaluate acute hemodynamic and autonomic responses to high-intensity interval (HIIT) vs moderate-intensity continuous (MICE) exercise in heated water-based in older hypertensive individuals. **METHODS:** 15 sedentary older hypertensives were randomized in 2:2:1 to HIIT, MICE or without exercise (CON)

sessions. Systolic/diastolic blood pressure (SBP/DBP), pulse wave velocity (PWV), endothelial function (EF) and variability of heart rate (HRV) were assessed before (pre), immediately after (post) and 45 min after intervention (rec). HIIT was consisted of warm-up (4 min), 21 min of 1 min of high-intensity alternating with 2 min of walking at moderate-intensity. MICE was performed by 4 min warm-up followed by 26 min of walking at moderate-intensity. Sessions were controlled using Rating Perceived of Exertion Scale (RPE). Two-way ANOVA (repeated measures) was used to indicate interventions differences and Bonferroni post hoc was used to identify significant differences ($p < 0.05$). **RESULTS:** No significant differences were found for PWV and EF. HRV showed an increase in the μ_{HF} (high frequency band) when compared the moments PRE vs REC within CON group (PRE: 906 ± 132 ms vs REC: 942 ± 148 ms; $p = 0.007$). Moreover, even though POST-HIIT session we found a decrease of $HF_{a,HP}$ (PRE: 413 ± 874 ms² vs POST: 272 ± 716 ms²; $p < 0.001$), during REC only the HIIT group was able to increase the $HF_{a,HP}$ index (POST: 272 ± 716 ms² vs REC: 530 ± 1336 ms²; $p < 0.001$). The changes in $HF_{a,HP}$ during REC was followed by a decreased of LF_{HP} (low frequency band) index after HIIT (POST: 49 ± 24 n.u. vs REC: 33 ± 18 n.u.; $p = 0.013$). None difference was found in pre SBP/DBP ($p > 0.05$). Although in post moment SBP was different between CON (153 ± 4) vs MICE (141 ± 6 , $p < 0.02$) and CON vs HIIT (136 ± 5 , $p < 0.001$), with no difference in DBP. For REC, only CON (131 ± 3) vs HIIT (123 ± 4 , $p < 0.02$), with no difference in CON vs MICE and MICE vs HIIT ($p > 0.05$) were founded. Only HIIT modality was able to return the SBP values to the PRE (122 ± 4 in REC moment (123 ± 4 , $p < 0.66$), but increasing in POST (136 ± 5) moment comparing with PRE ($p < 0.01$) and REC ($p < 0.02$). For DBP, all intensities increase the values in POST ($p < 0.05$) and maintain greater in REC moment comparing with pre ($p < 0.05$). **CONCLUSION:** Water-based HIIT using RPE may be a time-efficient intervention in hypertension treatment of older individuals.

521 Board #337 May 27 9:30 AM - 11:00 AM
Effects Of High Intensity Resistance Training Protocols On Cardiovascular Parameters In Hypertensive Women

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Establishing an ideal resistance training (RT) protocol for hypertensive individuals has been a challenging task, given the many variables that should be considered in these protocols. In general, the protocols established for hypertensive individuals involve the use of lower loads and a higher number of repetitions. However, recent evidence has shown that this approach might generate negative effects on cardiovascular parameters, especially in the short term, which may indicate a potential risk to participants. In contrast, the use of higher loads but with a reduced number of repetitions does not seem to cause such overload to the cardiovascular system and have been shown to promote comparable gains in variables such as strength, body composition, balance and quality of life. **PURPOSE:** Analyze the effects of different resistance training protocols with lower and higher loads on cardiovascular parameters in hypertensive women. **METHODS:** A randomized crossover design clinical trial was conducted with 20 postmenopausal hypertensive women who underwent a control session and two RT protocols involving 6 and 15 repetition maximum (RM). The cardiovascular variables were collected pre, immediately post, 1 h post, and 24 h post each protocol. Repeated-measures ANOVA was used. **RESULTS:** The HR indices were higher in 15RM protocol immediately and 1 hour after the exercise (86.55 ± 12.81 ; 75.96 ± 11.51) when compared with control (67.14 ± 7.38 ; 66.01 ± 8.88) and 6RM (78.56 ± 9.73 ; 71.29 ± 9.40) sessions ($p < 0.05$). The rate-pressure product indices that represent the myocardial workload also were higher in 15RM protocol immediately (12089.59 ± 3022.77) and persisted in 1 hour after (9947.44 ± 2184.58) the exercise when compared with control (8830.83 ± 1394.09 ; 8800.71 ± 1498.79) and 6RM (11002.58 ± 1986.82 ; 9226.33 ± 1604.68) sessions ($p < 0.05$). **CONCLUSIONS:** Performing high intensity RT with lower loads and a higher number of repetitions seems to promote higher heart rate and rate-pressure product, which may be related to an increased cardiovascular stress. Although the 6RM protocol also raises these parameters immediately after, these changes were not evident within 1 hour and may serve as an indication that the use of high loads may be safe to the cardiovascular system in hypertensive individuals.

522 Board #338 May 27 9:30 AM - 11:00 AM

Resistance Training And High-intensity Interval Training Improve Cardiometabolic Health In Older Adults: A Meta-analysis

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PURPOSE: Older adults have an increased risk of developing cardiometabolic disease including cardiovascular disease and type 2 diabetes. Progressive resistance training (PRT) and high-intensity interval training (HIIT) individually improve cardiometabolic health (CMH) in older adults. However, whether a combination of the two prescriptions provides greater benefit is yet to be explored. We conducted a systematic review and meta-analysis of controlled trials investigating the effect of PRT, HIIT and combination PRT+HIIT (COMB) on CMH in older adults with moderate cardiometabolic risk. **METHODS:** Nine databases were searched from inception until September 2019. We included studies comparing PRT, HIIT or COMB vs usual care that reported ≥ 2 modifiable CMH risk factors. Standardized mean (SMD) and mean differences (MD) were calculated using a random-effects inverse variance model. Heterogeneity and risk of bias were assessed according to Cochrane guidelines. **RESULTS:** We analysed 451 participants from ten studies (7 PRT, n=149, 2 HIIT, n=25, 1 COMB, n=60), 40.6% male with a mean age of 67.7 \pm 1.8 years. Training ranged from 2-4 times per week for 22 \pm 16 weeks. Compared to usual care, exercise significantly improved body mass index (BMI) (MD -0.36 [-0.50, -0.22], $p \leq 0.0001$), body fat % (BF%) (SMD -0.60 [-1.13, -0.06], $p=0.03$), peak aerobic capacity (SMD 0.40 [0.13, 0.68], $p=0.004$), triglycerides (SMD -0.22 [-0.45, 0.00] $p=0.05$) and fasting blood glucose (FBG) (SMD -0.30 [-0.54, -0.05], $p=0.02$). PRT alone significantly improved BMI (MD -0.37 [-0.53, -0.21], $p=0.00001$), BF% (SMD -0.91 [-1.70, -0.13], $p=0.02$) and lean body mass (SMD 0.96 [0.05, 1.87], $p=0.04$). COMB improved triglycerides (SMD -0.44 [-0.79, -0.08], $p=0.02$) and FBG (SMD -0.41 [-0.76, -0.05], $p=0.02$). **CONCLUSIONS:** Exercise improves CMH in older adults, with PRT interventions eliciting significant improvements in body composition. COMB exercise was the only modality to improve triglycerides and blood glucose. Further research is warranted on COMB, HIIT and PRT training, focusing on volume and intensity to investigate differences in effect. More thorough CMH outcome and exercise prescriptive element reporting is warranted in order to identify optimal exercise prescription for improving CMH in older adults.

523 Board #339 May 27 9:30 AM - 11:00 AM

Postmenopausal Women With Low Bone Mass Enjoy Bone-targeted, High-intensity Resistance Training: LIFTMOR Trial Observations

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PURPOSE: The LIFTMOR trial improved bone and function with high-intensity progressive resistance and impact training (HiRIT) in postmenopausal women with low to very low bone mass. While efficacious in a research setting, a comprehensive evaluation of participant perception of HiRIT was required to inform implementation in the 'real world'. Therefore, the aim of the current work was to examine physical activity enjoyment, quality of life (QOL), and participant perception of the HiRIT program undertaken in the LIFTMOR trial. **METHODS:** Postmenopausal women with low bone mass were randomized to either 8 months of 30-minute, twice-weekly supervised HiRIT (n=49) or unsupervised, low-intensity, home-based exercise (CON; n=52). At baseline and follow-up, all participants completed physical activity enjoyment (PACES-8) and QOL (WHOQOL-BREF) questionnaires (Kruskal-Wallis and Friedman's test). At follow-up, 17 HiRIT and 15 CON participants completed an exit survey relating to their experiences, scored using a 5-point Likert scale. Of those, 14 participants from the HiRIT program underwent semi-structured interviews to facilitate qualitative analysis (Leximancer v4.50) of their experiences undertaking the HiRIT program. **RESULTS:** Participants who undertook the HiRIT program reported improvements in PACES-8 (3.3 \pm 1.0 vs -1.6 \pm 0.9, $p < 0.001$), and on the exit survey, HiRIT were happier with their group allocation (4.8 \pm 0.6 vs 4.0 \pm 1.2, $p=0.03$), more enthusiastic about undertaking training sessions (4.4 \pm 0.5 vs 3.7 \pm 1.1, $p=0.03$) and more likely to participate in the LIFTMOR trial again given the chance (3.8 \pm 0.9 vs 2.9 \pm 1.3, $p=0.028$), than CON ($p < 0.05$). Qualitative analysis revealed current bone health status as the most common motivator for enrolling in the LIFTMOR trial, time was an important barrier to previous physical activity participation and supervised group exercise sessions were perceived as positive. All HiRIT participants would recommend the program to a friend. No differences in QOL were observed ($p > 0.05$). **CONCLUSIONS:** Supervised HiRIT was more enjoyable than a low-intensity home

exercise program. The combination of high acceptability and the osteogenic nature of the LIFTMOR program suggests supervised HiRIT is an effective and appealing therapy for postmenopausal women at risk of fracture.

524 Board #340 May 27 9:30 AM - 11:00 AM

Eccentric Training To Improve/maintain Motor And Speech Function For Persons With Parkinson's Disease

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PURPOSE: Parkinson's disease (PD) is a progressive motor disease that is typically characterized by gait, balance, and speech difficulties. This study evaluated the effectiveness of lower body eccentric training on adults with PD. It was hypothesized that completing a 24-session training protocol would maintain or improve balance, gait, and speech variables. **METHODS:** 6 male and 5 female PD volunteers (PDV) (61-78 yrs, \bar{x} = 70 yrs) completed the exercise program. All were clinically diagnosed with PD (.5 - 14 yrs since diagnosis, \bar{x} = 4 yrs) and able to walk/stand without assistance. The PDVs attended 24 biweekly training sessions, which consisted of three 45-second bouts of high-intensity lower body eccentric exercise with a 2-minute rest period between bouts. An exercise machine provided an eccentric quadriceps workout as PDVs stood with both feet on a solid platform that moved along an elliptical path. Pre- and post-exercise SWAY (30-second eyes-closed balance test) and SAW (self-paced 7-meter straight walk, turn around, and return) tasks were completed to record measures of balance and gait. Speech data were recorded at the beginning, in the middle, and at the end of the exercise program. **RESULTS:** SWAY test - Paired samples t-tests showed no significant pre/post (Session 1 to Session 24) differences for the total center of gravity path, coronal, or sagittal path length. SAW test - Paired samples t-tests showed significant pre/post (Session 1 to Session 24) improvement for Right leg cadence (RLC) ($p = .040$), Left leg cadence (LLC) ($p = 0.43$) and Right toe angle (RTA) ($p = .035$). No significant change was observed for Left toe-off angle, Right and Left leg double support time, or Right and Left leg elevation at midswing. Most PDVs produced similar respiratory, speech rate, intonation, and loudness values throughout the study, with a few producing slightly improved values. Sound production precision either remained unchanged or slightly deteriorated towards the end of the protocol. **CONCLUSIONS:** No balance or gait parameters evaluated over the duration of the study indicated a decrease in function in the 11 PDVs. RLC, LLC and RTA did show improvement. Most speech variables remained unchanged. Lower body eccentric training should be considered to maintain gait and balance functions for ambulatory adults with PD.

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Parkinson's Disease Treatments: Treating Symptoms Through Group Power Movements Or Passive Forced Cycling

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Introduction: Parkinson's Disease (PD) is a neurodegenerative disease that affects motor and non-motor function due to a loss of dopamine. There are exercise interventions that have been shown to improve PD symptoms, such as passive forced cycling and group fitness classes. Passive forced cycling is a useful, non-invasive treatment for PD, and has been shown to produce similar effects to common PD medications including improvement in motor function, gait, and quality of life. The Group Fitness-Only (GFO) class is based on large body movements in order to slow the progression of PD symptoms. The purpose of this study was to determine if Forced Cycling paired with a group fitness class or the group fitness class alone was better in the symptomatic treatment of PD. **Methods:** A total of ten participants diagnosed with stage two or three PD were recruited through a local support group and a medical facility. Each participant was randomly assigned to either GFO or group fitness class paired with Forced Cycling (PFC) exercise groups. Regardless of the group, the participants were asked to attend four 60-minute exercise sessions per week for four weeks. Pre and post data were collected using the MiniBESTest and PROMIS-29 survey. **Results:** The GFO group improved their Timed Up and Go test (Pretest: 6.51 \pm 0.80, Posttest: 5.87 \pm 1.03, $p = 0.041$). The time taken to perform the TUG also improved more for the GFO group when compared to the PFC group's posttest data (Pretest: 5.87 \pm 1.03, Posttest: 8.59 \pm 1.74, $p = 0.032$). Dynamic gait sub-score improved posttest in the PFC group compared to the GFO group (Pretest: 7.8 \pm 0.8, Posttest: 9.0 \pm 0.0, $p = 0.033$). Other variables showed improvement but were not statistically significant. **Conclusion:** This pilot study suggests that strength-based group fitness classes are a part of an effective intervention for managing PD symptoms and could

be a possible supplemental treatment option for these individuals. In this study, forced cycling showed improvements in managing symptoms of PD, however, only one variable was statistically significant. Future studies with longer interventions and larger sample sizes may yield more significant improvements than this study.

526 Board #342 May 27 9:30 AM - 11:00 AM
Group Exercise And Over-speed Cycling Effects On Mental Health In Parkinson's Disease.

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PURPOSE: Parkinson's Disease (PD) is a neurodegenerative disease that affects motor and non-motor function due to a loss of dopamine. Exercise has been shown to help physical and mental symptoms of PD. Over-speed cycling (OSC) involves cycling at a speed faster than the participant can actively produce. Group fitness classes (GF) for patients with Parkinson's Disease focus on dynamic movements to enhance activities of daily living. Both OSC and GF have been shown to improve PD symptoms, however, previous studies have not examined the effects of these modalities on mental health.

METHODS: Participants (n=8, mean age 73±3) diagnosed with level 2-3 PD were randomly assigned into two groups: 1) GF or 2) GF classes combined with OSC (GFC). GF was completed four times per week for one hour, for four weeks. In GFC, both the GF class and OSC was completed for one hour, two times per week for four weeks. The OSC protocol included a five minute-manual warm up each session, during the last 30 seconds participants cycled maximally. Speed of the cycle during forced exercise was determined by adding 10 RPM to the participant's maximal manual speed. After the speed was determined, participants performed the forced cycling for 55 minutes, and completed the session with a five-minute cool down. A previously validated survey was administered pre and post exercise intervention to determine scores for physical function, mental health, fatigue, sleep, ability to participate in social roles and activities, and pain.

RESULTS: All variables of the survey were recorded observing only one statistically significant change within physical function. There was a significant difference between GF and GFC when participants were asked, after the 4-week protocol, about their ability to go up and down stairs at a normal pace (5.0±0.0 vs. 4.2±0.5, p=0.024). All other variables included in the survey did not yield any significant changes during the 4-week exercise protocol.

CONCLUSIONS: The results of this pilot study suggest that mental health measures show no significant improvements or decrements in group, and between groups, following the completion of the four-week exercise programming. A larger sample size may assist in determining the impact of group fitness and forced cycling on aspects of mental health associated with PD.

527 Board #343 May 27 9:30 AM - 11:00 AM
Associations Between Physical Function Variables For People With Parkinson'S Disease In An Exercise Program

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Parkinson's disease (PD) is the second-most common neurodegenerative disorder in the United States. Physical activity has been shown to improve physical function in people with PD, however the correlation between many common measures of physical function is still unclear.

PURPOSE: To evaluate the correlation between various measures of physical function among people with PD who exercised regularly.

METHODS: Eighty-three individuals with PD (67 ± 6 years old; 8 ± 6 years since diagnosis; 54% women) were tested at baseline, and every 3 months to 1 year thereafter while participating in a twice-weekly group exercise program. Participants continued in the program for up to 10 years and completed a total of 605 examinations (range: 1-29/participant) during which they were assessed for gait velocity, six-minute walk test, timed up-and-go, single leg balance, Berg Balance Scale, grip strength, 30-second chair stand, and the Motor section of the Unified Parkinson's Disease Rating Scale (UPDRS). A correlation matrix across all 8 variables was calculated using Pearson correlation coefficients with a Bonferroni-adjusted alpha level of 0.002. Correlation strength was defined as strong (abs r > 0.7), moderate (0.7 ≥ abs r > 0.5), and weak (abs r ≤ 0.5).

RESULTS: Mean (± SD) six-minute walk test was 340 ± 188 meters, timed up-and-go was 11.0 ± 4.4 seconds, and gait velocity was 115 ± 24 cm·sec⁻¹. All correlations were significant (p < 0.002). Gait velocity had a strong correlation with the timed up-and-go (r = -0.72), as well as moderate correlations with the six-minute walk test (r = 0.52), Berg Balance Scale (r = 0.52), and 30-second chair stand (r = 0.55). The timed up-and-

go had moderate correlations with 30-second chair stand (r = -0.61), and Berg Balance Scale (r = -0.61). The Berg Balance Scale also had a moderate correlation with the single leg balance test (r = 0.54) and UPDRS (r = -0.60).

CONCLUSION: Gait velocity, timed up-and-go, and the Berg Balance Scale were all correlated with at least three other variables, indicating the greatest breadth of association. Grip strength was the only variable with no moderate or strong correlations. Further research should be conducted to determine whether these correlations change for people with Parkinson's disease following exercise training.

528 Board #344 May 27 9:30 AM - 11:00 AM
Effects Of 24-week Wuqinxi Intervention On Posture Control Ability Of Patients With Parkinson'S Disease

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PURPOSE: This study was to determine the effects of 24-week's Wuqinxi routine on posture control ability in patients with Parkinson's disease (PD). **METHODS:** A randomized, controlled trial design was used in this study. Forty-six patients (23 women) with stage 1 through 3 Parkinson's on the Hoehn and Yahr staging scale were randomly assigned into a Wuqinxi training group or a stretching group. All participants practiced 60-minute exercise sessions twice weekly for 24 weeks. The NeuroCom Balance Manager System was used to assess Limit of Stability and Unilateral Stance. Limit of Stability (LOS) is a test that evaluates the movement of the center of gravity on a test platform to the farthest boundary that can be achieved. Limit Of Stability was performed to assess posture control ability, along with the standing time of Unilateral Stance and the Unified Parkinson's Disease Rating Scale(UPDRS)III scores before and after the 24-week exercise interventions. Mixed-model (group by time) Repeated measures ANOVAs using SPSS 24.0 were conducted to determine the differences in balance ability between the Qigong and Wuqinxi groups before and after the intervention. Statistical significance was set at p<0.05. **RESULTS:** After 24 weeks of exercise intervention, PD patients in the Wuqinxi group showed a significant increase in forward maximum excursion and endpoint excursion.(Table 1) **CONCLUSIONS:** After 24 weeks of exercise intervention, the posture control ability of patients with Parkinson's disease in the Wuqinxi group was significantly improved and it has already been appeared after the 12th week.

posture control range changes before and after 24-week intervention					
				Forward	
			MXE	EDE	DCL
Time factor	Wuqinxi(N=23)	Baseline	71.08±19.91	53.21±19.36	80.21±14.21
		12 weeks	71.08±19.91	62.83±18.97	84.46±9.06
		24 weeks	79.66±18.17	60.08±20.27	82.96±8.71
		F	8.254	5.985	2.315
	p	0.001**	0.005**	0.110	
Stretch group		Baseline	75.00±17.72	60.38±17.54	83.88±8.44
		12 weeks	80.00±11.92	65.33±15.08	86.00±7.50
		24 weeks	79.63±17.50	62.17±19.08	85.33±6.68
		F	1.201	0.803	0.285
	p	0.310	0.446	0.754	
Group factor		F	1.346	1.360	2.749
		p	0.252	0.249	0.104

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EFFECTS OF A 12-WEEK WUQINXI INTERVENTION ON HAND FUNCTION OF PATIENTS WITH PARKINSON'S DISEASE

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PURPOSE: This study was to compare the effects of 12-week's Wuqinxi exercise versus stretching on hand function (including hand dexterity and hand-eye coordination) in patients with idiopathic Parkinson's disease (PD).

METHODS: This study used a randomized, controlled trial design, where 46 patients (23 women) with stage 1 through 3 Parkinson's on the Hoehn and Yahr staging scale were randomly and evenly assigned into a Wuqinxi exercise group or a stretching group. All participants practiced either 60-minute Wuqinxi or stretching exercise sessions twice a week for 12 weeks. The Purdue Pegboard test (PPT) and the Soda Pop test (SPT) were performed to assess hand dexterity (timed speed and flexibility), and hand-eye coordination, respectively, before and after the 12-week exercise intervention. Mixed-model (group by time) repeated measures ANOVAs using SPSS 24.0 were conducted to determine the differences in hand function between the Wuqinxi and stretching groups before and after the intervention. Statistical significance level was set at $p < 0.05$.

RESULTS: After the 12-week's exercise intervention, the post-intervention PPT score performed by both hands was greater ($P = 0.003$) in the Wuqinxi group than the stretching group; whereas the post-intervention SPT scores were significantly increased ($P < 0.01$) for both groups through the intervention, with no group difference being observed ($P = 0.734$). (Table 1)

CONCLUSIONS: The Wuqinxi exercise routine could improve hand dexterity following the 12-week's training in patients with mild-to-moderate PD.

Table 1. Scores of PPT and SPT before vs after 12-week intervention

Items	Wuqinxi (N = 23)			Stretching Group (N=23)			P values from ANOVAs		P value from the test for Δ difference
	Baseline	12-week	Δ (change)	Baseline	12-week	Δ (change)	Group factor	Time factor	
PPT-D	12.26 \pm 2.28	12.87 \pm 2.53	0.61 \pm 1.34*	12.22 \pm 3.72	11.83 \pm 3.74	-0.39 \pm 1.62	0.408	0.868	0.048
PPT-ND	10.74 \pm 2.09	11.52 \pm 2.25	0.78 \pm 1.86	11.74 \pm 3.12	11.83 \pm 2.75	0.87 \pm 1.20	0.229	0.421	0.387
PPT-B	17.22 \pm 3.85	19.04 \pm 4.22	1.83 \pm 3.13*	18.35 \pm 6.40	17.30 \pm 4.92	-1.04 \pm 3.86	0.769	0.705	0.003
PPT-A	20.74 \pm 6.57	22.78 \pm 7.20	2.04 \pm 3.44**	21.09 \pm 6.73	21.35 \pm 5.77	0.26 \pm 4.33	0.693	0.404	0.152
SPT	8.75 \pm 2.50	7.42 \pm 1.70	-1.32 \pm 0.38**	8.71 \pm 2.00	7.82 \pm 1.78	-0.89 \pm 0.16**	0.657	0.007	0.734

D: dominant hand; ND: non-dominant hand; B: both hands; A: Assemble task. Δ (change) = post-intervention - pre-intervention. * or ** denotes the change (Δ) with $P < 0.05$ or $P < 0.01$

530 Board #346 May 27 9:30 AM - 11:00 AM
Changes In Muscle Power After Usual Care Or Early Structured Exercise Intervention In Acutely Hospitalized Older Adults: A Secondary Analysis Of A Randomized Controlled Trial.

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(No relevant relationships reported)

PURPOSE: To assess the effects of a multicomponent exercise training intervention on dynamic and isometric maximal muscle strength of lower and upper extremities and muscle power output in acutely hospitalized older adults. **METHODS:** A secondary analysis of a single-blind randomized clinical trial in an acute care for elderly (ACE) unit in a tertiary public hospital in Navarre (Spain). 370 hospitalized patients (aged ≥ 75 years) were randomly allocated to an exercise intervention ($n = 185$) or a usual care ($n = 185$) group. The intervention consisted of a multicomponent exercise-training program performed during 5-7 consecutive days (2 sessions/day). The usual care group received habitual hospital care, which included physical rehabilitation when needed. The main endpoints were change in maximal dynamic strength (i.e., leg-press, chest-press, and knee extension exercises) and maximal isometric knee extensors and hip flexors strength from baseline to discharge. Changes in muscle power output at submaximal and maximal loads were also measured after the intervention period. **RESULTS:** The physical exercise program provided significant benefits over usual care. At discharge, the exercise group showed a mean increase of 19.6 kg (95% confidence interval [CI], 16.0, 23.2; $p < 0.001$) on the one-repetition maximum (1RM) in the leg-press exercise, 5.7 kg (95%CI, 4.7, 6.8; $p < 0.001$) on the 1RM in the chest-press exercise, and 9.4 kg (95%CI, 7.3, 11.5; $p < 0.001$) on the 1RM in the knee extension exercise over usual-care group. There were improvements in the intervention

group also in the isometric maximal knee extension strength (14.8 Newtons (N); 95%CI, 11.2, 18.5 vs. -7.8 N; 95%CI, -11.0, -3.5 in the control group; $p < 0.001$) and the hip flexion strength (13.6 N; 95%CI, 10.7, 16.5 vs. -7.2 N; 95%CI, -10.1, -4.3; $p < 0.001$). Significant benefits were also observed in the exercise group for the muscle power output at submaximal loads (i.e., 30%1RM, 45%1RM, 60%1RM, and 75%1RM; all $p < 0.001$) over usual care group.

CONCLUSIONS: An individualized, multicomponent exercise-training program, with special emphasis on muscle power training, proved to be an effective therapy for improving muscle power output of lower limbs at submaximal loads and maximal muscle strength in very old patients during acute hospitalization.

531 Board #347 May 27 9:30 AM - 11:00 AM
The Effects Of Power Training Frequency On Functional Performance In Healthy, Older, Untrained Women.

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Power training (PT) in older adults can improve muscle power and functional performance. The majority of studies have utilized higher intensities for training ($\geq 60\%$ of maximum strength) and have included combined results for older men and women. Less is known about the effects of low-intensity PT on muscle performance and function in older, healthy women. In addition, the dose-response of PT on power and function with 1, 2, or 3 days/week in older adults has not been determined.

PURPOSE: The purpose of this study was to investigate the impact of different weekly frequencies of low-intensity PT on muscle strength, power, and function in healthy, older, untrained women. **METHODS:** Older women ($n = 54$) were randomized to PT 1 ($n = 14$), 2 ($n = 17$), or 3 ($n = 17$) days/week or wait-control, C ($n = 15$). Participants undertook 12 weeks of PT using lower-body resistance training machines at an intensity of 40% of the 1-repetition maximum (1RM), and performed the concentric phase of the exercises 'as fast as possible'. The primary outcome was functional performance (Short Physical Performance Battery, stair climb, 30 second chair stands, and 400-meter walk) and secondary outcomes were strength (leg-press 1RM) and power (knee-extension power at 40% of maximal isometric strength). **RESULTS:** Within-group analyses (pre-post time points) indicated that strength improved in all PT groups ($p < 0.05$) with a 23.7%, 23.3%, 34.8%, and 9.8% increase from baseline for PT1, PT2, PT3 and C, respectively. Pre-post power improved significantly in PT2 and PT3 ($p < 0.05$) by 9.6% and 12.2%, respectively. For pre-post function, all PT groups improved in 3 of 4 functional tests ($p < 0.05$) with improvements ranging from 4.0 - 21.7% and with no differences observed between groups. Although the control group showed small but significant improvement in some aspects of function over the course of the study, effects sizes for all PT groups suggest small to large improvements above that observed in the controls. The large intra-individual variability in the data might have limited statistical power to detect differences between the groups. **CONCLUSIONS:** PT of 2 days/week or more is recommended for improving muscle power, however, 1 session weekly might be sufficient for improving functional performance.

532 Board #348 May 27 9:30 AM - 11:00 AM
Effectiveness Of Aquatic Exercise On Dynamic Balance In Older Adults: A Systematic Review And Meta-analysis

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Balance and mobility impairments are the leading causes of falls in older adults. Aquatic-based exercises have been broadly practiced as an alternative to land-based exercises due to several beneficial effects. However, there has been no systematic review with meta-analysis regarding the effects of aquatic exercises on dynamic balance in older adults.

PURPOSE: To compare the effectiveness of aquatic exercises (AE) to land exercises (LE) on dynamic balance in older adults. **METHODS:** Electronic databases (PubMed, MEDLINE, CINAHL, SPORTDiscus, psycINFO), from inception to March 2019, were searched. Studies met the following eligibility criteria: Randomized controlled trials, English language, older adults aged 65 years or older, a minimum of one AE group and one LE group, at least one assessment for dynamic balance. For the meta-analysis, the effect sizes of dynamic balance outcomes were calculated using a weighted mean difference (WMD) or a standardized mean difference (SMD) and a 95% confidence interval (CI). **RESULTS:** A total of 9 trials met the inclusion criteria, and 7 studies including 328 participants (age = 69.6 \pm 6.4yr) were eligible for the meta-analysis. Exercise intervention duration and frequency varied from 4 to 20 weeks, from 2 to 5 sessions per week, from 45 to 60 min per session. The tests most used in the studies were Berg Balance Scale (BBS), Tinetti scale, gait assessment, Functional Reach Test (FRT), Timed Up and Go test (TUG), and Five Times Sit-

to-Stand test (FTSTS). The meta-analysis showed that older adults in AE groups demonstrated comparably enhanced dynamic balance compared with those in LE groups (SMD = 0.38; 95% CI, 0.16-0.60). Subgroup analysis showed that there were no differences in BBS (WMD = 1.66; 95% CI, -0.27-3.59; $P = .09$), FRT (WMD = 2.40; 95% CI, -3.38-8.18; $P = .42$), TUG (WMD = 0.98; 95% CI, -0.08-2.04; $P = .07$), and FTSTS (WMD = 2.05; 95% CI, -0.59-4.70; $P = .13$) between AE and LE groups. **CONCLUSION:** AE may have comparable effects on dynamic balance abilities in older adults aged 65 years or older when compared to LE, which implies that AE may serve as a safe low-impact alternative to LE. Older adults may participate in various physical activities in the safer aquatic environment to improve dynamic balance and possibly reduce the risk of falls.

533 Board #349 May 27 9:30 AM - 11:00 AM
Weekly Sedentary And Standing Time As Predictors Of Body Composition In Older Adults

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Sedentary behavior is detrimental to body composition in older adults and a possible predictor for cardiometabolic disease. **PURPOSE:** To validate the correlation between levels of physical activity and body composition in older adults. **METHODS:** Activity levels from five days of accelerometer data of 315 subjects (mean age: 63.47 ± 5.90 years, mean BMI: 27.91 ± 4.54 kg·m⁻²; male: 155; female: 160) were retrieved from the Interactive Diet and Activity Tracking in AARP (iDATA) database from the National Cancer Institute. Subjects were also categorized into three body composition (BMI) subgroups: normal (<18.5-24.9 kg·m⁻²), overweight (25-29.9 kg·m⁻²) and obese (>30 kg·m⁻²). Average time spent (secs) in standing, sitting, lying and number of steps for each subject were measured. Descriptive statistics were performed for the entire sample and all three subcategories. Analysis of variance (ANOVA) between the three groups were performed for weekly steps and time spent standing, sitting, and lying down. An alpha level of .05 was considered statistically significant. A linear regression analysis was performed to explore the association between these variables and body composition for the entire sample. **RESULTS:** ANOVA analysis revealed statistically significant differences for time spent standing and sitting between the normal weight (standing: 26,941 ± 8,163 secs; sitting: 29,954 ± 9,197 secs) group and the overweight (standing: 22,840 ± 7,892 secs; sitting: 33,632 ± 10,630 secs) and obese (standing: 20,836 ± 7,318 secs; sitting: 34,467 ± 10,335 secs) groups. The regression analysis showed a statistically significant association ($r = .31$, $r^2 = .094$; $p < .001$) among steps, standing, sitting, and lying with the greatest contributors to the model being standing time ($p = .008$) and sitting (.042). The greater time standing indicated lower BMI, while greater time sitting contributed to greater BMI. **CONCLUSIONS:** In older adults, greater time spent standing and lower time spent sitting appears to be the greater contributors for desirable body composition. This population of adults should be encouraged to spend more time in standing activities to enhance their health and wellness for a more desired cardiometabolic profile.

534 Board #350 May 27 9:30 AM - 11:00 AM
The Effect Of Five-years Of Exercise On High-density Lipoprotein Cholesterol In Older Adults

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(No relevant relationships reported)

Purpose. Dyslipidemia, is one of the major risk factors for cardiovascular disease (CVD), the leading cause of death in older adults. Aging is associated with an unfavorable change in the lipid-profile. High levels of LDL can be reduced by cholesterol lowering medications, while pharmacological treatment have not proven to be as efficient in increasing HDL as they are at decreasing LDL. Exercise is associated with lower risk of CVD and exercise is a potential approach for obtaining and/or maintaining an optimal lipid profile. However, the effects of exercise on HDL cholesterol in older adults are unclear. It has been suggested that the time-frame needed to achieve a change in lipid-metabolism is longer in older compare to younger adults. The aim of this study was to examine the effect of five-year of exercise on HDL in older adults. **Methods.** A total of 1567 individuals (790 women) were included and randomized to either 5 years of two weekly sessions of high-intensity (HIIT) (10 min warm-up followed by 4x4 min intervals at ~90% of peak heart rate) or

moderate-intensity training (MICT) (50 min of continuous work at ~70% of peak heart rate) or, to a control group (CON) that followed the national recommendations for physical activity. Serum HDL cholesterol was measured immediately using standard procedures at St.Olavs Hospital, Norway. Linear mixed models were used to determine within- and between-group differences over time. **Results.** All groups had a significant reduction in HDL after 5 years, with no between group differences. In the per protocol analysis the reduction was less in HIIT, and significantly higher than CON and MICT (mean difference of 0.05 mmol/L, $p = 0.03$ in both). **Conclusion.** Supervised exercise twice a week was not enough to hinder an unfavorable decline in HDL. However, HIIT resulted in a smaller reduction in HDL in older adults.

535 Board #351 May 27 9:30 AM - 11:00 AM
Is The Physical Activity Vital Sign Associated With Fall Risk In Older Adults?

Colleen Griffin Hergott, Nathan Massey, Debra A. Beazley, Lori A. Bolgla. Augusta University, Augusta, GA.

(No relevant relationships reported)

PURPOSE: ACSM Exercise Is Medicine (EIM) initiative recommends the use of Physical Activity Vital Signs (PAVS) as an objective measure to assess compliance with the Physical Activity Guidelines for Americans. While physical activity is important for overall health, it may not necessarily improve balance and reduce risk of falls. The purpose of this study is to determine the associations between PAVS and measures of fall risk.

METHODS: 65 seniors (age=81.2±8.0) participated. The PAVS was calculated in accordance with ACSM Exercise Is Medicine. Fall risk was assessed using the Activities-Specific Balance Confidence Scale (ABC), Timed-Up-and-Go (TUG), and BTrackS™ Balance Plate. A less than 68-point ABC score suggested less balance confidence and a fall risk. A greater than 12-second TUG time and greater postural sway on the balance plate (based on BTrackS normative data) suggested a fall risk. Dependent measures were dichotomized as fall risk or no fall risk. Separate point biserial correlations were conducted to determine associations between the PAVS and fall risk category for the ABC, TUG, and postural sway.

RESULTS: No significant associations existed between PAVS and ABC ($r = .23$; $p = .06$), TUG ($r = .20$; $p = .12$), or postural sway ($r = -.01$; $p = .94$).

CONCLUSIONS: Increasing physical activity levels based on the PAVS was not strongly associated with scores from commonly used fall risk assessments. This finding suggests that meeting physical activity guidelines alone may not be sufficient to reduce fall risk. While the PAVS can provide beneficial information regarding other health factors, clinicians should utilize established balance screening tools and incorporate balance exercises into physical activity prescription to reduce fall risk in older adults.

A-56 Free Communication/Poster - Strength and Muscle Research in Exercise Oncology

Wednesday, May 27, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

536 Board #352 May 27 10:30 AM - 12:00 PM
Correlation Between Age, Sarcopenia, And Length Of Stay In Preoperative Cancer Patients

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(No relevant relationships reported)

PURPOSE: Data from the National Cancer Institute indicate that in Brazil (2018-2019) there should be 1.2 million new cases of cancer, and by 2025 the estimate is a 50% increase in its incidence. In this sense, researches indicate that cancer is associated with metabolic alterations, causing significant changes in body composition, which may promote muscle mass loss and, consequently, sarcopenia. The present study aimed to evaluate the correlation between age, sarcopenia, and length of stay (LS) in preoperative cancer patients (CP).

METHODS: Ninety-six CP of both sexes (53.1 ± 14.1 years old), admitted to the Mato Grosso Cancer Hospital (HCan-MT), Cuiabá, Mato Grosso, Brazil, were enrolled and performed the following evaluations: total body mass (TBM), height, BMI, and calf circumference (CC); answered a sarcopenia questionnaire (SARC-F); LS information was collected from the hospital database. The CP were divided into 2 groups according to the cutoff point of the CC measurement (indicative of sarcopenia;

men: <34 cm; women: <33 cm): non-sarcopenic (NS; 68 - 70.8%); probable sarcopenic (PS; 28 - 29.2%). Data are presented as mean \pm standard deviation and, for comparison between means, the Mann-Whitney test was applied. To verify the correlation between the variables, the Spearman correlation test was used. For all analyses, the p-value was set at 0.05. The analysis was performed using the IBM SPSS version 22.0 program (Ethics Committee Protocol Number: 87449918.5.0000.8124).

RESULTS: NS TBM (kg) (75.0 ± 16.7) was significantly higher ($p < 0.001$) if compared to PS (58.6 ± 9.1); The same occurred in relation to BMI (Kg. [m²]⁻¹) (NS: 28.3 ± 5.6 ; PS: 22.6 ± 2.8 ; $p < 0.001$). Regarding LS (days), there were no significant differences between groups (NS: 3.5 ± 3.5 ; PS: 5.2 ± 5.6 ; $p = 0.386$). There was a positive correlation ($p = 0.05$) (correlation coefficient: $p = 0.200$) between the LS and the score obtained in the SARC-F questionnaire. In addition, there was a significant positive correlation ($p < 0.001$) between the ranks of the LS and age (correlation coefficient: $p = 0.388$).

CONCLUSIONS: Take together, the results denote that sarcopenic CP, especially the elderly, presented a longer length of stay in the postoperative period.

537 Board #353 May 27 10:30 AM - 12:00 PM

Examination Of The Time Course Effect Of Creatine Supplementation On Acute Doxorubicin-induced Skeletal Muscle Dysfunction

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(No relevant relationships reported)

Chemotherapy drugs such as doxorubicin (Dox) may cause skeletal muscle dysfunction, and supplementing the diet with creatine (Cr) could counteract skeletal muscle dysfunction. Very little has been done, however, exploring the time course effects of Cr on Dox-induced skeletal muscle dysfunction. **PURPOSE:** To examine the effects of Cr on skeletal muscle function 1, 3, and 5 days following Dox treatment. **METHODS:** Male rats were randomly assigned to the control group (Con), the doxorubicin group (Dox), the standard Cr diet (2% Cr for 4 weeks) and doxorubicin group (Cr1+Dox), or the Cr loading diet (4% Cr for 1 week followed by 2% Cr 3 weeks) and doxorubicin group (Cr2+Dox). After 4 weeks of feeding, Dox groups received 15 mg/kg Dox and Con received saline. At 1, 3, and 5 days post-injection, grip force and extensor digitorum longus (EDL) forces during a 100 s *ex vivo* fatigue protocol were measured. **RESULTS:** No between group differences in grip force were observed 1 day post injection, but at 3 days, a between group difference in grip force was observed ($p=0.03$) with Dox and Cr1+Dox having lower grip forces than Con (-9.8% and -10.5%, respectively, $p < 0.05$), but this difference was not observed in Cr2+Dox. A between group difference in grip force was also observed at the 5 day time point ($p < 0.0001$) with Dox, Cr1+Dox, and Cr2+Dox having lower grip force than Con (-19.9%, -37.2%, and -19.5%, respectively, $p < 0.05$). With *ex vivo* EDL function, no between group differences were observed 1 day post injection, but at day 3, EDLs from Dox generated less force than Con at the 10 s through 40 s and the 70 s through 100 s time points ($p < 0.05$), but these differences were not observed in Cr1+Dox and Cr2+Dox. At day 5, Cr1+Dox EDLs generated significantly less force than Con at every time point during the 100 s fatigue protocol ($p < 0.05$), and Cr2+Dox EDLs generated significantly less force than Con at the 10 s through 40 s time points ($p < 0.05$). **CONCLUSIONS:** Cr supplementation provided protection against Dox-induced muscle dysfunction 3 days post injection, and this protection was more evident with the Cr loading diet (Cr2). This myoprotection, however, was not observed 5 days post Dox injection suggesting that Cr's benefit may be limited to protecting against the early phases of acute Dox myotoxicity.

538 Board #354 May 27 10:30 AM - 12:00 PM
Phase Angle Adaptation To Exercise Training In Cancer Patients Undergoing Treatment

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(No relevant relationships reported)

Phase angle is a measure of cellular resistance and reactivity to bioelectrical impedance analysis. This measurement is useful as a marker of cell membrane integrity and is used as a prognostic marker in several clinical populations. Cancer and its related treatments impact cell membrane integrity and lead to poor cell function. Exercise is shown to increase phase angle, which is associated with lowered risk of hospitalization and cardiovascular events. However, the effect of chronic exercise training on phase angle in the cancer population is unclear. **Purpose:** To assess the effect of chronic exercise on phase angle in cancer patients who are actively undergoing chemotherapy and/or radiation. **Methods:** A total of 56 cancer patients who were actively undergoing chemotherapy and/or radiotherapy were recruited to participate in a 12 week exercise-based rehabilitation program at the University of Northern Colorado Cancer Rehabilitation Institute (UNCCRI). Each participant underwent an initial assessment of physiological parameters, including body composition and phase angle analysis

via the InBody 770 (InBody USA, Cerritos, CA). Results of this assessment were used to develop an individualized exercise prescription. Each participant received prescribed, supervised, one-on-one training from a Clinical Cancer Exercise Specialist, three times per week for one hour each session. Each session of exercise consisted of 20 minutes of aerobic training, 30 minutes of balance and resistance training, and 10 minutes of flexibility training at a low to moderate intensity. After 12 weeks, each participant underwent a follow-up assessment of physiological parameters. **Results:** After 12 weeks of exercise training, significant increases in whole body (Initial: 4.55 ± 0.72 , Follow-up: 4.68 ± 0.68 ; $p = 0.02$), right arm (Initial: 4.45 ± 0.76 , Follow-up: 4.57 ± 0.72 ; $p = 0.03$), and left arm (Initial: 4.28 ± 0.79 , Follow-up: 4.39 ± 0.75 ; $p = 0.03$) phase angle was observed. **Conclusion:** This study demonstrates that prescribed exercise training can increase phase angle in cancer survivors even while undergoing chemotherapy and/or radiation treatments. These changes may provide insight into the protective and rehabilitative benefits (e.g., cellular health, membrane integrity, disease risk) that exercise may have in this population.

539 Board #355 May 27 10:30 AM - 12:00 PM

Muscle Cross-sectional Area Improves With Home-based Training During Metastatic Castration-resistant Prostate Cancer

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(Sponsor: Claudio Battaglini, FACSM)

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Reported Relationships: M.R. Harrison: Consulting Fee; Bayer, Janssen. Industry contracted research; Pfizer.

PURPOSE: Exercise training improves regional body composition in localized prostate cancer, but it is unknown if training has similar effects in advanced disease. Goals of this analysis were to determine changes in leg muscle cross-sectional area (CSA) and quality (MQ) values following home-based exercise training during metastatic castration-resistant prostate cancer (mCRPC) and to compare CSA values to healthy controls (CON).

METHODS: Sedentary mCRPC patients undergoing androgen deprivation therapy (ADT) including next generation androgen receptor signaling inhibitors ($n = 17$, age = 71 ± 8 , BMI = $32.0 \text{ kg/m}^2 \pm 6.5$) underwent CSA and MQ analyses using B-mode ultrasound for the vastus lateralis (VL) muscle before and after a 12-week home-based exercise protocol. Age- and BMI-matched CON ($n = 17$, age = 69 ± 2 , BMI = $32.8 \text{ kg/m}^2 \pm 6.5$) completed baseline scans only.

RESULTS: At baseline, VL CSA was lower in mCRPC ($9.12 \text{ cm}^2 \pm 3.15$) relative to CON ($36.55 \text{ cm}^2 \pm 7.04$, $p < 0.001$, $d = 4.95$). For mCRPC patients, the 12-week intervention did not change VL MQ, but increased CSA by 15.2% following the intervention (pre: $8.28 \text{ cm}^2 \pm 2.85$, post: 9.54 ± 3.56 , $p < 0.001$, $d = 0.39$) with no change in MQ.

CONCLUSIONS: Patients undergoing ADT for advanced prostate cancer exhibit lower muscle size compared to CON; however preliminary results suggest that home-based exercise training induces a moderate degree of regional muscle hypertrophy. The finding of regional hypertrophy is consistent with work conducted in patients with localized disease on ADT and may be an important outcome to monitor if increases in muscle CSA translate into improvements in physical function and quality of life. Supported by Physical Activity and Cancer Survivorship Pilot Funding.

540 Board #356 May 27 10:30 AM - 12:00 PM

Effect Of Exercise Training During Anthracycline Chemotherapy For Breast Cancer On Skeletal Muscle Composition, Strength And Physical Function.

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(No relevant relationships reported)

Adverse cardiovascular effects associated with anthracycline chemotherapy (AC) are well established, but the impact on skeletal muscle, and the ability of exercise to attenuate these effects has been poorly characterized. **PURPOSE:** To investigate the effects of structured exercise training during AC on skeletal muscle composition, strength and functional performance in women with early-stage breast cancer (BCa).

METHODS: This is a secondary and preliminary analysis of a 4-month, randomized controlled trial in which 53 women with early-stage BCa scheduled for AC (51 ± 8 years) were randomized to usual care lifestyle advice (UC, n=27) or structured, supervised exercise training (ET, n=26) consisting of moderate intensity aerobic and progressive resistance training (2/week), and high intensity interval training (1/week) during AC. Total body lean mass (LM) and fat mass (FM) (dual-energy x-ray absorptiometry), mid-thigh quadriceps muscle volume and fat-fraction (2-point DIXON MRI), muscle strength (grip strength, 1-repetition max leg press and seated row) and physical function (30 second sit to stand [30STS], 4-metre gait speed test) was assessed prior to commencing AC, and 4-weeks following the final cycle of AC (4-months). Data are presented as mean Δ or mean Δ (95% CI). **RESULTS:** Mean adherence to the exercise training was 78%. Following the intervention, ET resulted in a significant increase in mid-thigh quadriceps muscle volume [ET: +5.9%, (95% CI, 2.8, 9.0) vs UC: 0.9% (-2.2, 4.0), P=0.013] relative to UC, with no effect on fat fraction [ET: -7.9% (-22.2, 6.4) vs +1.4% (-11.9, 14.8), P=0.29]. There was no effect of ET on LM (P=0.77) or FM (P=0.28), however there was a main effect for time, with pooled results for ET and UC showing a significant increase in FM [+4.6% (0.8, 7.5), P=0.032]. Relative to UC, exercise also improved usual and fast gait speed (ET: +9.3% vs UC: -1.8%, P=0.034; ET: +9.8% vs UC: +0.6%, P=0.018 respectively), 30STS (ET: +19.4% vs UC: -0.6%, P<0.001) and upper (ET: +11.7% vs UC: -4.6%) and lower-body (ET: +14.7% vs UC: -5.2%) dynamic muscle strength (P=0.002 for both). **CONCLUSIONS:** Completing structured, multi-modal exercise training is an effective therapy for improving muscle strength, physical function and thigh muscle volume among breast cancer patients undergoing AC.

541 Board #357 May 27 10:30 AM - 12:00 PM
Antioxidant Supplementation Improves Neuromuscular Adaptations Induced By Strength Training In Breast Cancer Survivors

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 (No relevant relationships reported)

Strength training (ST) and antioxidant supplementation have been used to reverse oxidative stress and muscle loss. However, in healthy subjects, the combination of ST and antioxidant supplementations hamper neuromuscular adaptations. Studies investigating the use of dietary supplementation aimed to improve adaptations to exercise training in cancer survivors are scarce. Thus, there is a need to investigate the chronic effects of ST combined with antioxidant vitamins in breast cancer survivors. **PURPOSE:** To assess the effect of antioxidant supplementation on neuromuscular adaptations induced by ST in breast cancer survivors.

METHODS: Twenty-five breast cancer survivors were enrolled in this double-blinded placebo-controlled study. Survivors were randomly assigned to one of two groups: Antioxidant (AG; n = 12; 51 ± 9.03 years; 68.08 ± 10.57kg; 1.61 ± 0.07m) or Placebo (PG; n = 13; 48.23 ± 8.34 years; 70.45 ± 9.92kg; 1.58 ± 0.05m). Both groups participated in a 10-week ST protocol with six different exercises, twice a week. AG supplemented vitamins C (500mg/day) and E (400IU/day), and PG with polydextrose (1g/day). At the beginning and at the end of training period, muscle thickness of knee extensors (MT) was measured using B-mode ultrasound. Knee extension isokinetic peak torque (PT) was measured by two sets of four maximal isokinetic knee extension at 60°/s¹. Work capacity (WC) was measured by the amount of work performed in one set of 30 maximal isokinetic knee extensions at 120°/s¹. A two-way mixed model ANOVA was used to analyze data.

RESULTS: PT increased similarly in both AG (120.54 ± 17.85 to 133.53 ± 18.91 N.m; p < 0.001) and PG (120.56 ± 23.41 to 131.95 ± 26.57 N.m; p < 0.001). WC also increased in both AG (1805.25 ± 355.25 to 2210.34 ± 344.24 J; p < 0.001) and PG (1945.65 ± 294.87 to 2187.85 ± 396.90 J; p < 0.001). However, greater increase in WC was observed in AG than in PG (F = 5.030; p = 0.035; Δ = 22.44% vs. 12.45%). MT increased in AG (31.05 ± 6.05 to 35.86 ± 5.96mm; p < 0.001) but not in PG (31.83 ± 4.86 to 33.45 ± 6.04 mm; p = 0.105).

CONCLUSIONS: Antioxidant supplementation appears to affect strength gains induced by ST similarly between AG and PG groups. However, antioxidant supplementation appears to improve muscle work capacity and the promotion of muscle hypertrophy when compared to placebo in breast cancer survivors.

542 Board #358 May 27 10:30 AM - 12:00 PM
EXERCISE-RELATED SELF-MONITORING AND CHANGE IN MUSCULAR STRENGTH IN PROSTATE CANCER PATIENTS UNDERGOING ANDROGEN DEPRIVATION THERAPY

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Self-monitoring is associated with successful health behavior change and improvements in relevant fitness outcomes accompanying lifestyle interventions. Although exercise consistently results in meaningful improvements in muscular strength and physical function among prostate cancer patients (PCa) undergoing androgen deprivation therapy (ADT), the extent to which exercise-related self-monitoring is linked with improvements in clinically relevant outcomes among PCa patients remains unclear. **PURPOSE:** The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of a combined exercise and dietary (EX+D) intervention, implementing a group-mediated cognitive behavioral (GMCB) approach, relative to standard of care (SC) treatment among PCa patients undergoing ADT. In the current study, we conducted an exploratory analysis to evaluate the relationship between exercise-related self-monitoring in the EX+D intervention and change in muscular strength at 3-months post intervention. **METHODS:** A total of 32 PCa patients (M age = 65 years) on ADT were randomly assigned to the EX+D (n = 16) or SC (n = 16) interventions. Measures of 1RM chest and leg extension strength were obtained at baseline and 3-month follow-up assessments. **RESULTS:** Results from a linear regression analysis revealed that frequency of self-monitoring was not significantly associated with increased 1RM chest strength ($b = 0.52$; $SE_b = 0.551$; $r^2 = .083$; $p = 0.364$) or 1RM leg extension strength ($b = 0.234$; $SE_b = 0.716$; $r^2 = .083$; $p = 0.751$). **CONCLUSION:** Findings suggest that exercise-related self-monitoring was not significantly associated with change in upper or lower body muscular strength observed following the EX+D intervention in the IDEA-P trial. Given the importance of exercise and preservation of muscular strength for PCa patients undergoing ADT, exploring the role of exercise-related self-monitoring in future optimally-power lifestyle intervention trials is warranted.

543 Board #359 May 27 10:30 AM - 12:00 PM
Effect Of Different Rating Of Perceived Exertions On The Muscle Strength In Breast Cancer Survivors

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 (No relevant relationships reported)

PURPOSE: To evaluate the effect of resistance training (RT) with a higher rating of perceived exertion (RPE) and lower RPE on the muscle strength of upper limbs in breast cancer survivors (BCS).

METHODS: Twenty-six BCS women (age: 56.07 ± 6.94 years old; body mass: 68.32 ± 11.16 kg) undergoing hormonal therapy, performed eight weeks of RT once a week with high supervision ratio (one trainer per volunteer). RT protocol was three sets of 8 to 12 repetitions, with a 2-min rest interval between sets, until volitional muscle failure, on the bench press (BP). RPE scale (0-10) was assessed after each set. After eight weeks, the BCS were categorized into two groups using the average of RPE, lower than 7 (< 7) and higher than 7 (≥ 7). The muscle strength was assessed by the 10-repetitions maximum (10-RM) test on the BP, and then normalized by body mass (kg/BM). A repeated measurement ANOVA with the Bonferroni post hoc tests was used to examine differences between muscle strength changes.

RESULTS: After eight weeks of RT, 12 women reported RPE < 7 (6.12 ± 0.56) and 14 women reported RPE ≥ 7 (7.78 ± 0.49). There was no difference found at baseline (p = 0.23): 10-RM normalized was 0.27 ± 0.06 and 0.24 ± 0.05, for RPE < 7 and RPE ≥ 7, respectively. BCS who reported lower or higher RPE improved their 10-RM by Δ 19 ± 12 % and Δ 23% ± 14% (p < 0.0001), respectively, and no difference was found between groups (p = 0.30). **CONCLUSIONS:** The improvement in muscle strength of BCS seems is not related to higher or lower RPE, both levels of effort generated similar gains. Suggesting that RPE is not the main factor for improving muscle strength in this population. Further studies analyzing the differences between upper and lower RPE in upper muscle strength are needed.

544 Board #360 May 27 10:30 AM - 12:00 PM

Safe And Feasible Exercises For The Paravertebral Muscles In Cancer Patients With Unstable Spinal Metastases

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(No relevant relationships reported)

PURPOSE: Previous work showed that cancer patients with spinal metastases classified as stable (i.e. with low fracture risk) benefit from isometric exercises for the paravertebral muscles concomitant to palliative radiotherapy in terms of bone density and pain. In this exploratory randomized controlled trial we investigated whether paravertebral muscle training is safe and feasible also in patients with spinal metastases classified as unstable (i.e. with high fracture risk).

METHODS: Sixty cancer patients with unstable spinal metastases (Taneichi score $\geq D$) were randomized to an intervention group (INT, n=27 starters) or a control group (CON, n=29 starters). INT received 15 min of 1:1-supervised isometric exercises ("all fours", "plank", "swimmer", and a standing exercise with an elastic band) daily on 10 \pm 2 days of radiotherapy and continued home-based on 3 days/week for 3 months. CON received muscle relaxation. Adverse events and adherence (primary endpoints), strength, pain and quality of life (secondary endpoints) were assessed.

RESULTS: In 41% of patients, exercises were modified because of pain or immobility. There were no training-related adverse events. During radiotherapy, 67% of patients in INT and 55% of patients in CON attended $\geq 80\%$ of the planned training sessions. During home-based training, 64% of patients in INT performed $\geq 80\%$ of the planned training sessions. Plank position holding time (strength) increased by 24 \pm 28 s in INT and dropped by 2 \pm 34 s in CON by the end of radiotherapy (p=0.01). There were no differences between groups for pain or quality of life (p>0.05).

CONCLUSIONS: The described or individually modified isometric exercises for the paravertebral muscles are safe and in about 2/3 of cancer patients with unstable spinal metastases feasible when introduced 1:1 and continued home-based. To investigate potential benefits, larger studies powered for patient reported outcomes and clinical endpoints are needed.

B-09 Thematic Poster - Aging

Wednesday, May 27, 2020, 1:00 PM - 3:00 PM
 Room: CC-2007

586 **Chair:** Loretta DiPietro, FACSM. *The George Washington University School of Public Health and Health Services, Washington, DC.*

(No relevant relationships reported)

587 **Board #1** **May 27 1:00 PM - 3:00 PM**
Arterial Stiffness And Cardiorespiratory Fitness In Adults With And Without Down Syndrome: An Age-and Sex-matched Study

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(No relevant relationships reported)

INTRODUCTION: There are gaps in our knowledge about differences in arterial stiffness (AS) and cardiorespiratory fitness (CRF) in adults with and without Down syndrome (DS).

PURPOSE: To describe and compare AS and CRF in adults with DS versus adults without DS.

METHODS: Fourteen adults with DS (27±5 yrs) and 14 adults without DS (27±5 yrs) participated in this study. An informed consent and a health screening questionnaire was completed by each participant and/or legal guardian. After familiarization, participants rested lying for 5-10 minutes before the measurements were taken. Brachial and central systolic and diastolic blood pressure (BSP; BDP; CSP; CDP), central augmented pressure (AP), augmentation index (AIx), AIx normalized at 75 beats/min (AIx@75) and AS (carotid-femoral pulse wave velocity (cfPWV)) were measured by using the SphygmoCor Xcel device (SphygmoCor XCEL, AtCor Medical). To assess the CRF, all participants performed a maximal treadmill test. Respiratory gas-exchange was measured breath-by-breath with an automatic gas analysis system (Metasys TR-plus, Brainware SA, La Valette, France).

RESULTS: Non-DS participants were taller and had a lower BMI than the DS group (all $p < .05$). The CRF of the DS group was lower than the non-DS group (VO_2 peak = 29.4±6.3 vs. 51.5±11.3 ml/kg/min; $p < .001$). Non-significant differences were found for BSP/BDP (DS = 116.31 ± 10.9/68.4 ± 9.3 vs. Non-DS = 123.43 ± 8.8/71.6 ± 6.6 mmHg; all $p > .050$); CSP/CDP (DS = 103.6 ± 8.5/61.1 ± 9.3 vs. Non-DS = 107.0 ± 7.6/71.6 ± 6.6 mmHg; all $p > .050$) and cfPWV (DS = 5.5 ± .6 vs. Non-DS = 5.8 ± .7 m/sec; $p = .191$). The AP (DS = 6.4 ± 2.7 vs. Non-DS = 1.8 ± 3.2 mmHg; $p = .002$); AIx (DS = 18.1 ± 6.3 vs. Non-DS = 4.9 ± 10.3; $p = .001$) and the AIx@75 (DS = 12.3 ± 8.8 vs. Non-DS = -1.6 ± 11.7; $p = .002$) were significantly higher in the DS group.

CONCLUSIONS: Despite having lower CRF and higher BMI, adults with DS presented similar values of central and peripheral blood pressure than the Non-DS group. Nevertheless, the DS group showed higher AP, AIx and AIx@75 values, which may be due to a higher aortic wave reflection and arterial stiffness. **Partially supported by:** MINECO (DEP2017-86862-C2-1-R) & FPCEE Blanquerna (APR- FPCEE19/20).

588 **Board #2** **May 27 1:00 PM - 3:00 PM**
Evaluation Of 3D Body Imaging To Estimate Percentage Body Fat In Older Adults

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(No relevant relationships reported)

Aging is often associated with adverse changes in body composition that contribute to the development of age-related cardiometabolic and geriatric disorders. Although Dual Energy X-ray Absorptiometry (DXA) remains the gold-standard for assessing body composition, 3D body imaging is emerging as cost-effective, noninvasive, user-friendly alternative. However, the validity of 3D body imaging to assess percentage body fat in older adults is unknown.

PURPOSE: This study examined the association between percentage body fat estimated by 3D body imaging vs. DXA (criterion) in inactive older adults.

METHODS: The present analyses included data from 17 (12F, 5M and 13 White, 4 Black) older (X±SD; 71±4) adults that were participating in an ongoing exercise

intervention (REALPA). Participants completed a DXA using a Hologic Horizon A and 3D body imaging using a Fit3D to estimate whole-body percentage fat. Paired t-test were performed to assess mean differences between the two methodologies. Linear regression models were used to determine the association between the two methodologies. Finally, Bland-Altman plots were used to assess level of agreement between the two methodologies.

RESULTS: The mean percentage body fat measured by Fit3D was significantly lower than DXA (34±6% vs. 38±8%, $p < 0.01$). There was a strong positive correlation between the percentages body fat measured by the Fit3D and DXA methods ($r = 0.72$, $P = 0.001$). The mean difference (limits of agreement) between the Fit3D vs. DXA for percentage body fat was -3.8% (-14.5%, 6.7%). Finally, the Bland-Altman analysis revealed that the Fit3D over estimates percentage fat at lower percentages and under estimates percentage fat at high percentages.

CONCLUSION: Although the percentage body fat measured by the Fit3D was highly correlated with those measured by DXA (criterion), the Fit3D tended to produce lower percentage body fats than the DXA. The presence of measurement bias also suggests that the Fit3D measurements may not be interchangeable with those obtained from DXA in older adults. Future research is necessary to optimize the validity of the Fit3D to estimates of percentage body fat in older adults.

This study was supported by the NIH 5R21AG058181-02.

589 **Board #3** **May 27 1:00 PM - 3:00 PM**
Relative Intensity-associated Cadence (steps/min) Thresholds In 61-85 Year Olds, The Cadence-adults Study

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(No relevant relationships reported)

A cadence of 100 steps/min has been associated with absolutely-defined moderate intensity (3 metabolic equivalents [METs; where 1 MET = 3.5 mL O₂/kg]) in young and middle-aged adults. However, less is known about how cadence corresponds with relative intensity indicators, especially in older adults. **PURPOSE:** To investigate cadence thresholds associated with the lower thresholds of relatively-defined indicators of moderate intensity provided in the 2011 ACSM Position Stand (i.e., 40-59% of heart rate reserve [%HRR], 64-76% of maximum heart rate [%HRmax], and a Borg scale rating of perceived exertion [RPE] of 12-13) in healthy older adults. **METHODS:** Ninety-eight older adults (mean [SD]; age = 72.6 [7.0] years, BMI = 25.9 [3.5] kg/m²) completed a progressive treadmill walking protocol consisting of 5-minute bouts separated by 2-min rests increasing from 0.5 to 6.0 mph in 0.5 mph increments. The protocol concluded following the bout during which the participants naturally selected to jog or run, reached 75% age-predicted HRmax, or reported a Borg scale RPE >13. Cadence was calculated by dividing directly observed step counts by bout duration (5 min). Heart rate (HR) was measured using a chest-worn Polar HR monitor, and HR was averaged over the final 2-min of each bout. HRmax was estimated using the standard equation of 220 - age. Intensity indicators were analyzed using Receiver Operating Characteristic (ROC) curves and optimal cadence thresholds associated with moderate intensity were determined using Youden's Index. **RESULTS:** The cadence threshold associated with 40% HRR was 103 steps/min (sensitivity = 78%, specificity = 75%, area under the ROC curve [AUC] = 0.83), and that associated with 64% HRmax was 104 step/min (sensitivity = 66%, specificity = 75%, AUC = 0.77). Additionally, an RPE ≥12 was associated with a cadence threshold of 101 steps/min (sensitivity = 63%, specificity = 73%, AUC = 0.79). **CONCLUSION:** Cadence thresholds of 100 - 104 steps/min were associated with relative indicators of moderate intensity in ostensibly healthy older adults. These results are consistent with the commonly reported heuristic (i.e., practical, rounded, evidence-based) threshold of 100 steps/min associated with absolutely-defined moderate intensity walking in healthy adults.

Supported by NIH/NIA Grant 5R01AG049024

590 Board #4 May 27 1:00 PM - 3:00 PM
Abstract Withdrawn

591 Board #5 May 27 1:00 PM - 3:00 PM
Relationship Between Fitness Age And Face Age Amongst An Older Adult Population
 MaryBlake Williams. *University of North Carolina Wilmington, Wilmington, NC.* (Sponsor: Athanasios Jamurtas, FACSM)
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(No relevant relationships reported)

PURPOSE: To determine the relationship between Fitness Age and Face Age amongst a sample of older adults. **METHODS:** Sixty participants (38 females; 22 males; Age = 82.7 ± 5.7 yrs; Height = 163.3 ± 8.3 cm; Body Mass = 72.4 ± 15.0 kg; Body Fat = 34.2% ± 8.9%) participated in the five-part fitness assessment to obtain a Fitness Age (FITA). Face Age (FACEA) was derived from a single high-resolution digital photograph using a proprietary algorithm based on machine learning to derive a perceived age in years from the face. Pearson product-moment correlation coefficient was used to assess the relationships between FITA and FACEA. **RESULTS:** Data revealed no significant correlation between FITA and FACEA for males ($r = .418, p = .053$). There was a significant positive correlation between FITA and FACEA for females ($r = .531, p = .001$). **CONCLUSIONS:** There was no relationship between FITA and FACEA amongst the male participants. Female participants, however, who had poorer fitness levels (higher FITA) subsequently appeared facially older (higher FACEA) when compared to their chronological age. Despite these mixed findings, more research is deemed necessary in this nascent field of research.

592 Board #6 May 27 1:00 PM - 3:00 PM
Preliminary Investigations Into Muscle Recovery Following Exercise-induced Muscle Damage Between Younger And Older Males
 Yvoni Kyriakidou, Carly Wood, Isabella Cooper, Evangeline Tanner, Bradley Elliott. *University of Westminster, London, United Kingdom.*
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(No relevant relationships reported)

Unaccustomed resistance exercise is associated with reductions in muscle force output, avoidance of repeated loading, pain and an inflammatory response. Whilst well defined in the literature in healthy younger populations, research into older individuals is lacking. **PURPOSE:** Examine muscle function, recovery and inflammatory response following an unaccustomed exercise-induced muscle damage protocol (EIMD) in younger and older males. **METHODS:** Healthy younger ($n = 7, 27.3 \pm 3.5$ years) and older ($n = 5, 62.6 \pm 2.1$ years) males provided written informed consent, performed a unilateral eccentric exercise protocol (7 sets of 10 repetitions, leg press machine). Venous plasma was collected for creatine kinase (CK), tumour necrosis factor (TNF)- α and interleukin (IL)-6 prior to EIMD, immediately after EIMD, and at 1, 2, 24, 48, and 72 hours post-EIMD. Maximal voluntary isometric contraction (MVIC), peak power and perceived muscle soreness were assessed at all time points except 1 and 2 hours post-EIMD. **RESULTS:** Significant difference in CK was found between younger and older group at 72 hours post-EIMD ($p = 0.042$), with older showing a greater increase in CK (pre- vs 72h post-EIMD) compared to the younger group (165.7% vs 107.3%, respectively). Post EIMD, older group TNF- α concentrations were significantly increased relative to pre-EIMD in comparison to the younger group ($p = 0.042$). IL-6 did not differ between younger and older groups at any time point (each $p < 0.05$). A significant main effect for time was observed for MVIC ($p = 0.005$), with both groups showing a reduction in leg strength immediately post-EIMD. The main effect comparing the two groups MVIC was also significant ($p = 0.005$). The younger group had significantly higher power output than the older group ($p = 0.001$). No difference in perceived muscle soreness was observed at any time point. **CONCLUSIONS:** The older group had greater change in muscle damage and inflammatory response following EIMD, suggesting a blunted resolution relative to the younger group. As older individuals respond to EIMD in a different manner than younger people, prior research into recovery from EIMD in younger, primarily athletic populations, cannot be extrapolated into older populations.

593 Board #7 May 27 1:00 PM - 3:00 PM
Reference Standards For Cardiorespiratory Fitness In Overweight/obese Sedentary Adults 45-69 Years Of Age
 Megan A. Reaves, Kelsey N. Ball, Cris A. Slentz, Johanna L. Johnson, Leanna M. Ross, William E. Kraus, FACSM. *Duke Univ., Durham, NC.* (Sponsor: William E. Kraus, FACSM)
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(No relevant relationships reported)

Purpose In order to establish standards for cardiorespiratory fitness (CRF; peak $\dot{V}O_2$), peak heart rate (HR) and peak oxygen pulse (O_2 -pulse, a surrogate for stroke volume), we collated percentile data from maximal exercise testing from a sample of sedentary, overweight and obese adults in North Carolina. A second objective was to describe the relative role of declines in peak HR and peak O_2 -pulse in the overall decline in CRF that occurs from ages 45-69 years. **Methods** A total of 669 sedentary adults, ages 45-69, with BMI 25-35 kg/m² from the three STRRIDE clinical trial cohorts were included in the analysis. All three cohorts used the same graded maximal treadmill test. Peak $\dot{V}O_2$ was determined by the greatest two consecutive 15-sec collection periods. O_2 -pulse was calculated as: peak $\dot{V}O_2$ (mL/min) / peak HR (beats per min). Only subject's data with peak RER ≥ 1.00 were included in the registry. Sex-specific percentile data for each half-decade of age are shown in **Table 1** (only $\dot{V}O_2$ Peak data shown below) **Results** When assessing trends across the 25 year age range, we observed a 20.6%, 14.3% and 11.6% decrement in peak $\dot{V}O_2$ (mL/kg/min), peak HR and peak O_2 -pulse from the youngest to oldest women. In men, the magnitude of these trends across 25 years was slightly less, with 15.1%, 12.6% and 7.2% decrements in peak $\dot{V}O_2$ (mL/kg/min), peak HR and peak O_2 -pulse. In both women and men, the age-dependent decrements in peak HR were greater than the decrements in peak O_2 -pulse. The trend for decrement in the weight-independent absolute peak $\dot{V}O_2$ (L/min) was 24.1% in women and 19.7% in men across the 25-year period. **Conclusion** This CRF registry represents sedentary, overweight or obese adults in North Carolina. As a majority of Americans are sedentary and have an elevated BMI, these data are also likely representative of the U.S. population. Further, these data suggest that the age-dependent decrements in peak HR play a greater role than the loss of stroke volume in the decrease of CRF with age.

Table 1. STRRIDE Cardiorespiratory Fitness Data Registry by Percentiles of Peak $\dot{V}O_2$

Percentiles	10	25	50	75	90
Women Age 45 – 49.9 (N=58)	17.9	19.8	23.6	25.8	27.9
Women Age 50 – 54.9 (N=91)	18.9	20.9	22.5	25.4	27.1
Women Age 55 – 59.9 (N=84)	18.0	20.5	23.0	25.6	27.8
Women Age 60 – 64.9 (N=60)	15.8	18.1	21.0	22.7	24.4
Women Age 65 – 69.9 (N=40)	15.0	16.7	18.8	20.1	21.7
Men Age 45 – 49.9 (N=50)	22.9	27.6	31.0	33.3	37.1
Men Age 50 – 54.9 (N=67)	21.2	24.7	28.6	31.8	36.3
Men Age 55 – 59.9 (N=60)	20.7	24.0	27.3	30.6	33.5
Men Age 60 – 64.9 (N=68)	19.9	23.8	26.1	29.4	31.2
Men Age 65 – 69.9 (N=48)	19.6	22.9	26.2	29.4	30.5

594 Board #8 May 27 1:00 PM - 3:00 PM
Does Carbohydrate Mouth Rinsing Affect Six Minute Walk Test And Blood Glucose Responses In Older Adults?
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(No relevant relationships reported)

Carbohydrate mouth rinsing (MR) prior to exercise can improve performance in endurance and power activities in young physically active populations. Carbohydrate MR may also improve impulse and power during the sit-to-stand maneuver in healthy older adults; however, its effect on functional aerobic endurance and underlying physiological mechanisms are not well established. **PURPOSE:** To determine if carbohydrate MR affects six-minute walk test (6MWT) distance and blood glucose responses in healthy older adults. **METHODS:** 26 participants (12 males, 14 females) age ≥ 70 years completed the 6MWT during two testing sessions under two MR conditions: a 6.4% maltodextrin (MDX) condition and a placebo (PLAC) condition. Participants and researchers were blinded to MR contents, and MR administration was counter-balanced. Prior to testing, participants refrained from food and drink (except water) for 4 hours, as well as exercise, caffeine, and alcohol for 12 hours. Testing

sessions occurred at the same time of day, separated by at least 48 hours. Participants held the MR in their mouth for 20 seconds, returned it to a vial, and immediately completed the 6MWT. Total distance walked and rating of perceived exertion (RPE) during the 6MWT were compared between MR conditions using paired sample t-tests. Blood glucose and lactate levels were compared pre- and post-6MWT and between MR conditions using 2x2 repeated measures ANOVAs. **RESULTS:** Total distance walked and RPE were similar between MR conditions (481 ± 79 m vs. 485 ± 70 m, $p = 0.33$ and 11 ± 3 vs. 11 ± 3 , $p = 0.62$). Blood glucose did not significantly differ according to MR condition or time (100 ± 16 mg/dL and 102 ± 17 mg/dL for the MDX condition pre- and post-6MWT; 105 ± 26 mg/dL and 104 ± 26 mg/dL for the PLAC condition pre- and post-6MWT, $p = 0.16$ - 0.49). Blood lactate significantly increased pre- to post-6MWT, but did not significantly differ according to MR condition (1.4 ± 0.5 mmol/L and 2.7 ± 0.9 mmol/L for the MDX condition pre- and post-6MWT; 1.4 ± 0.4 mmol/L and 2.6 ± 1.1 mmol/L for the PLAC condition pre- and post-6MWT; $p < 0.01$ - $p = 0.99$). **CONCLUSION:** Carbohydrate MR may not significantly impact functional aerobic performance in older adults. Continued research into the clinical relevance of pre-exercise MR in older adults, including the use of other variations of gustatory stimuli, is warranted.

B-10 Thematic Poster - Cardiac

Wednesday, May 27, 2020, 1:00 PM - 3:00 PM
Room: CC-2000

595 **Chair:** Eric J. Stohr. *Cardiff Metropolitan University, Cardiff, United Kingdom.*

(No relevant relationships reported)

596 Board #1 May 27 1:00 PM - 3:00 PM

Differences In Left Ventricular Twist In Elite Short And Long Distance Swimmers

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(No relevant relationships reported)

Exercise-induced cardiac remodeling is influenced by sport-specific exercise characteristics, such as the isometric and isotonic components of the activity. Differences in cardiac dimensions and left ventricular (LV) systolic and diastolic function have been observed between short- (SS) and long-distance (LS) swimmers. Intensity and duration specific adaptations in LV mechanics may help to explain these differences in global function. **PURPOSE:** To examine whether there are event-specific differences in LV twisting mechanics between elite SS and LS athletes. **METHODS:** Data were collected during the 2019 FINA World Championships. SS were identified as competing in pool events ranging from 50-400m; LS were identified as open water swimmers competing in events 5-25 km. Fourteen SS (7 males; 23 ± 4 years; 100% identified as white) and 14 sex, age and ethnicity matched LS were selected for comparison. Echocardiography was performed in the left lateral decubitus position following 10 minutes of rest. Parasternal short axis images at the level of the mitral valve and apex were analyzed using speckle-tracking software and post-processed in custom software to normalize the temporal sequence of heart rate. **RESULTS:** Data are presented as mean \pm SD for LS vs. SS. Athletes had a similar body surface area (1.92 ± 0.15 vs. 1.94 ± 0.18 m², $P=0.76$), resting heart rate (52 ± 10 vs. 54 ± 8 bpm, $P=0.54$), years of event-specific training (11 ± 6 vs. 14 ± 5 years, $P=0.21$), and weekly training duration (25 ± 5 vs. 22 ± 5 hours/week, $P=0.15$). Peak LV twist (13.8 ± 3.5 vs. 12.7 ± 5.0 deg, $P=0.49$) and peak LV twist normalized to LV length (1.7 ± 0.5 vs. 1.6 ± 0.6 deg/cm, $P=0.67$) were similar between groups. Time to peak LV twist (94 ± 4 vs. 98 ± 4 % systole, $P=0.006$) and time to peak LV untwisting rate (9 ± 4 vs. 12 ± 3 % diastole, $P=0.03$), were faster in LS, while time to peak twisting rate was also trending to be faster in LS (56 ± 9 vs. 62 ± 10 % systole, $P=0.06$). **CONCLUSION:** In swimming, event distance appears to influence the temporal sequence of LV mechanics at rest with faster twisting and untwisting rates occurring in swimmers who train and compete in longer-distances. The relationship between these observations and global systolic and diastolic function warrants investigation.

597 Board #2 May 27 1:00 PM - 3:00 PM
Cardiac Remodeling Following High Intensity Exercise Training In A Preclinical HCM Mouse Model

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(No relevant relationships reported)

Participation in high intensity exercise for individuals with hypertrophic cardiomyopathy (HCM) remains controversial. Retrospective data has suggested that HCM patients who participate in lifetime vigorous exercise can have favorable cardiac remodeling that resembles that which occurs in healthy athletes. Cardiac hypertrophy is highly variable in HCM patients and may mask physiologic hypertrophy induced by exercise. **PURPOSE:** Evaluate the effects of high intensity interval training (HIIT) on cardiac hypertrophy in a preclinical transgenic cardiac troponin T delta160E (TG) HCM mouse model. **METHODS:** C57BL/6J non-transgenic (NTG) (n=6 F, n=5 M) and TG (n=4 F, n=8 M) mice (13-16mos) underwent a translationally parallel cardiac rehabilitation HIIT protocol. One treadmill training bout included 4-4 minute high intensity intervals (~80% preVO₂ max speed) interspersed by 5-3 minute recovery intervals (~50% preVO₂ max speed) for 31 total minutes. Exercise compliance was measured as percent of total training time completed. Bouts were repeated 3 times/wk for 10wks. Pre and post HIIT murine echocardiography (ECHO) was recorded and analyzed by a blinded technician. Unpaired and paired t-tests were used for data analysis. **RESULTS:** Training compliance between TG and NTG did not differ (921.90 min \pm 4.24 , 99.13% vs 928.95 min \pm 1.05 , 99.90% ; $p=0.14$). Pre and post HIIT left ventricular (LV) mass was significantly greater in both NTG (Mean difference & SEM: 23.04 mg, 6.23 ; $p=0.0042$) and TG (Mean difference & SEM: 17.56 mg, 6.31 ; $p=0.019$) mice. Body weights measured prior to pre and post HIIT ECHOs did not differ in NTG (Mean difference & SEM: 0.473 g, 0.8370 ; $p=0.585$) or TG (Mean difference & SEM: 1.354 g, 0.819 ; $p=0.129$) mice. **CONCLUSION:** In a preclinical HCM mouse model that doesn't demonstrate pathologic hypertrophy, HIIT training resulted in LV hypertrophy in both NTG and TG mice. Our data provides initial evidence that high intensity exercise training may result in physiologic hypertrophy. Biochemical analyses are underway to elucidate the underlying type of cardiac remodeling.

598 Board #3 May 27 1:00 PM - 3:00 PM
Abstract Withdrawn

599 Board #4 May 27 1:00 PM - 3:00 PM
Naltrexone, Opioid Antagonist, Decreases Left Ventricular Function At Rest And Following Acute Exercise In Mice.

Sophie B. Green¹, Candace Longoria², Sara C. Campbell, FACSM², John J. Guers¹. ¹Rider University, Lawrenceville, NJ. ²Rutgers University, New Brunswick, NJ.

(No relevant relationships reported)

Naltrexone (NTX) is an opioid receptor blocker which can be prescribed for weight loss. To augment the effects of NTX on weight reduction, exercise (EX) is recommended as an adjacent therapy. There is prior evidence that NTX may interfere with the psychological benefits of EX. Despite a working knowledge of how NTX influences the psychological dynamics of EX investigations into how opioid receptor blockade may alter left ventricular function (LVF) following EX is lacking. **PURPOSE:** To determine the effect of NTX on LVF following EX in a rodent model. **METHODS:** Male 8 wk C57-BL6 mice were divided into 4 groups: control (CON), exercise (EX), naltrexone (NTX), exercise with naltrexone (EX+NTX). Mice that underwent EX performed 50 mins of forced swimming following a week of familiarization. NTX or saline was given (i.p., 4 mg/kg), 15 min prior to EX or 65 min prior to echocardiography (ECHO). Mice were anesthetized using isoflurane (4-5% for induction; 0.5-2.0% for maintenance of anesthesia). Fur was removed from the anesthetized animal with nair and echo gel was applied. LVF was assessed by ECHO using a VisualSonics Vevo 2100 ultrasound. LV internal dimensions (LVID) were measured in systole and diastole using Vevo 2100 for calculations. LV systolic function was estimated from LV dimensions by the cubed method. Results were quantified using a one-way ANOVA with a Tukey Post-HOC. **RESULTS:** Heart rate was elevated ($p<0.05$) in the EX group when compared to CON (CON = 275 ± 12 vs. EX = 360 ± 30 bpm; $n=8-9$). This effect was abolished with the addition of NTX (EX vs. EX-NTX = 275 ± 36 BPM). Stroke volume (SV), was reduced in the NTX group compared to CON and EX ($p<0.05$), exercise mediated increase in SV was attenuated with pre-treatment of NTX (CON 128.8 ± 15.0 , EX 147.4 ± 7.5 , EX+NTX 14.3 ± 17.7 , NTX 76.9 ± 19.0 ml; $n=7-8$). Cardiac output was

reduced in NTX group when compared to EX and CON ($p < 0.05$), NTX+EX was also lower ($p < 0.05$) than the EX group (CON 35.4 ± 4.3 , EX 52.5 ± 2.5 , EX+NTX 29.4 ± 6.5 , NTX 19.2 ± 4.5 L/min; $n = 7-8$).

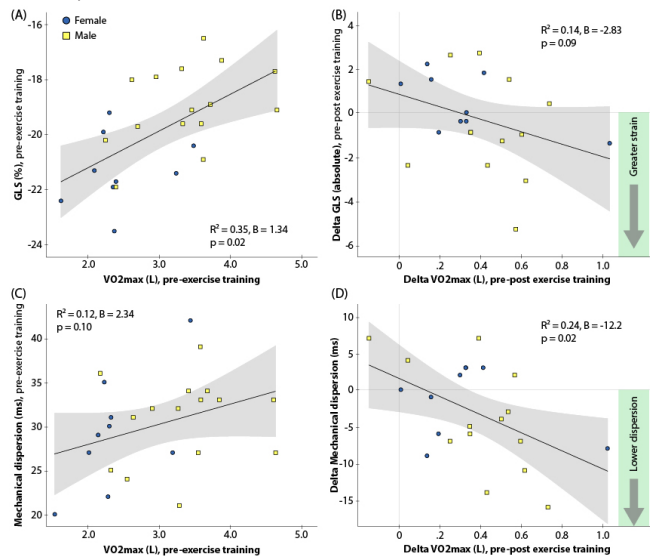
CONCLUSION: To our knowledge, this is the first study to examine the effects of NTX on LVF following acute exercise in a mouse model. These data suggest that NTX diminishes LVF following exercise. Being that exercise is a frontline therapy for weight loss the addition of NTX may alter LVF and ultimately negatively affect exercise recovery.

600 Board #5 May 27 1:00 PM - 3:00 PM

Effects Of Very Low Volume, High-intensity Interval Training On Left Ventricular Volume And Systolic Function

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(No relevant relationships reported)

PURPOSE: It is unknown whether exercise training of extremely low volume and high intensity is enough to elicit measurable changes in cardiac dimensions or function at rest. **METHODS:** Healthy, young subjects not performing regular training were recruited for six weeks of supervised exercise training, three times per week. Each of the 18 sessions consisted of three 30 seconds all-out sprints on a bicycle ergometer (breaking force 7.5% of the subject's body weight), separated by two minutes of low intensity cycling. A maximal cardiopulmonary exercise test (CPX) and an echocardiographic examination (echo) at rest were performed before and the week after the last session. Left ventricular (LV) and left atrial (LA) volumes were determined with 4-D echo. LV systolic function was measured as ejection fraction (LVEF), global systolic longitudinal strain (GLS, 2-D speckle tracking), and mechanical dispersion (MD, standard deviation of time to peak systolic strain in all 17 LV segments). **RESULTS:** Twenty eight subjects (27 ± 5 yrs, 16 male) performed all sessions and pre- and post echo. VO_{2max} , determined in 27 subjects, increased from 3.0 ± 0.8 L/min to 3.4 ± 0.8 L/min post-training (mean +14%, $p < 0.001$). LV end-diastolic volume and LV stroke volume were similar pre-/post training (112 ± 20 vs 115 ± 24 mL, $p = 0.29$; 65 ± 13 vs 66 ± 3 mL, $p = 0.64$), as was LA end-systolic volume (47 ± 9 vs 51 ± 15 mL, $p = 0.26$). LVEF and GLS were similar pre-/post training (58 ± 5 vs 58 ± 6 %, $p = 0.89$; -20 ± 2 vs -20 ± 2 %, $p = 0.60$) while MD decreased from 30 ± 6 to 27 ± 7 ms, $p = 0.042$. There was a significant association between the decrease in MD and increase in VO_{2max} as well as between baseline GLS and VO_{2max} (figure 1). **CONCLUSIONS:** Less than five minutes of high-intensity exercise training per week for six weeks increased VO_{2max} , but not LV or LA volume at rest. Interestingly, LV longitudinal shortening was more synchronous following training, proportional to the increase in VO_{2max} , which could indicate a more efficient LV contraction.



601 Board #6 May 27 1:00 PM - 3:00 PM

Time-frequency Analysis Of The Seismocardiogram

William J. Armstrong, Western Oregon University, Monmouth, OR.
(No relevant relationships reported)

PURPOSE: The present study compares the features of the seismocardiograph (SCG) resolved in the time-frequency domain to the features of a single-lead electrocardiogram (ECG). **METHOD:** SCG and ECG signals were obtained from the combined measurement of ECG, breathing and seismocardiogram (CEBS) database. Baseline signals (b001 to b020) were selected from the data base and trimmed to include a minimum of ~10 beats (range: 8-12 beats; 50,000 samples). The analyzed data included lead II ECG with a bandwidth between 0.05 Hz and 150 Hz and SCG acquired using a triaxial accelerometer with a bandwidth between 0.5 Hz and 100 Hz, sampled at 5000 Hz. Time values for the peak P- and T-waves and the Q, R, and S of the ECG were identified and recorded. The SCG was subjected to an adaptation of the von Tscharny intensity analysis for accelerometry ($r = 1.959$, $q = 1.45$, scale = 1.0), and total intensity (sum of the intensities over the set of $J = 11$ Cauchy wavelets for each sample in time) was calculated. The peaks (P1 & P2) and valleys (V1 & V2) of the total intensity for each cardiac cycle (10 per sample) were determined and compared to the ECG. Correlation coefficients were determined and P1-P1 and R-R intervals were compared using a paired t-test in R. Statistical significance was set at an alpha-level of 0.05. **RESULTS:** Correlations were consistently strong among the variables (range: 0.971 to 0.999). There were no significant differences between the rate intervals for P1-P1 and R-R ($p = 0.60$). **CONCLUSION:** This preliminary analysis suggests that the SCG intensity analysis may be a suitable alternative when EMG signals are not feasible. Visual analysis and these results suggest that SCG intensity provides reliable heart rate data and may offer further insight into the nature of the cardiac cycle (e.g., pre-ejection period, left ventricular ejection time, etc.), however, the CEBS database lacked data (e.g., heart sounds) that would permit more thorough analyses. Additional study is, therefore, warranted.

602 Board #7 May 27 1:00 PM - 3:00 PM

Importance Of Frequency In Volume Matched Exercise On Heart Rate Variability In Type 2 Diabetes

Charlotte Bjoerk Ingul, Michael Shelver, Norwegian University of Science and Technology, Trondheim, Norway.
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(No relevant relationships reported)

Type 2 diabetes mellitus is associated with a decrease in heart rate variability (HRV), which reflects autonomic nervous system modulation of cardiac activity and is associated with increased mortality. HRV variation is the time interval between consecutive heartbeats. Nighttime HRV provides a more unambiguous measurement of changes in the autonomic nervous systems regulation.

PURPOSE: To compare two volume and intensity matched exercise protocols with different frequencies in individuals with T2D and to investigate the effects on HRV. **METHODS:** 54 subjects with T2D were recruited and randomly assigned to either a high-frequency high-intensity interval training protocol (HF, $n = 29$) (10-minute high frequency, 12 sessions per week) or a low-frequency high-intensity interval training protocol (LF, $n = 25$) (30-minute low frequency, 4 sessions per week). Both groups were matched for volume and intensity, and the study participants exercised for 120 minutes a week for 12 weeks. 24-hour time-domain HRV measurements were selected for analysis. Aerobic capacity (VO_{2peak}) and glycosylated hemoglobin (HbA1c) were also measured. **RESULTS:** HRV improved only in the LF group, with a significant decrease in nighttime heart rate and an increase in nighttime HRV (rMSSD, root mean square of differences between NN intervals) (Table). Both the HF and LF group significantly improved aerobic capacity by 9% (3.0 ml, baseline 33.2 ml/kg/min) and 10% (3.3 ml, baseline 32.1 ml/kg/min), respectively, with no significant difference between groups. A significant decrease of 5% in HbA1c was observed in the LF group only ($p = 0.001$). **CONCLUSION:** Longer, less frequent exercise training seems to be more effective in improving heart rate variability, and glycemic control in type 2 diabetes provided this is at a frequency of at least four times a week. This finding might be associated with enhanced cardiovascular health in a population with an elevated risk of cardiovascular morbidity and mortality.

Nighttime Heart Rate Variability in type 2 diabetes after an exercise intervention						
	Baseline High-frequency training	Post intervention High-frequency training	P-value	Baseline Low-frequency training	Post intervention Low-frequency training	P-value
Night heart rate (beats/minute)	61±10	61±7	0.40	69±11	64±10	0.005
Night HRV rMSSD (ms)	29±13	35±17	0.36	27±13	32±17	0.02

B-11 Thematic Poster - Mitochondrial Metabolism

Wednesday, May 27, 2020, 1:00 PM - 3:00 PM
 Room: CC-2010

603 **Chair:** Robert Jacobs. *University of Colorado at Colorado Springs, Colorado Springs, CO.*
(No relevant relationships reported)

604 Board #1 May 27 1:00 PM - 3:00 PM
PO₂-dependent Changes In Contractility And Mitochondrial Activation In Single Myofibers From Young And Old Mice

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(No relevant relationships reported)

Aging shows muscle contractile and mitochondrial dysfunctions, as well as muscle hypoxia. **PURPOSE:** To investigate how aging affects contractile function during fatigue and contraction-induced mitochondrial activation at near-physiological oxygen tensions (PO₂). **METHODS:** Flexor digitorum brevis muscles were dissected from young (4-mo old, YM) and old (21-25 mo-old, OM) C57BL/6J mice. Single myofibers were perfused with Tyrode's solution (22°C), pre-equilibrated with 5% or 1% or 0% O₂, which produced an extracellular PO₂ of ~40, or 10, or 3 Torr, respectively. To measure fatigue resistance, myofibers (n=5 for YM and OM) were repetitively contracted (100 Hz) with progressive increases in train frequency each 2 min until fatigue (30% of initial tension) at 5% O₂. The myofibers rested for 1h, perfused with 1% O₂, and the previous contractile protocol was repeated. To measure NAD(P)H changes during contractions, myofibers (n=4 for YM and OM) were equilibrated at 5% O₂, then at 1% O₂, and then at 0% O₂, with 1h rest between conditions. For each PO₂ condition, myofibers contracted repetitively for 2 min at a fixed train frequency (0.5 trains per second). **RESULTS:** At 5% O₂, time to fatigue was significantly higher in myofibers from OM (509 ± 93 sec) vs YM (207 ± 38 sec, p<0.01). At 1% O₂, time to fatigue was not different to 5% O₂ in YM (4 ± 11% decrease, p=0.87), but showed a trend to be decreased in OM (16 ± 7% decrease, p=0.06). Relaxation time (½RT) at 5% O₂ was higher in OM (122 ± 17 ms) compared to YM (77 ± 4 ms, p<0.05) before fatiguing contractions, but showed a similar slowing in relaxation at fatigue (103 ± 30 vs 117 ± 33% increase, respectively, p>0.05). At 1% O₂, ½RT was further increased at fatigue (154 ± 39%) compared to 5% O₂ (p<0.05) in YM. ½RT changes with fatigue were not different in OM at 1% O₂ (151 ± 31 %) vs 5% O₂ (p>0.05). Contractions produced a transient (for ~30-40 s) increase in NAD(P)H fluorescence in YM at 5% O₂, which was enhanced at 1% and at 0% O₂. However, the increase in fluorescence at 1% O₂ was minimized in OM. **CONCLUSION:** These data suggest that myofibers from old mice have a higher fatigue resistance during repetitive contractions under "near-physiological" PO₂ conditions, although mitochondrial NAD(P)H responses were lower and relaxation was slower in aged myofibers. **FUNDING:** NIAMS AR069577

605 Board #2 May 27 1:00 PM - 3:00 PM
Skeletal Muscle Cells Derived From Old Donors Show Mitochondrial Fragmentation And Decreased Oxygen Consumption Rates

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(No relevant relationships reported)

With age, skeletal muscles lose their oxidative capacity and have a reduced mitochondrial fusion leading to fragmentation. These phenomena can lead to a reduction in oxygen consumption, atrophy, and an increased risk of developing age-related diseases such as sarcopenia. Skeletal muscle cells derived from humans can be used to investigate these physiological capacities in primary culture. **PURPOSE:** Investigate mitochondrial morphology and maximal oxygen consumption rates (OCR) of skeletal muscle cells derived from healthy young and old men. **METHODS:** Primary skeletal muscle cells derived from the Rectus abdominis muscle of healthy active eighteen and sixty-nine year old men (SKM18M and SKM69M, respectively) were obtained from Cook MyoSite Inc. (Pittsburgh, PA). Cells were stained with MitoTracker Red (Cell Signaling; Danvers, MA) and mitochondria morphology was observed using a Zeiss LSM 710 AxioObserver confocal scanning microscope (Carl Zeiss; White Plains, NY). The mitochondrial network was analyzed using the Mitochondrial Network Analysis tool in ImageJ (MiNA, FIJI) to estimate

mitochondrial footprint from a binarized image. Oxygen consumption rates were measured in intact cells using Seahorse Cell Mito Stress Tests on a XFp extracellular flux analyzer (Agilent Technologies; Santa Clara, CA). **RESULTS:** Primary cells derived from the young donor (SKM18M) had a larger mitochondrial footprint, longer branch length, and a greater number of network branches compared to SKM69M (Footprint: 34.65 ± 25.30 vs. 11.64 ± 9.53 μm²; Branch Length: 20.59 ± 7.23 vs. 12.10 ± 6.84 μm; Network: 17.25 ± 0.16 vs. 7.67 ± 4.97 counts). SKM18M also showed higher Basal and Maximal OCR compared to SKM69M (Basal: 38.78 ± 8.34 vs. 12.82 ± 2.07; Maximal: 60.09 ± 10.84 vs. 20.52 ± 2.36 pmol/min/protein). **CONCLUSIONS:** We observed differences morphologically and metabolically between the primary skeletal muscle cells derived from young and old donors. These preliminary results give us an insight into human skeletal muscle-derived cellular physiological capacity. Technology to observe human muscle mitochondrial fragmentation in vitro will help us elucidate the effects of aging on skeletal muscle mitochondrial fragmentation and loss of metabolic flexibility in aging.

606 Board #3 May 27 1:00 PM - 3:00 PM
The Impairment Of Oxidative Metabolism After 10-day Of Bed Rest Is Upstream Of Skeletal-Muscle Mitochondria

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(No relevant relationships reported)

PURPOSE: Exposure to microgravity, as simulated by bed rest (BR), leads to an impairment of oxidative metabolism. The sites of this impairment are still debated. Aim of this study was to identify markers of impaired oxidative metabolism along the O₂ pathway, from ambient air to skeletal muscle mitochondria, following 10 days of BR.

METHODS: Measurements were carried out on 10 recreationally active young males (age 23 ± 5 years [mean±SD]) before (PRE) and after (POST) 10 days of horizontal BR. Pulmonary O₂ uptake (V̇O₂) and other respiratory, cardiovascular and skeletal muscle variables were determined during an incremental exercise on a cycle ergometer. Peripheral vascular and endothelial functions were evaluated by the blood flow response (Doppler ultrasound) in the femoral artery during 1-min passive leg movement (PLM). Mitochondrial respiration was evaluated by high-resolution respirometry on permeabilized vastus lateralis fibers obtained by biopsy.

RESULTS: Peak V̇O₂ was lower (P=0.001) in POST (41.5 ± 6.5 ml·kg⁻¹·min⁻¹) vs. PRE (44.5 ± 7.4). The area under the blood flow vs. time curve during PLM was lower (P=0.038) in POST (274 ± 233 mL) vs. PRE (427 ± 291). Skeletal muscle citrate synthase activity, an estimate of mitochondrial mass, was not different (P=0.115) in POST (131.2 ± 15.9 U·mg⁻¹·protein) vs. PRE (137.9 ± 18.8). Maximal ADP-stimulated mitochondrial respiration (66.4 ± 17.5 pmol·s⁻¹·mg⁻¹ wet weight [POST] vs. 72.3 ± 14.0 [PRE], P=0.127) and oxidative phosphorylation coupling efficiency (respiratory control ratio, 4.10 ± 1.19 [PRE] vs. 3.59 ± 1.11 [POST], P=0.443) were not affected by BR. **CONCLUSIONS:** These preliminary data suggest that the whole-body impairment of oxidative metabolism during exercise, following 10 days of horizontal BR, is associated with an impairment of peripheral vascular and endothelial functions, whereas mitochondrial volume and respiratory function are unaffected. Data related to several other markers (pulmonary function, cardiac output, submaximal exercise tolerance, skeletal muscle fractional O₂ extraction, skeletal muscle V̇O₂ recovery kinetics, mitochondrial respiration sensitivity to submaximal [ADP]) are yet to be analyzed. Funding: ASI, MARS-PRE Project, n. DC-VUM-2017-006

607 Board #4 May 27 1:00 PM - 3:00 PM
Effect Of Endurance Exercise On Localization Of Myoglobin In Mitochondria In Muscle

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(No relevant relationships reported)

Purpose: Mitochondria play a principal role for metabolism and have a primary role in regulating respiration in myocytes. Recently, we have shown that the muscle-specific protein myoglobin (Mb) interacts with complex IV to augment mitochondrial respiratory capacity in skeletal muscles. However, the precise mechanism for the Mb-mediated upregulation remains unclear. The present study has focused on effect of the endurance training (eTR) on Mb within the mitochondria. **Methods:** Wistar male

rats aged 10-week, were subjected to eTR sessions for 4 weeks (25 m/min X 60 min X 5-day/week, n=6). Muscle specimen from the deep portion of m. Gastrocnemius was taken and homogenized. Crude mitochondria were isolated by differential centrifugations and washed with the mitochondrial isolation buffer. The isolated mitochondria were treated with proteinase K (PK), osmotic shock (OS), and SDS (or TrX) in order to digest proteins on the outer membrane and in the intramembrane. The final samples were subjected to SDS-PAGE and immunoblotting using antibodies to localize the proteins in the mitochondria. **Results:** The eTR increased VDAC-I and COX-IV around +80~130% as compared with non-exercise control ($p<0.05$). Mb increased by +50% ($p<0.05$). Western blotting analysis revealed that the PK digested Tom20, and Tom20 band intensity decreased with the amount of PK used. PK treatment, however, did not affect Mb found in the mitochondrial fraction. Combining treatment with PK, OS and SDS (or TrX) allowed immunoblotting detection of the mitochondrial proteins localized in specific regions of the mitochondria. Mb was detected with either PK or OS treatment. But it cannot be detected with a combined PK+OS treatment, suggesting that Mb associated with the inner membrane (intramembrane side, not matrix side) of the mitochondria. The Mb content inside the mitochondria in eTR rat was similar with that in the control muscles (n.s). **Conclusion:** The present results suggest that Mb in muscle cells localizes both in the cytosol and in the mitochondrial intermembrane space. Although eTR elevates mitochondrial volume and Mb content but does not change Mb content in the mitochondria. Therefore, the observation might imply that the dynamic flux of Mb from cytosol to mitochondria has greater importance than just the amount found in the mitochondria

skeletal muscle fat oxidation in healthy humans and to what extent exercise regulates ETF remains largely unknown. **PURPOSE:** To determine the relationship between skeletal muscle ETF protein abundance and mitochondrial fat oxidation capacity in healthy adult humans at rest and after acute aerobic exercise. **METHODS:** Sedentary lean adults (n=14 [10F/4M], age 28 ± 7 years, BMI 22.2 ± 2.1 kg/m²) completed two studies involving 1-hour of cycle ergometry (65% $\dot{V}O_{2max}$) or sedentary rest in a randomized cross-over design. Vastus lateralis muscle biopsies were collected at rest and 15 minutes after exercise. High-resolution respirometry was performed on isolated mitochondria using palmitoyl-carnitine (lipid substrate, ETF-linked) and glutamate-succinate (non-lipid substrate, N and S-linked). ETF protein abundance and methylation status were determined via western blot. **RESULTS:** Exercise did not alter ETF-linked oxidative phosphorylation or leak respiration compared to rest. Acute exercise did not stimulate N or S linked respiration states. Oxidative phosphorylation was lower for ETF substrates ($p<0.0001$), but with greater electron leak to H_2O_2 , than N or S substrates ($p<0.0001$). Acute exercise did not alter protein abundance of ETF-beta subunit or trimethylation ($p=0.41$ and 0.28 , respectively). **CONCLUSION:** Moderate intensity aerobic exercise did not alter mitochondrial respiration for either lipid or non-lipid substrates. ETF proteins did not undergo acute regulation to a single session of aerobic exercise. The lower capacity for lipid oxidation indicates factors upstream to ETF may regulate muscle lipid oxidation to acute exercise.

608 Board #5 May 27 1:00 PM - 3:00 PM
Vastus Lateralis Muscle Oxygenation Measured By Near-infrared Spectroscopy During Voluntary Isometric Leg Extension Muscle Actions
 Marni E. Shoemaker, Zachary M. Gillen, Nicholas A. Bohannon, Sydney M. Gibson, Joel T. Cramer, FACSM. *University of Nebraska-Lincoln, Lincoln, NE.*
(No relevant relationships reported)

Purpose: Examine vastus lateralis muscle tissue oxygenation measured by near-infrared spectroscopy (NIRS) during submaximal (10-90%) and maximal voluntary isometric contractions (MVIC) of the leg extensors.

Methods: Ten healthy, active males (age: 23 ± 1 y, mass: 84.5 ± 4.5 kg, stature: 181.4 ± 2.5 cm) performed three, 5-s MVICs and nine, 5-s submaximal isometric step muscle actions at 10 – 90% of the MVIC in 10% increments (randomly-ordered). Bipolar surface electromyography (EMG) and NIRS were used simultaneously to record muscle activation and muscle tissue oxygenation, respectively, from similar adjacent locations of the vastus lateralis muscle. The following four variables from the NIRS device were quantified for 0.5-s epochs during the isometrics force plateaus: concentration changes ($\Delta \mu M$) in oxygenated hemoglobin (Hb) + myoglobin (Mb) (oxy[heme]), deoxygenated Hb + Mb (deoxy[heme]), total Hb + Mb (total[heme]) and tissue saturation index (StO_2 , %). Difference EMG amplitude values were calculated for the same 0.5-s epochs and normalized to the MVIC. B-mode ultrasound was used to measure muscle and subcutaneous adipose tissue thicknesses.

Results: The sample demonstrated homogenous muscle thickness (range = 3.8 – 5.6 cm) and subcutaneous adipose thickness (0.3 – 0.6 cm). MVIC torque values ranged from 129 – 308 Nm. As expected, EMG amplitude increased incrementally from 10% to 100% MVIC ($p<0.001-0.021$). Oxy[heme] and total[heme] decreased incrementally from 10% to 80% MVIC ($p<0.001-0.05$), while deoxy[heme] did not change ($p=0.897$), from 10% to 100% MVIC. StO_2 remained unchanged from 10% to 60% MVIC ($p=0.406-0.992$), then decreased incrementally from 60 to 100% MVIC ($p=0.001-0.039$).

Conclusions: Despite systematic decreases in vastus lateralis blood diffusion (total[heme]) from 10% to 80% MVIC, muscle perfusion (deoxy[heme]) remained unchanged across the force spectrum. Interestingly, vastus lateralis tissue oxygen saturation remained intact from 10% to 60% MVIC, but then systematically decreased to 100% MVIC from 71% saturation to 64% saturation. These findings suggest that non-fatiguing submaximal isometric leg extension muscle actions from 10% to 60% MVIC may allow for a steady maintenance of oxygen saturation, which is decreased at higher force production.

609 Board #6 May 27 1:00 PM - 3:00 PM
No Change To Muscle Mitochondrial Fat Oxidation Or ETF Abundance Following Exercise In Healthy Adults
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(No relevant relationships reported)

Electron transfer flavoproteins (ETF) serve a critical role in mitochondrial fat oxidation by accepting electrons liberated during beta-oxidation, with mutations in ETF proteins linked with mitochondrial diseases in humans. Yet, the role of ETF as a regulator of

610 Board #7 May 27 1:00 PM - 3:00 PM
Skeletal Muscle Mitochondrial Plasticity Is Reduced In Liver Transplant Recipients

Caroline Elizabeth Echevarria¹, Shu'aib Abdul-Mateen¹, Steve Shen¹, Marnie Blalock¹, Chandra Bhati², Mohammad S. Siddiqui², Danielle Kirkman¹. ¹*Virginia Commonwealth University, Richmond, VA.* ²*Virginia Commonwealth University Health System, Richmond, VA.*
 Email: ceechevarria@gmail.com
(No relevant relationships reported)

Skeletal Muscle Mitochondrial Plasticity is Reduced in Liver Transplant Recipients Echevarria CE, Abdul-Mateen S, Shen S, Blalock M, Bhati C, Siddiqui MS, Kirkman DL

PURPOSE Sarcopenic obesity is a hallmark of liver transplant recipients, of which the mechanisms are not yet fully understood. Decline in mitochondrial plasticity could play a mechanistic role in muscle wasting, loss of strength, and increased adiposity via impaired energy substrate utilization. The purpose of this study is to determine if skeletal muscle mitochondrial plasticity is reduced in liver transplant (LT) recipients. **METHODS** In this prospective cohort study, 15 LT patients (Mean \pm SD; Age: 58 ± 10 years; months since transplant: 55 ± 81 months) and 10 age matched healthy controls (Age: 55 ± 4 years), underwent assessment of mitochondrial oxidative capacity of the wrist flexor muscle group. Near infrared spectroscopy coupled with repeated, transient arterial occlusions, measured the recovery kinetics of oxygen consumption following a 10 second bout of hand grip exercise. Post exercise metabolic recovery rate constant was calculated and reported as an index of mitochondrial oxidative capacity. **RESULTS** Post exercise metabolic recovery rates were significantly greater in LT recipients (Mean \pm SEM; Recovery Time Constant: 72 ± 7 s) compared to HC (51 ± 4 s; $p=0.03$) indicative of diminished mitochondrial plasticity in this patient cohort (Figure 1). **CONCLUSION** Skeletal muscle mitochondrial plasticity is reduced in LT patients compared to matched healthy controls. Further investigations are warranted to determine the role of mitochondrial dysfunction in the development of sarcopenic obesity and frailty following LT.

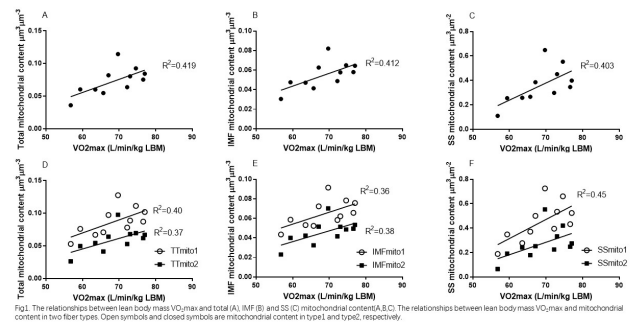
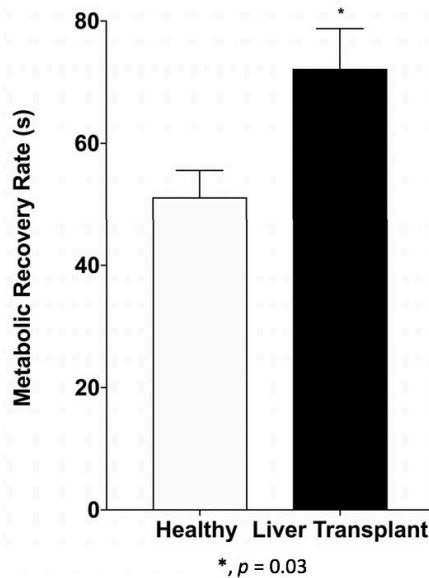


Fig 1. The relationships between lean body mass VO_{2max} and total (A), IMF (B) and SS (C) mitochondrial content (A, B, C). The relationships between lean body mass VO_{2max} and mitochondrial content in two fiber types. Open symbols and closed symbols are mitochondrial content in type 1 and type 2, respectively.

B-12 Thematic Poster - Muscular Strength, Strength Training and Health

Wednesday, May 27, 2020, 1:00 PM - 3:00 PM
Room: CC-2011

612 Chair: Alpa V. Patel, FACSM. *American Cancer Society, Atlanta, GA.*

(No relevant relationships reported)

611 Board #8 May 27 1:00 PM - 3:00 PM The Associations Of Mitochondrial Content And Maximal Oxygen Uptake

Yiheng Liang¹, Rasmus Jensen², Guoqiang Geng¹, Junqiang Qiu¹, Niels Ortenblad², Joachim Nielsen². ¹Beijing Sport University, Beijing, China. ²University of Southern Denmark, Odense, Denmark.

(No relevant relationships reported)

Introduction The purpose of this study was to explore the relationship between human fiber type specific mitochondria volume density and VO_{2max} . **Methods** Eleven recreational active subjects (VO_{2max} mean 4.54 ± 0.58 L/min) reported to lab for a progressive ergometer cycle test to estimate VO_{2max} . Ten muscle fibers were obtained in each 9 biopsies in vastus lateralis from each of the 11 subjects. In each fibers, 24 images were obtained in a randomized systematic order, thus 528 fibers and 13968 images were analyzed. Point counting was used to estimate intermyofibrillar (IMF) mitochondrial content as a volume density and subsarcolemmal (SS) mitochondrial content as a volume per fiber surface. Total mitochondrial content were obtained by recalculating the SS subfraction to myofibrillar volume density. Fibre type was determined by z-disk widths. Lean body mass (LBM) was determined by DXA. All data are presented as means \pm SD. Associations was evaluated using Pearson's correlation coefficient. **Results** The total, IMF and SS mitochondrial content in type 1 are $0.087 \pm 0.021 \mu m^3/\mu m^2$, $0.065 \pm 0.014 \mu m^3/\mu m^2$, $0.451 \pm 0.159 \mu m^3/\mu m^2$, respectively, and in type 2 are $0.059 \pm 0.018 \mu m^3/\mu m^2$, $0.046 \pm 0.012 \mu m^3/\mu m^2$, $0.271 \pm 0.129 \mu m^3/\mu m^2$, respectively. Total mitochondrial volume content was a strong predictor of VO_{2max} per LBM. Further, IMF mitochondrial content is a better predictor of a subject's VO_{2max} per LBM than SS mitochondrial content. The fiber type specific correlations revealed that, total, IMF and SS in different fiber types are associated with VO_{2max} per LBM, except SS mitochondrial content in type 2 is not associated (Fig1). **Conclusion** There is a strong correlation between mitochondrial content and VO_{2max} per LBM, however, VO_{2max} and relative VO_{2max} are not associated with mitochondrial content. Also, there is a clear correlation between total and IMF mitochondrial content and VO_{2max} per LBM in both type 1 and type 2 fibers, whole this was only the case for SS in type 1 fibers.

613 Board #1 May 27 1:00 PM - 3:00 PM Associations Of Muscle Strength And Genetic Predispositions To High Blood Pressure With Mortality And Cardiovascular Disease Outcomes: Findings From The Uk Biobank Project

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(No relevant relationships reported)

PURPOSE: High blood pressure (BP) is a heritable risk factor for cardiovascular diseases (CVD). Whether muscle strength, a modifiable environmental trait, is associated with risk of mortality and CVD independently of genetic risk for high BP is unknown. The purpose was to investigate the associations of genetic risk for high BP and muscle strength with mortality from all causes and CVD, and incidence of myocardial infarction (MI) and stroke. **METHODS:** This study is based on data from UK Biobank, a prospective cohort containing >500,000 adults aged 40-69 years. We included 304,020 individuals of European ancestry without 2nd-degree genetic relatedness and prevalent CVD at baseline. Polygenic risk scores (PRS) for high BP were determined by averaging the standardized calculated risk scores for systolic BP (using 274 single-nucleotide polymorphisms [SNPs]), diastolic BP (278 SNPs) and pulse pressure (231 SNPs). Muscle strength was assessed through grip strength tests. The average grip strength values from both hands were divided by measured fat-free mass. Independent and stratified associations were estimated using Cox regression. **RESULTS:** Compared with the bottom muscle strength tertile, hazard ratios of the top tertile were 0.72 (95% Confidence Interval: 0.69-0.76) for all-cause mortality, 0.66 (0.59-0.75) for CVD mortality, 0.84 (0.78-0.90) for MI, 0.81 (0.74-0.89) for stroke, 0.79 (0.72-0.88) for ischemic stroke and 0.80 (0.67-0.96) for hemorrhagic stroke after adjusting for confounders and PRS. Higher PRS was associated with higher hazards of each disease outcome. At all tertiles of genetic risk for high BP, higher muscle strength was associated with lower hazard of mortality due to all causes and CVD (except at low genetic risk), MI, stroke, ischemic and hemorrhagic stroke (except for high muscle strength at medium genetic risk), compared with low muscle strength: no additive and multiplicative interactions detected. **CONCLUSION:** Individuals with higher levels of muscle strength have lower rates of mortality from all causes and CVD, and incidence of MI and stroke, independent of genetic risk for high BP. Increased muscle strength is, in general, protective against mortality and CVD in the whole population including those at increased genetic risk for high BP.

614 Board #2 May 27 1:00 PM - 3:00 PM

Association Of Knee Extensor Strength With Prevalence Of Type 2 Diabetes Among Japanese: A Cross-sectional Study

Takahisa Ohta¹, Junzo Nagashima², Takeshi Yoshihisa², Yasunori Imagawa², Nobuyoshi Ono², Wataru Fukuda², Susumu S. Sawada, FACSM³, Hiroyuki Sasai⁴, Kazushige Sasaki¹, Naokata Ishii¹. ¹The University of Tokyo, Tokyo, Japan. ²Yokohama Sports Medical Center, Yokohama, Japan. ³Waseda University, Saitama, Japan. ⁴Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan.

(No relevant relationships reported)

Low hand grip strength is known to be an independent risk factor for developing type 2 diabetes. However, the relationship between the strength of lower limb muscles such as knee extensors and the prevalence of type 2 diabetes remains unclear among Japanese adults. **PURPOSE:** To investigate the relationship between knee extensor strength and prevalence of type 2 diabetes among Japanese adults.

METHODS: This cross-sectional study was conducted in 6227 Japanese male [age: 49.7 (16.0) years, mean (standard deviation)] and 7790 Japanese female [age: 50.4 (14.6) years] who had undergone medical checkup and physical fitness tests voluntarily from 1998 to 2018 at a preventive medical center. Participants completed a maximal voluntary knee extension test, a medical examination, and lifestyle questionnaires. Knee extensor strength, expressed as knee joint torque per body weight (Nm/kg), was measured at 60 degrees/s with an isokinetic dynamometer. Type 2 diabetes was defined as having at least one of the following criteria; fasting plasma glucose ≥ 126 mg/dL, hemoglobin A1c $\geq 6.5\%$ (NGSP) and self-reported physician diagnosis. All participants were divided into quartile according to knee extensor strength. Odds ratios and 95% confidence intervals for having type 2 diabetes were obtained by using logistic regression models. The models were adjusted for age, systolic blood pressure, current smoking status, alcohol intake, and body mass index.

RESULTS: Of the participants who had complete data, 720 males (11.6%) and 505 females (6.5%) had type 2 diabetes. Using the lowest quartile of knee extensor strength as reference, odds ratios and 95% confidence intervals for the highest quartile were 0.71 (0.59- 0.86) for overall (p for trend < 0.001), 0.64 (0.51- 0.82) for male (p for trend <0.001), and 0.75 (0.55- 1.01) for female (p for trend =0.036).

CONCLUSIONS: Our results suggest an inverse relationship between knee extensor strength and prevalence of type 2 diabetes among Japanese adults. Further cohort studies are warranted to investigate longitudinal associations between lower limb muscle strength and type 2 diabetes.

615 Board #3 May 27 1:00 PM - 3:00 PM

Muscle Strength Moderates The Harmful Relationship Between Abdominal Obesity With Health Variables Among Adults

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(No relevant relationships reported)

PURPOSE: Clinical variables are usually altered among individuals with abdominal obesity (AO). However, few population-based studies have investigated whether clinical variables are improved according muscle strength (MS) levels in adults with AO or without AO. We investigate whether MS levels moderates the relationship between AO with clinical variables among adults.

METHODS: Cross-sectional population-based study comprising 862 adults (39.3 \pm 11.4 years, 46.4% men) from Florianópolis, Southern Brazil. MS was assessed by handgrip strength. Clinical variables investigated as outcomes were systolic (SBP) and diastolic blood pressure (DBP), carotid intima-media thickness (IMT), high sensitive C-reactive protein (hs-CRP) levels, lipid and glucose metabolism markers. Multiple linear regression adjusted for confounding factors was used.

RESULTS: Higher levels of MS were related to lower levels of IMT, hs-CRP, triglycerides, insulin resistance (HOMA-IR) and higher HDL cholesterol (HDL) among male (p<0.05 in both cases). Among female, to have higher levels of MS was associated with lower levels of SBP, DBP, IMT, hs-PCR, glycated hemoglobin (HbA1c), HOMA-IR and higher HDL (p<0.05). Reduced IMT was observed in male with AO who presented higher MS levels (p<0.05). Among female with AO, lower levels of SBP, HbA1c, HOMA-IR, and higher levels of HDL and IMT were identified in those with higher MS levels (p<0.05).

CONCLUSIONS: MS levels moderated the harmful relationship between AO with clinical variables in male and female.

616 Board #4 May 27 1:00 PM - 3:00 PM

The Independent And Combined Effects Of Aerobic Physical Activity And Muscular Strengthening Activity On All-Cause Mortality: An Analysis Of Effect Modification By Race-Ethnicity

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(No relevant relationships reported)

The relationship between aerobic physical activity (PA) and all-cause mortality risk is well documented. However, the combined effects of sufficient aerobic PA and muscular strengthening activity (MSA) on all-cause mortality risk need further exploration. Moreover, the 2018 PA guidelines committee report suggests that effects of race-ethnicity on this relationship need to be examined. **PURPOSE:** To examine the independent and joint relationship between meeting the current aerobic PA and MSA recommendations and all-cause mortality while considering potential effect modification by race-ethnicity. **METHODS:** This study sample (n=14,384), included adults (20-79 years of age), who participated in the 1999-2006 NHANES. Participants self-reported participation in aerobic PA (leisure-time, transportation, household) and MSA. PA was categorized into 6 categories based around the 2018 PA guidelines: category 1 (no aerobic PA and no MSA), category 2 (insufficiently active and no MSA), category 3 (active and no MSA), category 4 (no PA and meeting the MSA recommendations), category 5 (insufficiently active and meeting the MSA recommendations), and category 6 (meeting both the aerobic and MSA recommendations). All-cause mortality was the dependent variable. Race-ethnic groups examined included non-Hispanic White (NHW), non-Hispanic Black (NHB) and Mexican American (MA). Cox-proportional hazard models were used for the total sample and for individual race-ethnicity estimates. **RESULTS:** A significant interaction was found between aerobic PA and race-ethnicity (p=0.0001) and MSA and race-ethnicity (p=0.0005). Significant risk reductions were found for categories 2,3 and 6 among NHW (cat 2: HR 0.76, 95% CI 0.64-0.91; cat 3: HR 0.63, 95% CI 0.52-0.74; cat 6: HR 0.58, 95% CI 0.44-0.76) and NHB (cat 2: HR 0.63, 95% CI 0.52-0.74; cat 3: HR 0.51, 95% CI 0.41-0.65; cat 6: HR 0.54, 95% CI 0.38-0.77). Among MA, only those meeting both guidelines had significant reductions in all-cause mortality risk (HR 0.54, 95% CI 0.32-0.92). **CONCLUSIONS:** In support of the most recent PA guidelines, participation in sufficient volumes of both aerobic PA and MSA lead to significant reductions in risk for all-cause mortality across race-ethnic groups. The positive effects of aerobic PA alone seem to be isolated to NHW and NHB.

617 Board #5 May 27 1:00 PM - 3:00 PM

Abstract Withdrawn

618 Board #6 May 27 1:00 PM - 3:00 PM

Weakness May Cause Mortality In Older Americans: A Matched Cohort Analysis

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(No relevant relationships reported)

Muscle weakness has been implicated with early mortality; however, quantifying the extent of this association with a carefully matched not weak and strong control will help to better establish the impact of weakness on premature death. **PURPOSE:** We utilized a propensity cohort analysis in a national sample of older Americans for this study to determine if persons who were weak had a higher risk for early mortality compared to a not weak or strong control group. **METHODS:** Data from 19,729 Americans aged at least 50 years from 2006-2014 waves of the Health and Retirement Study were analyzed. Handgrip strength was measured with a hand-grip dynamometer. Men with handgrip strength <26 kilograms were considered weak, ≥ 26 kilograms were considered not weak, and ≥ 32 kilograms were considered strong. Women with handgrip strength <16 kilograms were classified as weak, ≥ 16 kilograms were classified as not weak, and ≥ 20 kilograms were classified as strong. The National Death Index and postmortem interviews determined date of death. The greedy matching algorithm was used to separately match the weak cohort 1:1 to a 1) not weak control cohort, and 2) strong control cohort on several influential covariates. Kaplan-Meier estimators examined survival probabilities and Cox models determined the association between weakness and time to mortality for each of the matched pairs. **RESULTS:** Of the 1,077 weak and not weak matched pairs, 401 weak (37.2%; mortality rate per 1,000 person years: 90.6) and 296 not weak (27.4%; mortality rate per 1,000 person years: 57.8) older Americans died over an average 4.4 \pm 2.5 year follow up. There were 392 weak (37.0%; mortality rate per 1,000 person years: 89.6)

and 243 strong (22.9%; mortality rate per 1,000 person years: 46.7) persons that died over a mean 4.5±2.5 year follow up from the 1,057 weak and strong matched pairs. Those in the weak cohort had a 1.40 (95% confidence interval (CI): 1.19-1.64) and 1.54 (CI: 1.30-1.83) higher hazard for mortality relative to older Americans in the not weak and strong control cohorts, respectively. **CONCLUSION:** Our findings may indicate a causal association between muscle weakness and mortality in older Americans. Healthcare providers should include measures of handgrip strength as part of routine health assessments and discuss the health risks of weakness with their patients.

619 Board #7 May 27 1:00 PM - 3:00 PM

Association Between Silent Lacunar Infarcts And Muscle Strength: The Bunkyo Health Study

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(No relevant relationships reported)

Silent lacunar infarcts by definition, lack clinically overt stroke-like symptom, are occasionally found by brain magnetic resonance imaging (MRI) scan in asymptomatic elderly individuals. A previous study revealed that more than 25% of elderly people have silent lacunar infarcts. The main risk factors for lacunar infarcts and stroke were reported as aging, hypertension, and smoking. While a recent study showed that low muscle strength is also a risk factor for cerebrovascular events, it remains unclear whether low muscle strength is a risk factor for silent lacunar infarcts. **PURPOSE:** To investigate the association between muscle strength and silent lacunar infarcts in the elderly people living in urban community. **METHODS:** This study included 1,536 elderly people without past history of cerebral vascular events, aged 65-84 years living in an urban area of Tokyo, Japan (Bunkyo Health Study). All participants underwent brain MRI scan and silent lacunar infarcts were defined as the presence of 1 or more lacunar infarcts. Isokinetic muscle strength of knee extensors was evaluated at angular velocity of 60 degree per seconds using dynamometer. Subjects was categorized tertiles (high, medium, and low) by muscle strength, and compared the prevalence of silent lacunar infarcts. **RESULTS:** Mean age of subjects was 73.0±5.4 years old and 58.9% were female. Two hundred fifty-two (16.4%) subjects were diagnosed as silent lacunar infarcts, and the subjects categorized as lower muscle strength showed higher prevalence of silent lacunar infarcts (high: 12.3%, medium: 17.7%, and low: 19.3%, p for trend 0.003), while skeletal muscle indices among the groups were similar. After multivariate adjustment by age, sex, body mass index, smoking status, physical activity, hypertension, diabetes, and dyslipidemia, the trend was still significant and the odds ratio for having silent lacunar infarcts was significantly higher in the lowest muscle strength tertile compared to the highest tertile [High: 1.00 (reference), medium: 1.42 (95%CI: 0.98-2.04), Low: 1.48 (1.02-2.14), p for trend 0.043]. **CONCLUSIONS:** In the elderly people living in urban community, lower muscle strength of knee extensors was associated with higher prevalence of silent lacunar infarcts independent of other established risk factors.

620 Board #8 May 27 1:00 PM - 3:00 PM

Genetic Risk, Muscle Strength And Stroke Risk

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PURPOSE: Little is known about whether the beneficial impacts of increased muscle strength are consistent across all levels of genetic predispositions to stroke. The purpose was to examine whether the associations between muscle strength and stroke are independent of or vary by genetic risk for stroke.

METHODS: We included 312,398 individuals of European ancestry in UK Biobank (a prospective cohort of >500,000 adults aged 40-69 years) who had no stroke at baseline and genetic relatedness. Genetic risk was assessed using polygenic risk scores, calculated by multiplying the sum of risk-increasing alleles at a given locus by the known effect estimates. Muscle strength was assessed through grip strength tests via a hand dynamometer. Values from both hands were averaged, then divided by fat-free mass. The outcome variables included incidence of overall ($n=3,356$), ischemic ($n=2,632$) and hemorrhagic ($n=861$) stroke over 9-year median follow-up. Overall, stratified and joint associations were estimated using Cox regression. **RESULTS:** Compared with the bottom tertile of muscle strength, hazard ratios [95% confidence interval] of stroke were 0.88 [0.81-0.95] and 0.80 [0.73-0.87] for the middle and top tertiles of muscle strength, respectively, after adjusting for confounders and genetic risk; higher levels of genetic risk were independently associated with higher hazards of stroke. Hazard ratios of stroke for the top muscle strength tertile were 0.82

[0.69-0.96], 0.78 [0.67-0.91] and 0.81 [0.70-0.93] at low, medium and high genetic risk, respectively: no evidence of additive and multiplicative interactions detected. Compared with the reference category of high muscle strength and low genetic risk, there was an increased hazard of stroke for individuals who had medium or high genetic risk combined with low or medium muscle strength, but not for those who had medium genetic risk but high muscle strength. Similar associations were observed for ischemic and hemorrhagic stroke, although for hemorrhagic stroke, confidence intervals were wider and inconclusive for some of the associations.

CONCLUSIONS: Higher muscle strength was associated with lower risk of stroke, independently of genetic risk for stroke. The increased genetic risk of overall and ischemic stroke was partly attenuated through increased muscle strength.

B-13 Thematic Poster - Pediatrics

Wednesday, May 27, 2020, 1:00 PM - 3:00 PM

Room: CC-2009

621 Chair: Karin A. Pfeiffer, FACSM. Michigan State University, East Lansing, MI.

(No relevant relationships reported)

622 Board #1 May 27 1:00 PM - 3:00 PM

Acute Perceptual Responses To Individual And Group-based High-intensity Interval Exercise In Girls

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(No relevant relationships reported)

Vigorous-intensity physical activity (PA), such as high-intensity interval exercise (HIIE), elicits greater health benefits than moderate-intensity PA. However, predictors of PA adherence such as affect and enjoyment are rarely assessed during HIIE in children. **PURPOSE:** To compare girls' acute perceptual responses to different types of HIIE, treadmill-based (TM) and body-weight resistance exercise circuit (CIRC), and to CIRC performed in a small group setting. **METHODS:** Fifteen active girls (age = 9.2 ± 1.1 years) completed a graded exercise test to determine maximal aerobic speed (MAS). TM and CIRC were performed on separate days (randomized and counterbalanced), and then CIRC was completed in a small group (group CIRC). TM required eight 30s sprints at 100% MAS with 30s of active recovery at 40% MAS; whereas, CIRC consisted of 2 sets of 4 exercises performed 'all out' for 30s with 30s of active recovery. Perceived exertion (RPE 0-10), affective valence (Feeling Scale, -5 to +5), and exercise enjoyment (facial scale, 1-4) were recorded at pre-exercise, 38%, and 75% of protocol completion, and post-exercise. Participants also completed surveys encompassing exercise enjoyment (PACES, 16-80) and positive and negative affect (10-item PANAS) prior to the exercise test and 15 minutes post-exercise.

RESULTS: RPE increased significantly during exercise ($P<0.001$), yet there was no time by protocol interaction ($P=0.12$). Affective valence and enjoyment were unchanged during exercise ($P>0.05$) and similar between protocols ($P>0.05$). Mean affective valence and exercise enjoyment at post-exercise were equal to 3 ± 2 and 3 ± 1 (TM) respectively, 3 ± 2 and 3 ± 1 (CIRC), and 4 ± 2 and 4 ± 1 (group CIRC). Mean exercise enjoyment (PACES) at baseline was equal to 69 ± 10 and did not significantly change post-exercise, and there was no change in positive or negative affect ($P>0.05$). **CONCLUSION:** Despite an exercise-induced increase in RPE, affect and enjoyment were unchanged during all protocols, suggesting that HIIE did not elicit unfavorable perceptual responses in individual and small-group settings. A possible explanation for our findings is our use of relatively brief work intervals and a lower volume exercise protocol compared to previous HIIE studies.

623 Board #2 May 27 1:00 PM - 3:00 PM

JOINT-, CONTRACTION-TYPE, AND CONTRACTION-VELOCITY SPECIFIC DIFFERENCES IN MUSCLE STRENGTH OF LOWER EXTREMITY IN CHILDREN

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(No relevant relationships reported)

PURPOSE: Concentric and eccentric muscle contractions produce dynamic movements requisite for activities of daily living (e.g. walking, running, and jumping). The purpose of this study is to examine joint-, contraction-type, and contraction-velocity specific differences as a function of lower extremity muscle strength in children. Methods: Thirteen children (male = 5, female = 8; age = 11.2 ±

1.1 years) participated in our cross-sectional study. After a familiarization session, participants performed randomized unilateral isometric (ISO), concentric (CON) and eccentric (ECC) muscle strength testing of the non-dominant knee extensors and ankle plantarflexors in a seated position at 120°/s and 180°/s on Biodex. Obtained peak torques were normalized to body mass. Differential muscle strengths were also calculated [D1 = (ECC120-CON120)_{knee}; D2 = (ECC120-CON120)_{ankle}; D3 = (ECC180-CON180)_{knee}; D4 = (ECC180-CON180)_{ankle}]. We used separate within repeated measures ANOVA to calculate muscle strength differences. Paired t-tests were used to compare the differential muscle strength (D1 vs D2; D3 vs D4). Results: No difference was noted between ISO and CON. However, ISO and CON were lower than ECC muscle strength at 120°/s and 180°/s (P < 0.01) at the knee and ankle. No difference was noted between D1 and D2 but D4 was significantly lower than D3 (P = 0.009). Conclusion: Irrespective of contraction velocity and the body sites, children display greatest muscle strength for ECC relative to CON or ISO which is site-dependent. Whether this is dictated by maturation associated site-specific neuromuscular inhibition remains to be investigated.

624 Board #3 May 27 1:00 PM - 3:00 PM
Relationship Between Deep Squat And Joint Range Of Ankle Motion In Young Female Hockey Players

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BACKGROUND: The “Deep Squat” (DS) is a qualitative functional test that integrates muscle strength, neuromuscular control, mobility and joint stability. This test has been frequently used to identify risk of musculoskeletal injury in varied populations. The active joint range of motion (AROM) is the arc of mobility that an individual performs during a voluntary movement, measured objectively by goniometer. **PURPOSE:** Identify the relationship between the DS and the AROM of the ankle measured by goniometer in young female hockey players who belong to *Gimnasia Esgrima Rosario Club*. **METHODS:** Twenty young and healthy female hockey players (age: 16.12 ± 1.16 years; Weight: 57.40 ± 6.32 Kg; Height: 161.42 ± 6.14 cm), participated in this study. Asymptomatic subjects were included, with no history of lumbar spine, hip, knee or ankle injuries. The functional DS test was measured by goniometer in angular degrees of movement for knee flexion, and three bilateral tests for the AROM of dorsiflexion of the ankle (a- Bipedal position with partial load; b- Seated with knee flexed at 90°; and c- Seated with knee at 0° of flexion). The Intraclass Correlation Coefficient (ICC: 0.832-0.993) and the Standard Error of Measurement (SEM: 0.803-0.971) were established by analysis of variance one way for each variable measured. We have applied matched t-test differences to determine statistical differences (SD) between dominant and non-dominant leg at p<0.05. Correlations were calculated through Pearson coefficient (r) between DS and right and left AROM mean values. **RESULTS:** No significant differences (ns) were found for dominant and non-dominant leg. Low correlation was found for dorsiflexion in bipedal position with partial load (r = 0.48; p <0.05) and seated with knee flexed at 90° (r = 0.39; p = 0.09 ns). However, a moderate correlation was found between the goniometric measurement of DS and dorsiflexion in the seat with 0° knee flexion (r = 0.61; p <0.01). **CONCLUSION:** Based on the results, we conclude that the DS measured objectively by goniometer has a moderate r with dorsiflexion seated with knee at 0° of flexion (gastrocnemius muscle length test). Therefore, in this sample, the DS test could be influenced by other determinants factors different from mobility, as they are the muscle strength, neuromuscular control and joint stability.

625 Board #4 May 27 1:00 PM - 3:00 PM
Association Between Strength Fitness And Gross Motor Function In Children: A Us National Study

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Zezhao Chen¹, Jingyuan Zhu¹, Suda Xu² & Weimo Zhu, FACSM¹ ¹University of Illinois at Urbana Champaign, Champaign, IL. ²Parkland College, Champaign, IL
 It was believed that children with better motor function and skills will be likely more physically active. Yet, contribution of fitness, especially muscular strength, to children’s motor function and skill has not been well understood. **Purpose:** To examine the relationship between core and upper-body strength and gross motor function in children using a US national sample. **Methods:** Three data sets in the 2012 National Youth Fitness Survey (NNYFS) were merged: Test of Gross Motor Development – Second Edition (TGMD-2), modified pull-up, and plank. TGMD-2 total score (TGMD-2 TS) was calculated by adding “Local

motor subtest raw score” and “Object control subtest raw score” together. Descriptive statistics and correlations of TGMD-2 TS, “# of correctly completed modified pull-ups (M-Pull-up)”, and “# of seconds planks position is held (Planks)” were computed using the 2012 NNYFS data.

Result: A total of 6375389 of boys and 6134317 of girls who aged between 3 and 5 yr. old participated in 2012 NNYFS, and their performances (M±SD) in gross motor function and fitness, as well as their correlations (r), are summarized below:

	Boy			Girl		
Age (yr.)	3	4	5	3	4	5
TGMD-2 TS	37.8814.79	49.8515.95	60.5515.29	34.259.46	50.5012.60	60.0113.16
M-Pull-up			2.082.75			2.282.92
Plank	10.286.29	15.7014.87	24.6123.52	12.8910.02	21.9419.25	28.5521.38
r, TGMD-T vs. Plank	0.07	0.12	0.38	0.3	0.38	0.56
r, TGMD-T vs. M-Pull-up			0.43			0.25
r, M-Pull-up vs. Plank			0.35			0.30

Conclusion: As children become older, core and upper-body strength seems playing a positive impact on children’s gross motor function in both boys and girls.

626 Board #5 May 27 1:00 PM - 3:00 PM
The Pedi-CHAMP Agility Test: Completion Rates For Typically Developing Children Aged 5 To 17yrs

Kirsten Tulchin-Francis, Wilshaw Stevens, Anthony Anderson, Kelly Jeans. Texas Scottish Rite Hospital for Children, Dallas, TX. Email: Kirsten.Tulchin-Francis@tsrh.org Reported Relationships: K. Tulchin-Francis: Ownership/interest/stock; Maxim Integrated.

The Comprehensive High-Level Activity Mobility Predictor (CHAMP) was developed to assess the rehabilitation and performance in active military service-members who sustained traumatic injury. A pediatric version of this 4-part agility test (the Pedi-CHAMP) has been adapted for use in children aged 5 to 17 years. The Pedi-CHAMP consists of a) 30sec single limb stance (SLS) on each leg, b) a modified Edgren Side-Step Test (Edgren) consisting of 3 continuous repetitions of side-step movements in each direction over a 4m course c) an L-test (10m forward, 10m side-step in each direction, 10m backwards) and d) the Illinois Agility Test (IAT) triple shuttle run with directional weaving on the second pass.

PURPOSE: To assess the completion rate of each portion of the Pedi-CHAMP in typically developing children aged 5 to 17 years.

METHODS: With IRB-approval, 1,093 children (574 females, average age 11.0±3.9yrs (range 5.0-17.9yrs) were tested and included for analysis. Each participant was given two attempts to complete each portion of the test. If one attempt was unsuccessful or disqualified based on performance, a third attempt was offered. Participants were grouped by age (rounded down to the nearest year) and sex (male/female). A complete test was noted if the participant was able to follow directions and did not demonstrate any performance deemed to disqualify the trial (missed end line/ cone, failed to maintain proper body position during side step, etc.)

RESULTS: All participants were able to follow the directions and perform the SLS test. It should be noted, however, that 29% were not able to maintain balance for 30 secs on one or both legs. The SLS rate of completion was higher in girls than boys for children aged 5 to 11 years. The overall completion rates for the modified Edgren and L-test tasks were 93% and 92%, respectively. Similar trends between sexes were seen for both tests, with completion rates improving from 74% (Edgren) and 69% (L-Test) in children aged 5yrs to <90% by 8yrs of age. The Illinois Agility Test (IAT) had an overall completion rate of 99%, with all age-sex groups achieving at least 92% completion.

CONCLUSION: The Pedi-CHAMP is a 4-part agility test that can be successfully administered in typically developing children aged 5 to 17yrs.

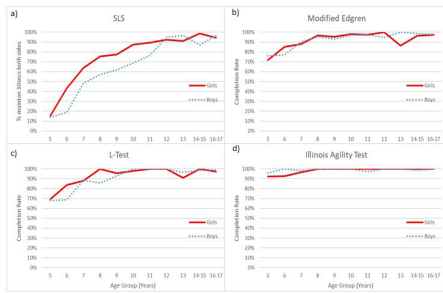


Figure 1. a) Percentage of participants who were able to maintain single limb balance for 30secs on each side; b-d) Completion rates for the modified Edgren, L-Test and Illinois Agility tests. Data for N=1,089 participants grouped by age and gender.

627 Board #6 May 27 1:00 PM - 3:00 PM
Effects Of Aerobic Training With Different RPEs To Double Poling Performance In Adolescent XC Skiers
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 (No relevant relationships reported)

Cross-country (XC) skiers frequently perform low intensity training sessions to improve their endurance capacity or for recovery from hard sessions. It is well known that exercise performed below a certain threshold intensity, adaptational responses will only occur after a certain duration. Rating of perceived exertion (RPE) scale may be helpful to identify reference markers for intensity-duration relationship. Such reference markers, especially during low intensity trainings, could help to improve exercise training in XC skiers' performance.

PURPOSE: To investigate adaptation of low intensity sessions, by means of session RPE (sRPE) in two groups of adolescent XC skiers with different RPEs on double poling performance after 1-week pre-competitive season training camp. **METHODS:** Thirteen national level XC skiers (13.4±1.9 yrs; VO_{2max} 51.2±8.0 ml·min⁻¹·kg⁻¹) participated in a 1-week camp in preparatory period. Pre- and post-camp double poling performance was measured with incremental exercise test on the ski ergometer. All XC skiers trained with the same training program. Based on the athletes' RPE values they were divided into two groups. Group1, who rated their trainings lighter and a Group2 who rated trainings harder compared to the median rating of all trainings. **RESULTS:** After excluding the intensive training session, Group1 average RPE rating was significantly higher compared to Group2 (3.09±0.90 vs 4.94±1.84, respectively) and total sRPE was also higher in Group2 compared to Group1 (4010±765 vs 2499±193 AU, respectively), while total training time was not different (796±41 vs 786±55 min, p<0.05). No significant differences were found in time spent in different HR zones between the two groups. Progression in ski ergometer performance in Group1 was 10.0% (ES=0.18, small), while in Group2 the progression was 12.0% (ES=0.39, moderate). **CONCLUSION:** Despite training with similar training plan, adolescent XC skiers experience training load differently. This leads to differences in performance changes, highlighting the importance of individual volume-intensity description. Supported by NRC Grant no. PUT1395G.

628 Board #7 May 27 1:00 PM - 3:00 PM
The Relationship Between Core Strength And Sportive Performance In Adolescent Female Soccer Players
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 (No relevant relationships reported)

PURPOSE: The effect of the strength of the core muscles on the sportive performance is still a controversial issue. At the same time, there is very little research on female soccer players on this topic. The aim of this study was to search the relationship between core strength and sportive performance in adolescent female soccer players. **METHODS:** Thirty-six (mean age 16.5±1.1 years, BMI: 20.3±2.1 kg/m²) woman soccer players were included in this study. Core strength was evaluated by isokinetic dynamometer at the velocity of 60°/s and front abdominal power test. In the assessment of the sportive performance vertical jump test, 20 m sprint test and T-test were used. Spearman and Pearson correlation tests were used to compare the correlation between core strength and sportive performance.

RESULTS: The correlation between isokinetic flexor muscle strength at 60°/s velocity and vertical jump peak power (r = .643, p<.05); 20 m sprint performance (r = -.629, p<.05); T test performance (r = -.510, p<.05) were determined. The correlation between isokinetic extensor muscle strength at 60°/s velocity and vertical jump peak power (r = .657, p<.05); 20 m sprint performance (r = -.714, p<.05); T test performance (r = -.442,

p<.05) were determined. The correlation between front abdominal power test and vertical jump peak power (r = .737, p<.05); 20 m sprint (r = -.683, p<.05); T test (r = -.574, p<.05) were determined.

CONCLUSIONS: Core strength was correlated with sportive performances of adolescent female soccer players. The relationship between core strength and sportive performance tests reveals the importance of trunk strength in improving sportive performance. For this reason, we recommend that athletes' training programs should include exercises improving trunk strength. In addition to this, athletes should be informed about core strength's importance by physiotherapists or coaches.

629 Board #8 May 27 1:00 PM - 3:00 PM
Us Children Became Heavier And Unfit To Make Another Pull-up Test Failing
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 (No relevant relationships reported)

PURPOSE: Since too many children and youth, especially girls, cannot perform a single chin-up, a modified pull-up (M-Pull-Up) test was developed (Pate et al., 1987), in which a test taker only pulls up only partial his/her body weight, and was used in the 2nd National Children and Youth Fitness Study (NCYFS II) in 1987. This study was to determine if M-Pull-Up could still eliminate the "zero score" problem for the current children population.

METHOD: The modified pull-up data of 6-9 yr. old (N = 4678) from the 2012 NHANES National Youth Fitness Survey (NNYFS, N= 494), were compared with the modified pull-up data from NCYFS II. Statistics, including median, interquartile range, cumulative frequency distributions for scores from 0 to 10, and correlations, were used for the analyses.

RESULTS: Between 1987 and 2012, 6-9 yr. children, on average, got slightly shorter (boys = -0.05 cm, girls = -0.2 cm), heavier (Weight: boys = +5.19 kg, girls = + 4.13 kg; BMI: boys = +1.31, girls = +1.14), less # of pull-ups (boys = -4.75, girls = -5). The "zero score" rates (%) in 1987 for 6-, 7-, 8-, 9-yr.-old boys were 7.16, 5.11, 2.60, and 2.61, respectively and for 6-, 7-, 8-, 9-yr.-old girls were 9.41, 6.29, 5.69, and 5.92, respectively; the corresponding "zero scores" rates in 2012 were increased to 22.86, 6.45, 16.67, and 26.92 for boys, respectively and to 19.67, 30.65, 21.43, and 30.00 for girls, respectively.

CONCLUSION: The US children became heavier and less fit, which made another easier pull-up test failing.

B-14 Free Communication/Slide - All in the Wrist: Development and Application of Methods for Wrist-worn Devices
 Wednesday, May 27, 2020, 1:00 PM - 3:00 PM
 Room: CC-2022

630 Chair: Tiago V. Barreira. *Syracuse University, Syracuse, NY.*
 (No relevant relationships reported)

631 May 27 1:00 PM - 1:15 PM
Deep Learning Approach To Recognize Physical Activity Type From Wrist-worn Tri-axial Accelerometer
 Mamoun T. Mardini¹, Subhash Nerella¹, Duane B. Corbett¹, Amal Wanigatunga², Todd Manini, FACSM¹. ¹University of Florida, Gainesville, FL. ²Johns Hopkins, Baltimore, MD.
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 (No relevant relationships reported)

PURPOSE: Wrist accelerometers for assessing physical activity type and intensity are rapidly growing with the advent of smartwatch technology in both public and research arenas. There is a necessity to enhance the accuracy of the wrist models in estimating hallmark measures of physical activities. The purpose of this study is to compare the performance of conventional machine learning and deep learning networks in recognizing physical activity type and estimating energy expenditure using raw data from wrist-worn tri-axial accelerometer.

METHODS: Participants (95 women and 46 men, aged 20-89 yrs) performed a battery of 31 typical daily activities in a standardized laboratory setting (e.g. washing dishes, walking) while a tri-axial accelerometer collected data at 100 Hz on the right wrist. A portable metabolic unit was worn to measure metabolic intensity (ml/min of oxygen consumption) that was expressed as a relative metabolic equivalent (MET=(ml/kg/min)/3.5). Deep learning networks comprising of convolutional neural networks

(CNN) and long-short-term memory (LSTM) were used to extract spatial and temporal representations from the raw accelerometry data. These representations were used to estimate energy expenditure and to recognize physical activity type. As a comparison, random forest algorithm was also used to estimate energy expenditure and recognize activity type from seven time and frequency domain features extracted from the raw data.

RESULTS: Deep learning networks resulted in high performance in recognizing physical activity type and estimating energy expenditure. The balanced accuracy was: 88%, 93%, and 92% for recognizing locomotor, lifestyle and sedentary activities, respectively. Random forest resulted in a slightly lower accuracy for the same set of tasks (78%, 91%, and 86%). The root mean square error for estimating energy expenditure using deep learning networks was slightly lower at 0.74 compared to 0.78 using random forest.

CONCLUSIONS: Deep learning models built using raw data from wrist-worn accelerometer data outperformed conventional machine learning algorithms such as random forest. These results show the efficacy of deep learning in extracting representation from the raw data without the need to relying on first creating a feature set that requires domain expertise.

632 May 27 1:15 PM - 1:30 PM
A Novel Method To Estimate Free-living Physical Behaviors From A Wrist-Worn ActiGraph™ Accelerometer

Greg J. Petrucci, Jr., Robert T. Marcotte, Melanna F. Cox, Patty S. Freedson, FACSM, John Staudenmayer, John R. Sirard, FACSM. *University of Massachusetts, Amherst, MA.* (Sponsor: John R. Sirard, PhD., FACSM)
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(No relevant relationships reported)

BACKGROUND: Despite the proliferation of body-worn sensors to assess physical behaviors (e.g. physical activity and sedentary behavior; PBs), processing accelerometer data collected from free-living (FL) individuals remains a challenge.

PURPOSE: To develop a method to estimate FL PBs from wrist-worn ActiGraph accelerometer count data.

METHODS: Forty-nine participants (X +/- SD age:20.4±1.3 yrs, 45.8% male) wore an ActiGraph wGT3X-BT on their non-dominant wrist during four, 1-hour FL sessions. Sessions were video-recorded and coded using a direct observation (DO) system that provided criterion measures, including intensity category. All steps in the novel method were developed using a subset (n=44) of participants and tested on the remaining (n=5). The first step identifies inactive bouts (e.g. sedentary and standing behaviors) using a vector-magnitude threshold, chosen via a grid-search to maximize the positive predictive value (PPV) of inactive classification. The second step uses statistical features of the count data and bout length (seconds) as inputs to random forest models to estimate active (light, moderate, vigorous) vs inactive periods. Percent agreement between criterion-measured (DO) and method estimated PB was evaluated using second-by-second data. Gini impurity index was used to measure the importance of statistical features used as inputs to the random forest models.

RESULTS: The first step identified a vector magnitude threshold that resulted in a PPV 95.71% for inactive classification. In the holdout sample, steps 1 and 2 correctly classified 84.1% of inactive and active bouts. Gini impurity index revealed that bout length (seconds) was most important among statistical features.

CONCLUSIONS: The new method performed well at estimating FL PBs from wrist-worn ActiGraph accelerometer counts. Future work should investigate how to improve method estimates using PB bout duration and other novel accelerometer statistical features. Supported by NIH NIDDK 1R01DK110148

633 May 27 1:30 PM - 1:45 PM
A Method To Estimate Free-living Behaviors Using High-frequency Wrist Accelerometer Data

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(No relevant relationships reported)

PURPOSE: To develop a novel method to estimate free-living sedentary behavior and activity intensity using high-frequency wrist accelerometer data. **METHODS:** Forty-nine participants (mean ± SD; age: 20.4±1.3 yrs, 45.8% male) completed four, 1-hour sessions of free-living behaviors in home, school, community, and exercise environments. Each session was video-recorded (DO) and participants wore an ActiGraph wGT3X-BT (AG) accelerometer on the non-dominant wrist. Videos were coded for whole body movement, contextual activity type, and activity intensity from the Compendium of Physical Activities (e.g. walking, shopping, 2.8 METs). The novel two-step method (SojWrist) first segments AG data into bouts, or “sojourns”, of inactivity (i.e. sedentary and standing behaviors) or activity using an acceleration

standard deviation threshold and random forest model. The second step estimates the intensity of inactive (sedentary, light) and active (light, moderate, vigorous) sojourns. Separate inactive and active sojourn RF models were fit to estimate intensity using bout duration and time- and frequency-domain AG signal characteristics. A 90-10 sample split was used for SojWrist development (N = 44) and cross-validation (N=5). Percent agreement between DO and SojWrist was evaluated at each step using second-by-second data. **RESULTS:** In the cross-validation sample, 91.8% [95%CI: 87.0%, 96.5%] of inactive and active periods were classified correctly from step 1 of SojWrist. After step 2, overall percent agreement between DO and SojWrist was 86.9% [95%CI: 78.9%, 95.0%] across all intensity categories (Table). **CONCLUSION:** The new SojWrist performed well at estimating free-living activity intensity categories from a wrist worn accelerometer. Future work should strive to improve method performance for predicting activity intensity categories and test validity on a diverse, independent, free-living sample. Supported by NIH NIDDK 1R01DK110148

Table. Confusion matrix for sojourn estimates compared to directly observed criterion time spent in intensity categories (seconds)

		Sojourn Estimate				% Correct
		Sedentary	Light	Moderate	Vigorous	
Direct Observation	Sedentary	36610	2694	109	0	92.9%
	Light	1070	9983	1144	0	81.8%
	Moderate	151	3088	10465	28	76.2%
	Vigorous	0	0	1022	4970	82.9%

634 May 27 1:45 PM - 2:00 PM
Does Heart Rate Improve Prediction Of Oxygen Uptake From Hip Or Wrist Accelerometer Output In Adults With Down Syndrome?

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Heart rate (HR) may improve the prediction of the rate of oxygen uptake (VO₂) from accelerometer output, but this has not been examined in adults with Down syndrome (DS). Addressing this issue may have implications for accelerometer-based measurement of physical activity and sedentary behavior in adults with DS. **PURPOSE:** To examine if HR improves VO₂ prediction from hip- and wrist-accelerometer output in adults with DS. **METHODS:** Sixteen adults with DS (10 men; age 31 ± 15 years) performed 12 tasks including physical activities and sedentary behaviors. VO₂ was measured with portable spirometry (K4b², Cosmed) and accelerometer output (Vector Magnitude [VM] with a hip- and a wrist-worn accelerometer (wGT3X-BT, Actigraph). We used multi-level regression to predict VO₂ from VM alone and VM and HR together. We evaluated prediction accuracy with the absolute percent error and Bland-Altman plots. Analyses were run separately for hip and wrist accelerometer VM. **RESULTS:** Both hip- and wrist-derived VM significantly predicted VO₂ (p <0.001; R² = 0.74 and 0.49 for hip and wrist model, respectively). HR significantly contributed to both models (p <0.001; R² = 0.73 and 0.55 for hip and wrist model, respectively). For hip data, absolute error did not differ significantly between the model with VM alone and the model with VM and HR (24 ± 27 and 26 ± 27%, respectively; p = 0.15). For wrist data, absolute error was higher for the model with VM alone than the model with VM and HR (43 ± 39 and 37 ± 38%, respectively; p = 0.017). Bland-Altman plots indicated zero mean error for all models and limits of agreement were wider for wrist- than hip-models. For hip-models, limits of agreement were similar between VM alone and VM and HR (-5.6 to 5.6 and -5.8 to 5.6 ml kg⁻¹ min⁻¹, respectively). For wrist-models, limits of agreement were somewhat wider for VM alone than VM and HR (-7.9 to 7.6 and -7.4 to 7.1 ml kg⁻¹ min⁻¹, respectively). **CONCLUSION:** Inclusion of HR does not improve prediction of VO₂ from hip-accelerometer VM in adults with DS. HR may slightly improve prediction of VO₂ from wrist-accelerometer VM. Overall, hip-accelerometer VM is better than wrist-accelerometer VM at prediction of VO₂ during physical activities and sedentary behaviors in adults with DS. Supported by NIH Grant R15HD098660

635 May 27 2:00 PM - 2:15 PM

Sedentary Time And Markers Of Physical Function In Those With Established Type 2 Diabetes

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(No relevant relationships reported)

PURPOSE: An accelerated ageing process places those with type 2 diabetes mellitus (T2DM) at risk of physical functional impairments at a younger age. Although the importance of moderate-to-vigorous physical activity (MVPA) is acknowledged, emerging research suggests that sedentary time may be also important. Therefore, the aim was to examine cross-sectional associations between device-assessed sedentary time and markers of physical function in a population with T2DM and to determine whether associations were modified by the recommended levels of MVPA.

METHODS: Participants with T2DM (>6months), aged 18-75 years were recruited as part of an ongoing, cross-sectional study (CODEC) conducted in the Midlands, UK. Participants were asked to wear an accelerometer (GENEActiv, ActivInsights Ltd, Kimbolton, UK) on their non-dominant wrist for 7 days to quantify habitual levels of sedentary time and MVPA. Generalised linear models examined the associations between sedentary time, the short physical performance battery (SPPB), the sit-to-stand 60 second test (STS60) and 4 metre timed walk. Interaction terms determined whether results were consistent across MVPA categories (active [$>150\text{min/wk}$ of MVPA] vs. inactive [$<150\text{min/wk}$ of MVPA])

RESULTS: 621 participants had valid accelerometer and physical function data (age 63.6±8.4 years, 34.5% female, BMI=31.0±5.0kg/m²). Following adjustment for various covariates, including age, sex, ethnicity, medication and MVPA, sedentary time was detrimentally associated with SPPB score, STS60 reps and walk time. When results were stratified by MVPA (active (24.5%) vs. inactive (75.5%)), each 60 minutes of sedentary time was associated with a 0.3 lower SPPB score (p=0.020), 1.4 fewer STS60 reps (p=0.016) and 0.2s longer walk time (p=0.043) in the inactive group only. No significant associations were found in the active group.

CONCLUSION: Sedentary time is adversely associated with markers of physical function, but associations were only present in those individuals who do not meet current physical activity recommendations for health. Along with promoting MVPA, future therapeutic interventions that focus on reducing sedentary time in those with T2DM and impaired physical function may be warranted in inactive individuals. Supported by NIHR Leicester BRC

636 May 27 2:15 PM - 2:30 PM

Agreement Between Fitbit And Actigraph Estimates Of Physical Activity In Young Children

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(No relevant relationships reported)

Commercial wearables are used to track physical activity (PA) levels in children and as tools for increasing PA participation in youth. However, few studies have examined the agreement between commercial and research grade devices in assessing PA in children.

PURPOSE: To compare estimates from a wrist-worn Fitbit Flex 2 to a waist-worn Actigraph GT9X Link in elementary school children. **METHODS:** Forty children aged 6-10 years wore a Fitbit Flex 2 (on non-dominant wrist) and an Actigraph GT9X Link (on waist) for up to two weeks while school was in session. Children were instructed to wear the Fitbit continuously and to wear the Actigraph during all waking hours. Parents were given wear reminders via text each morning. For each device, an adapted Choi algorithm was used to flag non-wear periods (defined as ≥ 90 minutes of continuous 0 step values). Steps and intensity-specific estimates of daily PA from each device were averaged across time periods when both devices were worn simultaneously, and estimates were compared using days with 10+ h of concordant wear and using all available data. **RESULTS:** Across 91 days with concordant device wear of 10+ h, Fitbit estimates were 25% higher for steps (Mean±SD = 10318±3846 steps) and 44% higher for vigorous intensity PA (16.2±22.1 min) compared to the Actigraph GT9X Link (8260±3614 steps; 11.3±15.9 min). In contrast, Fitbit estimates of moderate intensity PA (26.8±21.1 min) were 20% lower than Actigraph estimates (33.3±24.3 min). Pearson correlations between device estimates were higher for steps (r=0.62) than for moderate (r=0.55) or vigorous (r=0.28) intensity PA. Similar patterns were observed when all available concordant data were analyzed (n=377 days), with the Fitbit recording 20% more steps, 28% less moderate PA, and 36% more vigorous PA than the Actigraph. **CONCLUSIONS:** Wrist-worn consumer wearables may produce higher estimates of steps and vigorous intensity PA, and lower estimates of

moderate intensity PA, in elementary school children. Absent additional evidence, consumers and researchers should be cautious when using wrist-worn consumer devices to assess absolute levels of PA in youth.

Supported by a grant from NHLBI (R01HL135359).

637 May 27 2:30 PM - 2:45 PM

Do GPS Capable Fitness Watches Accurately Measure Exercise Distances?

David Q. Thomas, FACSM, Adam Jagodinsky, Delaney Mahoney, Ryan Schwerzler, Tessa Gridley, Catherine Guiffre.

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(No relevant relationships reported)

Fitness watches have become popular for assessing activity habits. Manufacturers of GPS capable activity monitors claim their devices provide valid and reliable measures of distances traveled. **PURPOSE:** To determine if six popular physical activity watches provide accurate measures of GPS recorded distances. **METHODS:** An Apple Watch (AW), Fitbit Ionic (FI), Fitbit Versa (FV), Garmin Vivosport (GVS), Garmin Vivoactive 3 (GVA), and a Garmin ForeRunner 35 (GF) were all tested on indoor and outdoor oval tracks, an outdoor walking trail and a zig-zag pattern course. Twenty trials were performed on each course by the same researcher. An industrial TR 88016 FX Series collapsible measuring wheel established actual distance (200 m). Two watches were worn at the same time on the left arm. Each watch was set to walking and their GPS signal was turned on and connected. Distance measured by the wheel and each watch was recorded. Means, standard deviations, and percent relative error were calculated for the GPS distance of each watch. **RESULTS:** For the outdoor trail condition, the results showed distances ranging from 180.0 to 204.4 m (FI: 180.2 m, 10.4%, FV: 186.6 m, 7.6%, GVA: 200.7 m, 4.0%, AW: 201.1 m, 4.2%, GVS: 204.4 m, 4.8%, GF: 204.4 m, 4.4%). For the zig-zag course condition, the range was from 184.2 to 204.4 m (GVS: 184.2 m, 4.1%, GF: 189.0 m, 6.0%, FI: 189.8 m, 5.6%, FV: 197.9 m, 4.0%, AW: 197.9 m, 4.0%, GVA: 204.4 m, 4.1%). For the outdoor track, the range was from 179.3 to 204.4 m (FV: 179.3 m, 10.8%, AW: 189.8 m, 5.6%, FI: 195.5 m, 4.8%, GVS: 200.3 m, 4.0%, GVA: 202.8 m, 4.0%, GF: 204.4 m, 4.1%). For the indoor track, the range was from 164.2 to 169.0 m (FI: 164.2 m, 18.3%, AW: 169.0 m, 16%). All Garmin devices failed to record an indoor measurement. **CONCLUSIONS:** The least and most accurate measurements for each condition were: trail (FI and GVA), zig-zag (GVS and FV), outdoor track (FV and GVS) and indoor track (FI and AW), respectively. The Garmins were the most accurate for the outdoor track with all exhibiting a 4.0% error. Indoor, all devices were less accurate. Only AW and FI had functioning GPS indoor and showed their most error in this setting. Caution must be used when relying on physical activity monitors if accuracy is desired in measuring distance via GPS.

638 May 27 2:45 PM - 3:00 PM

Calibrating Physical Activity And Sedentary Behavior For Wrist-worn Accelerometry In Women 60 Years And Older

Kelly R. Evenson, FACSM¹, Fang Wen¹, Chongzhi Di², Andrea Z. LaCroix³, Cora E. Lewis⁴, Michael J. LaMonte, FACSM⁵, I-Min Lee, FACSM⁶, Eileen Rillamas-Sun², Lesley Fels Tinker², David M. Buchner, FACSM⁷. ¹University of North Carolina - Chapel Hill, Chapel Hill, NC. ²Fred Hutchinson Cancer Research Center, Seattle, WA. ³University of California - San Diego, San Diego, CA. ⁴University of Alabama - Birmingham, Birmingham, AL. ⁵University at Buffalo - SUNY, Buffalo, NY. ⁶Harvard Medical School, Boston, MA. ⁷University of Illinois at Urbana-Champaign, Champaign, IL.

(No relevant relationships reported)

PURPOSE: While emerging approaches for defining physical activity and sedentary behavior using accelerometry exist, cutpoint-based definitions remain a frequent convention. We explored whether a calibration study could contribute to wrist-worn accelerometer count cutpoints among women ≥ 60 years.

METHODS: Women (n=199) 60-91 years wore an ActiGraph GT3X+ accelerometer on their left wrist while performing eight structured activities. Intensity was continuously measured using an Oxycon portable indirect calorimeter. Accelerometer data were analyzed in 15-second epochs with both normal and low frequency extension (LFE) filters. Receiver operating characteristic (ROC) curves were used to calculate cutpoints for sedentary behavior, light (low and high), and moderate to vigorous physical activity (MVPA) using vertical axis and vector magnitude (VM) counts. Cutpoints were selected that balanced the number of false positives and false negatives using three different classifications: one based on specific activities and two based on measured metabolic equivalents (e.g., 1 MET=3.0 or 3.5 ml/kg/min). Area under the ROC curves (AUC) were interpreted as excellent (0.90-1.00), good (0.80-0.89), fair (0.70-0.79), poor (0.60-0.69), or failure (≤ 0.59).

RESULTS: Average VM counts/15-sec varied by activities: 76 watch DVD, 675 assemble puzzle, 836 mopping, 1875 wash/dry dishes, 2180 laundry, 570 walk

1.5 mph, 637 walk 2.0 mph, 1132 walk 2.5 mph, and 1094 400 meter walk. Of the three cutpoint classifications, activity types performed best based on sensitivity and specificity. Using the normal filter, the AUC was good for sedentary cutpoints (vertical axis 0.88; VM 0.88), but was fair to poor for light high intensity (vertical axis 0.74; VM 0.64) and failed for MVPA (vertical axis 0.50; VM 0.50). Findings were similar when using the LFE filter, with only sedentary results indicating good to excellent results (vertical axis 0.90; VM 0.89).

CONCLUSION: This approach provided useful sedentary but not physical activity indicators for wrist-worn accelerometry counts. Further research is needed to understand whether wrist-worn accelerometry can accurately measure higher intensity physical activity in older adults.

B-15 Free Communication/Slide - Clinical Exercise Testing

Wednesday, May 27, 2020, 1:00 PM - 3:00 PM
Room: CC-2005

639 Chair: Jonathan Myers, FACSM. *Veterans Affairs Palo Alto Health Care System, Palo Alto, CA.*
(No relevant relationships reported)

640 May 27 1:00 PM - 1:15 PM Calf Muscle Oxygenation Limits Maximal Respiratory Performance During Incremental Walking Test In Obese Children

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PURPOSE: To study the interrelationship between respiratory and muscle haemodynamic responses during an incremental exercise in overweight children and confirm the limitations clinically observed that lead to the premature termination of an aerobic fitness test.

METHODS: Twenty-four overweight children (12 girls and 12 boys) performed a progressive maximal treadmill test during which the slope increases every minute. Changes in muscle oxygen (O_2) supply were continuously assessed using near-infrared spectroscopy. Pulmonary gas exchanges and heart rate (HR) were measured. For each participant, changes in deoxyhemoglobin level ($\Delta[Hb]$) in the medial head of the gastrocnemius muscle were expressed as a function of time, then as a percentage of peak of oxygen uptake (VO_2 peak). The influence of the sex, BMI and maturation on breakpoint in muscle desoxyhemoglobin (BP_{Hb}) was assessed with linear model effects.

RESULTS: Girls reach lower VO_2 peak than boys ($p = 0.07$). A BP_{Hb} occurred during the test in 9 girls and 6 boys and was strongly correlated with VO_2 peak ($r = 0.80$, $p < 0.001$). Expressed as a percentage of maximal theoretical value, HR peak tended to be higher in non BP_{Hb} (94.7 ± 5) than in BP_{Hb} (89.9 ± 8) participants ($p = 0.1$). Current data suggests that a lower maturation and lower BMI are the two main factors that delay the onset of BP_{Hb} .

CONCLUSIONS: Oxygenation of the calf muscle could limit maximal respiratory performance during an incremental walking test with a slope, especially in prepubere obese children who have lower BMI. Muscle limitations should be considered when choosing a protocol to assess VO_2 peak in this population.

641 May 27 1:15 PM - 1:30 PM High Peak Exercise Blood Pressure In Athletes Is Proportional To Exercise Capacity.

Kristel Johanna Hilde Janssens¹, Guido Claessen², Stephen Foulkes¹, Luke Rowsell¹, Darragh Flannery¹, Erin Howden¹, Andre La Gerche¹. ¹Baker Heart and Diabetes Institute, Melbourne, Australia. ²UZ Leuven, Leuven, Belgium.
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(No relevant relationships reported)

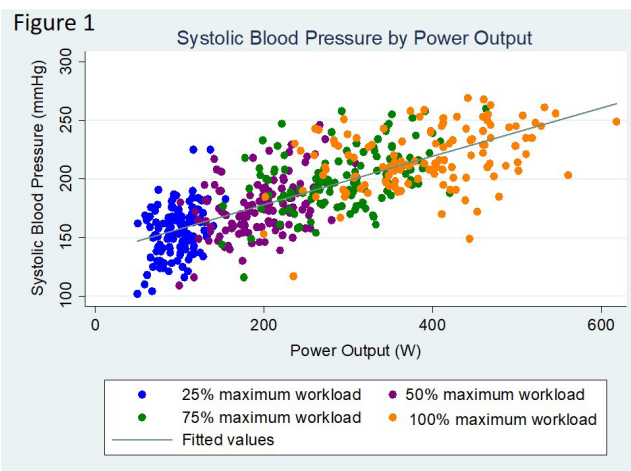
An abnormal blood pressure (BP) response to exercise is an important physiological variable associated with a risk of sub-clinical hypertension. Reference values are poorly defined and lack contextualization to physiological demands that can be obtained among very active populations.

PURPOSE: To assess the relationship between systolic BP (SBP) and workload and to determine reference values of SBP response to exercise in endurance athletes.

METHODS: We recruited 123 current and former endurance athletes (76% male), aged 16-80 years. BP was measured every 2 min during a maximal bicycle cardiopulmonary exercise test using a TangoM2 automated BP monitor. Relationship between SBP measured at 25%, 50%, 75% and 100% of maximum workload and power output during exercise were determined by linear regression analysis using STATA software.

RESULTS: SBP increased from 128 ± 13 mmHg in males (age 40 ± 18 years) and 116 ± 12 mmHg in females (age 35 ± 14 years) to peak 223 ± 27 mmHg and 203 ± 19 mmHg, respectively ($P < 0.0001$). The majority of participants demonstrated an exaggerated SBP response to exercise (72% of males and 82% of females) as defined by the American Heart Association guidelines. There was a strong correlation between power output and SBP ($r^2 = 0.67$, $P < 0.001$, Figure 1). Males achieved $123 \pm 18\%$ and females $134 \pm 26\%$ of their predicted VO_2 max ($P < 0.01$). There was no statistical difference in exercise SBP response according to age or BMI. Gender and hypertensive medication did have a statistically significant, but weak correlation to SBP ($P < 0.01$ and $P < 0.001$ respectively $r^2 = 0.03$ for both).

CONCLUSION: High SBP values are observed in athletes at peak exercise, frequently exceeding 'normal value' definitions. However, SBP increases can be explained by the supra-normal exercise capacity, thus, should be considered in the context of exercise capacity.



$r^2 = 0.67$, $p < 0.001$

642 May 27 1:30 PM - 1:45 PM Aerobic Fitness Is Related To Sports Participation In Children With Congenital Heart Disease

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(No relevant relationships reported)

Purpose: Underlying structural lesions in congenital heart disease (CHD) result in differences in anatomy and physiology that may affect peak aerobic capacity (VO_{2peak}). The relationship between sports participation and VO_{2peak} is unclear in these patients. The aim of this study was to determine if children with CHD who participated in sports had a higher VO_{2peak} than those who did not.

Methods: Two-year, single-centre, retrospective review (May 2016-November 2018). Fifty-eight CHD patients were included based on diagnosis: 9 aortic valve disease; 13 coarctation; 6 Ross procedure; 20 tetralogy of Fallot, and 10 transposition of the great arteries. Sports participation was assessed by an ACSM Clinical Exercise Physiologist at the time of testing and categorized into 3 groups: 0-1 day/week; 2-3 days/week; ≥ 4 days/week. A validated institutional treadmill protocol (BCCH) was used. The criteria for a maximal test included: VO_2 plateau, respiratory exchange ratio > 1.0 , and/or a peak heart rate > 200 bpm. VO_{2peak} Z-scores¹, gas exchange threshold (GET) and O_2 Pulse were calculated. Data are reported in frequency tables and as medians and interquartile ranges. Kruskal-Wallis and Mann Whitney U tests were used to test for group differences. $P < 0.05$ was considered statistically significant.

Results:

	Sports Participation			P
	0-1 day/week n=17	2-3 days/week n=30	≥4 days/week n=11	
Age (years)	15.6 (13.5,17.8)	15.5 (13.7,17.2)	15.0 (14.0,16.1)	NS
VO _{2peak} (mL/min/kg)	30.3 (27.8,39.6)	39.9 (34.6,48.1)	44.7 (41.3,51.5)	<0.001
VO _{2peak} Z-Score	-1.89 (-2.37,-1.16)	-0.84 (-1.28,-0.30)	-0.78 (-0.88,0.05)	0.002
%VO _{2peak} @ GET	52 (45,65)	61 (45,69)	57 (44,65)	NS
O ₂ Pulse (mL/beat/kg)	0.16 (0.14,0.21)	0.20 (0.19,0.25)	0.23 (0.21,0.28)	0.004

Those who participated in sports 2-3 days/week or more had a significantly higher VO_{2peak}, VO_{2peak} Z-score, GET and O₂ Pulse than those with 0-1 day/week (Table 1). There were no differences between those who participated in sports 2-3 days/week compared to ≥4 days/week. VO_{2peak} was similar between CHD cohorts (p=0.21). Conclusions: VO_{2peak} is higher in those who participate in sports compared to those who do not. It is unclear whether those who have a higher VO_{2peak} are more inclined to participate in sports or whether sports participation leads to a higher VO_{2peak} these CHD patients. The role of exercise rehabilitation in the 0-1 day/week group needs to be explored.

¹Ahmad et al 2001

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Symptom And Physiological Response To Exercise Following Concussion

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(No relevant relationships reported)

Exercise can exacerbate concussion symptoms, even when symptom are not apparent at rest. Whether this relates to a physiologic response to exercise remains unknown. **PURPOSE:** To examine symptom and physiologic responses to a stationary bike exercise protocol among participants with concussion and uninjured controls. **METHODS:** 32 concussed individuals (age=16.9±2 years; 50% female; 12.4±5 days post-injury) and 22 healthy controls (age=18.3±2 years; 59% female) completed a modified YMCA branching exercise protocol. After warmup (3 mins; 50 watts), participants progressed to Stage 1 (3 mins; 100 watts). Stage 2 was based on Stage 1 HR (2 mins; 175 watts if <60% age predicted HR; 150 watts if 60-70% age predicted HR; 125 watts if >70% age predicted max HR). Stages 3-5 lasted 2 mins, and increased by 50 watts/stage. Stopping criteria were symptom worsening (visual analog scale [VAS, 0 - 100] change>30) or 85% age-predicted HR. We assessed changes (end - baseline) for VAS, HR, systolic/diastolic blood pressure (SBP/DBP), rating of perceived exertion (RPE), carbon dioxide output (VCO₂), respiratory exchange ratio (RER), and oxygen consumption (VO₂). **RESULTS:** The concussion group reported significantly higher symptom severity at rest than controls (21.0±19.6 vs. 5.6±5.6; p=0.002). Resting HR (63.4±9.8 vs. 64.6±7.3) and protocol duration (11.3±2.0 vs. 11.5±1.3 minutes) were similar between groups. 22% of concussed participants stopped due to symptom exacerbation. Symptom change was not significantly different between groups (VAS= 10.4±16.1 vs. 4.7±11.2; p=0.18). The control group had significantly larger increase in DBP than the concussion group (6.1±5.7 vs. 1.4±4.8; p=0.003). VAS change was significantly associated with HR change among concussed (β=-0.45; 95% CI=-0.87, -0.02; p=0.04) and control groups (β=0.67; 95% CI=0.18, 1.17), and for control subjects, VAS change was associated with RPE (β=2.9; 95% CI=0.55, 5.22; p=0.02) and SPB (β=-0.73; 95% CI= -0.97, -0.48; p<0.001) changes. **CONCLUSIONS:** Using a branching bike-based exercise protocol, most participants achieved 85% age-predicted maximum HR, rather than symptom exacerbation. The amount of symptom provocation between groups was similar. Greater HR changes during exercise were associated with greater symptom provocation independent of group.

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VO₂/WR Slope And HR/VO₂ Slope Predict Major Adverse Events In Patients With Severe Heart Failure

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(No relevant relationships reported)

In chronic heart failure (CHF), cardiopulmonary exercise testing (CPET) yields key prognostic parameters. In addition to peak oxygen uptake (peakVO₂), ventilatory efficiency (VE/VCO₂ slope) and exercise oscillatory ventilation (EOV), other parameters such as oxygen pulse [O₂-pulse; VO₂/heart rate (HR)] kinetics are considered of clinical interest. However, the prognostic value of O₂-pulse kinetics in CHF has not yet been thoroughly examined. **Purpose:** The purpose of this study was to determine whether impaired O₂-pulse kinetics and associated parameters including VO₂ as a function of work rate (VO₂/WR slope) and HR/VO₂ slope predict major adverse events in patients with CHF. **Methods:** O₂-pulse kinetics was classified as 1) continual rise; 2) plateau; and 3) decrease. To evaluate the hazard ratio and significance of the optimal cutoffs for VO₂/WR slope and HR/VO₂ slope we used a two-fold cross-validation process. Kaplan-Meier curves and univariate as well as multivariate cox regressions were used to compare time to the composite outcomes of all-cause death, heart transplantation (HTx) and left ventricular assist device (LVAD) implantation between groups. **Results:** 242 patients (55±13 years, 78% male, 50±15% of predicted peakVO₂) with CHF were included in the study. During the mean follow-up of 27.5±23.3 months, 112 patients (46%) had an event (50x LVAD, 39x HTx, 23x death). Neither an O₂-pulse plateau (43%) nor a decrease (7%) distinguished patients with and without events. However, VO₂/WR and HR/VO₂ slopes were significant univariate predictors (p<0.001) of the outcomes (Fig.1). In the multivariate analysis, peakVO₂, VO₂/WR slope and EOV [hazard ratios (95% CI): 2.06 (1.20-3.54), 2.03 (1.21-3.38) and 1.65 (1.11-2.45), respectively] remained significant independent predictors (p<0.05). **Conclusion:** VO₂/WR slope and HR/VO₂ slope during CPET appear to be of potential benefit for predicting outcomes in patients with CHF, whereas O₂-pulse kinetics did not.

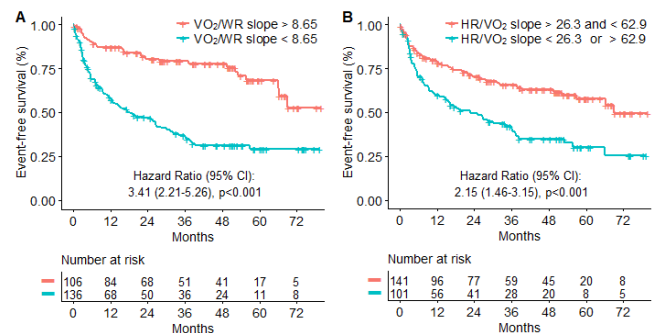


Fig.1: Kaplan-Meier curves and results of the univariate cox regression analysis [hazard ratio (95% confidence interval)] of (A) VO₂/WR slope and (B) HR/VO₂ slope

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Optimal Distance For Normal Gait Speed Testing

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PURPOSE: Walking speed tests are valid tools for predicting functional independence outcomes, however research has not yet agreed on their predictive ability for cardiovascular disease events. There are a range of distances used for walking speed tests, which generates a gap in knowledge and questions the test's accuracy and clinical significance. The purpose of the current study was to determine an optimal distance to calculate gait speed that can be used to standardize walking tests in clinical settings. **METHODS:** Participants walked at their normal gait speed for 20m through Brower timing gates set up at the starting line and at 5m, 10m, and 20m. Speeds from 0-5m, 5-10m, and 10-20m were compared using a linear mixed effect model. **RESULTS:** The average speed for 0-5m segment was 1.361 m/s, 5-10m was 1.449 m/s, and the 10-20m average speed was 1.467 m/s. Comparing 0-5m to 5-10m, the estimated difference was 0.088 m/s with a 95% CI between 0.062-0.079 m/s with a

p-value < 0.0001. Comparing 0-5m to 10-20m, the estimated difference was 0.106 m/s with a p-value of <0.0001. The estimated 5-10m to 10-20m difference was 0.018 m/s with a p-value of 0.18.

CONCLUSIONS: The most efficient distance to measure gait speed is between 5-10 meters of a 15 meter walk test to provide room for acceleration and deceleration. Using a walk speed test under 5 meters is not advised because people are still accelerating and have not achieved stable speed.

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The Predictive Value Of The Sf-36 Questionnaire In Determining CPET Performance In Patients With ME/CFS

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Introduction

Patients diagnosed with Myalgic Encephalomyelitis (ME/CFS) tend to have difficulties with higher-intensity exercise, and usually show diminished maximal exercise capabilities when compared to their sedentary healthy counterparts (sHC). Thus, it is important to find new ways to identify patients most at risk for diminished exercise performance as soon as possible.

Purpose

The present study seeks to determine the predictive validity of the Short Form Health Questionnaire (SF-36) and its subscales as a non-exercise component in patient evaluation.

Methods

18 male patients diagnosed with ME/CFS (Age: 39.2 ± 12.8 years) and 18 male sedentary healthy controls (Age: 39.9 ± 13.4 years) were asked to fill out the SF-36 health survey before participating in a symptom-limited maximal exercise test (CPET). CPET was performed on a cycle ergometer, and initial resistance was set at 30 Watts with a 30 Watt increase every 2 minutes. Subjects were asked to maintain a cycling cadence of 60-70 RPM for as long as possible, or until they experienced any of the predetermined symptoms. Maximal exercise data and veniality efficiency measures were recorded and used in correlative analyses.

Results

Significant differences were observed between ME/CFS and sHC in all relevant subscales of the SF-36 ($p < 0.005$ in all cases). The Physical Functioning, Vitality and Physical Health subscales were all positively correlated with maximal oxygen uptake ($\text{VO}_2 \text{ Max}$) in the ME/CFS group ($r = 0.67$, $p < 0.005$; $r = 0.59$, $p < 0.05$; and $r = 0.65$, $p < 0.005$ respectively), but showed poor correlations in the sHC group ($r = 0.28$, $p = 0.24$; $r = 0.16$, $p = 0.51$; $r = 0.11$, $p = 0.65$ respectively). Although there were significant differences in VE/VCO_2 slopes between the groups ($p < 0.05$), neither group showed strong correlations between and subscales and ventilatory efficiency.

Conclusions

The SF-36 and its subscales showed strong correlations with maximal exercise performance in subjects diagnosed with ME/CFS. These results were not observed in sHC, possibly due in part to the large percentage of "perfect" scores recorded in this group. While the SF-36 did not show any significant correlations with inter-test ventilatory efficiency measures, it might still hold some value in predicting outcomes of maximal CPETs in subjects with diminished exercise capacity.

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Serial Assessment Of The Cardiorespiratory Fitness Vital Sign: Prognostic Significance One Year Post Cardiac Rehabilitation

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Cardiorespiratory fitness (CRF) consistently demonstrates robust prognostic value in apparently healthy individuals and in those at risk for or diagnosed with one or more chronic conditions. While CRF at baseline and immediately following cardiac rehabilitation (CR) hold prognostic value, little is known about the significance of serial CRF assessments over a prolonged period. **PURPOSE:** Assess the prognostic utility of serial CRF assessments in patients completing CR.

METHODS: 3,185 patients (mean age = 62 ± 10 years, 82% male) with cardiovascular disease (CVD) that were referred to and completed a 12-week exercise-based CR program were included. All patients completed a symptom-limited treadmill exercise test at baseline, immediately following CR and at 1-year follow-up. Peak metabolic equivalents (METs) were determined at each exercise test from treadmill speed and grade. The difference between peak METs at baseline and immediately post CR and between baseline and 1-year post CR were also calculated. Patients were subsequently tracked for all-cause mortality.

RESULTS: 206 subjects died during the tracking period (mean tracking = 79 ± 34 months). Peak METs at baseline (Mean = 7.7 ± 2.0 METs, HR: 0.66, 95% CI: 0.62-0.71, $p < 0.001$), immediately following CR (Mean = 8.7 ± 2.0 METs, HR: 0.65, 95% CI: 0.60-0.69, $p < 0.001$) and 1-year post CR (Mean = 8.6 ± 2.2 METs HR: 0.65, 95% CI: 0.61-0.69, $p < 0.001$) were all significant predictors of survival. The mean change in peak METs from baseline to immediate post CR (0.88 ± 1.4 METs) and from baseline to 1-year post CR (0.88 ± 1.3 METs) was significant ($p < 0.001$). However, only the change in peak METs from baseline to 1-year post CR was a significant predictor of survival (HR: 0.73, 95% CI: 0.66-0.80, $p < 0.001$).

CONCLUSIONS: The current findings again demonstrate the prognostic significance of the CRF vital sign in patients with CVD undergoing CR. Our results indicate continued serial assessment of the CRF, in this analysis 1-year following completion of CR, provides important prognostic information. In particular, maintenance of CRF improvement following CR over the long-term is clinically important and should be monitored.

B-16 Free Communication/Slide - Nutritional Ergogenic Aids

Wednesday, May 27, 2020, 1:00 PM - 3:00 PM

Room: CC-2016

648 **Chair:** Shawn M. Arent, FACSM. University of South Carolina, Columbia, SC.

(No relevant relationships reported)

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The Impact Of Placebo Caffeine Dose On Cognitive Performance And Endurance Running In Recreational Athletes.

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(No relevant relationships reported)

PURPOSE: A caffeine-mediated dose-response placebo effect has previously been observed in trained cyclists. The current study aimed to determine if perceived caffeine dose influences cognitive and/or running performance in recreational athletes.

METHODS: Twenty-nine healthy individuals (23.7 ± 5 y (Mean ± SD), 16 males) completed two morning trials (repeated measures design, separated by 1 week), involving a choice reaction time (CRT) test followed by a 10km performance run. Prior to the first trial, participants indicated their beliefs of caffeine's effects on performance and any previous experience using caffeine as an ergogenic aid. On arrival to the testing facility, participants randomly received (and were told they were getting) "Low dose (100mg)" or "High dose (300mg)" of caffeine capsules (all contained placebo, (psyllium husk powder)) prior to commencing the CRT test (30min post capsule ingestion). Paired samples t tests were used to determine differences between trials and CRT latency (employing Ex-Gaussian analysis) and running performance using the entire participant sample and for the sub-groups exhibiting strong "beliefs" +/- prior experience.

RESULTS: Perceived caffeine dose did not influence CRT (μ -, σ - and τ -components respectively, Low: 400 ± 53ms vs High: 388 ± 4ms; Low: 35 ± 18ms vs High: 34 ± 17ms; Low: 50 ± 24ms vs High: 52 ± 19ms, all p 's > 0.05). Neither personal belief ($n = 9$), nor belief + experience ($n = 6$) influenced this effect. Furthermore, perceived caffeine dose did not influence run time (Low: 49.05 ± 3.75 min vs High: 49.06 ± 3.85 min, $p = 0.979$). Personal belief (Low: 48.93 ± 3.71 min vs High: 48.9 ± 3.52 min, $p = 0.976$), and belief + experience (Low: 48.68 ± 1.87 min vs High: 49.55 ± 1.75 min, $p = 0.386$) did not influence this effect.

CONCLUSIONS: Placebo effects of perceived caffeine-dose ingestion on cognitive and running performance were not observed in this study of recreationally active individuals, irrespective of individual's prior beliefs or caffeine use.

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The Perfect Timing For Sodium Bicarbonate Supplementation: Greater Possibilities With Probabilities

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PURPOSE: To describe the reliability of blood bicarbonate pharmacokinetics to sodium bicarbonate (SB) supplementation and, based on those data, to estimate probabilities of SB ingestion timing before exercise using currently accepted thresholds. **METHODS:** Thirteen males (age 27±5 y; body mass (BM) 77.4±10.5 kg; height 1.75±0.06 m) ingested 0.3 g·kg⁻¹BM SB in capsules on 3 occasions (SB1, SB2 and SB3). Blood was obtained at baseline and every 10 min following SB ingestion for 3h, then every 20 min for a further hour to determine bicarbonate concentration. Time-to-peak (Tmax), absolute peak (Cmax), absolute peak change (ΔCmax) and area under the curve (AUC) were determined and analysed using mixed models, as was the intraclass correlation coefficient (ICC), coefficient of variation (CV) and typical error (TE). Individual variation in pharmacokinetic responses was assessed using a Bayesian simulation approach using multilevel models with random intercepts. **RESULTS:** No significant differences between sessions were shown for blood bicarbonate regarding Cmax, ΔCmax or AUC (all p>0.05), although Tmax occurred significantly earlier in SB2 (127±36 min) than in SB1 (169±54 min, p=0.0088) and SB3 (159±42 min, p=0.05). ICC, CV and TE showed moderate to poor reliability for these variables. Bayesian modelling estimated that over 80% of individuals from the population experience elevated blood bicarbonate levels greater than +5 mmol·L⁻¹ between 75-240 min after ingestion, and between 90-225 min for elevations greater than +6 mmol·L⁻¹ (Table 1). **CONCLUSIONS:** Assessing SB supplementation using discrete values showed only moderate reliability at the group level, and poor reliability at the individual level, while Tmax was not reproducible. However, when analysed as modelled curves, a 0.3 g·kg⁻¹BM dose was shown to create a long-lasting window of ergogenic potential, which has practical utility for athletes and suggests that individually tailored timings are not required.

Table 1. Probability estimates of elevating blood bicarbonate above 5 mmol·L⁻¹ and 6 mmol·L⁻¹ (from baseline) at different time points following sodium bicarbonate ingestion. Probability values were estimated using Bayesian simulation (n = 1 million)

Prob-ability of increases	Time after ingestion (min)																
	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240
↑5 mmol·L ⁻¹ (%)	0	0	0	9	69	93	97	99	99	99	99	99	98	97	95	91	85
↑6 mmol·L ⁻¹ (%)	0	0	0	0	14	60	86	93	95	96	96	95	94	92	88	80	70

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Muscle Glycogen Utilization During Exercise Following Ingestion Of Alcohol

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PURPOSE: Following alcohol ingestion, ethanol (EtOH) is metabolized gastrically and hepatically, which may influence metabolism at rest and/or during exercise. Previous experiments involving exercise have provided EtOH via intravenous infusion rather than oral ingestion, which alters the metabolic effects of EtOH. Furthermore, no previous studies have directly compared the effects of EtOH metabolism at rest followed by exercise.

METHODS: Eight recreationally active men (Mean ± SD, Age: 24 ± 5 y; Body Mass: 76.7 ± 5.6 kg; Height: 1.80 ± 0.04 m; $\dot{V}O_{2peak}$: 4.1 ± 0.2 L·min⁻¹) performed two bouts of fasted cycling exercise at 55 % $\dot{V}O_{2peak}$ for 2-h, with (EtOH) and without (CONTROL) prior ingestion of ethanol 1 h and immediately before exercise (total dose: 0.1 g·kg lean body mass⁻¹·h⁻¹ - 30.2 ± 1.1 g 40% ABV Vodka; fed in 2 equal boluses) in a randomized order, separated by 7-10 days. NHS REC: 17/SW/0219.

RESULTS: The rate of muscle glycogen degradation was not different between conditions (CONTROL:-214.5 [nCI: -287.6—-141.4] mmol·kg⁻¹ vs EtOH:-257.7 [nCI: -330.8—-184.6] mmol·kg⁻¹) and plasma glucose concentrations during exercise were similar (mean concentration: CONTROL: 5.26 [nCI: 5.17-5.34] mmol·L⁻¹ vs EtOH: 5.26 [nCI: 5.18-5.34] mmol·L⁻¹). Ingestion of EtOH suppressed plasma non-esterified fatty acids (NEFA) at rest (mean concentration: CONTROL: 0.40 [nCI: 0.31-0.50] mmol·L⁻¹ vs EtOH: 0.30 [nCI: 0.21-0.40] mmol·L⁻¹) but not during exercise. Plasma

lactate was higher across the rest period in the EtOH condition (mean concentration: CONTROL: 0.88 [nCI: 0.79-0.97] mmol·L⁻¹ vs EtOH 1.01 [nCI: 0.91-1.09] mmol·L⁻¹) but the response during exercise was similar.

CONCLUSIONS: Ingestion of a small dose of EtOH transiently altered the resting availability of systemic NEFA and lactate but this effect did not persist during exercise. Muscle glycogen utilization was similar during exercise in both trials, which reflects the similar concentrations of systemic metabolites observed during exercise.

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Effects Of Vitamin C Enriched Hydrolyzed Collagen On Explosive Performance

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The stiffness of a tendon is determined by the amount and cross-linking of collagen within the tissue. Acute exercise and possibly vitamin C-enriched collagen supplementation have been shown to increase collagen synthesis as well as the expression of the primary enzyme involved in collagen cross-linking (lysyl oxidase). The result may be a denser and stiffer tissue. Stiffness is directly related to force transfer. Whether this nutritional supplementation can further augment response to training, in particular rate of force development (RFD), and translate to improved explosive performance compared to training alone is unknown. **Purpose:** To determine if nutritional supplementation with vitamin C-enriched collagen improves RFD compared to placebo (PLA) with an explosive power-based training regime. **Methods:** Healthy male collegiate football players (18-25 years) were enrolled in a 3-week double-blinded, parallel design study. Athletes were randomly assigned to the intervention group (COLL; 15g hydrolyzed collagen with 50mg vitamin C) or placebo group (PLA; 15g rice flour). Supplements were ingested 60min prior to training 5 days per week and with breakfast on rest days. Athletes completed the same training program and progression. RFD was measured from the best of three maximal isometric squats, countermovement jumps and squat jumps (Kistler, Novi, MI) performed at the same time on each testing day (baseline and after 1, 2 and 3 weeks of training). Two-way ANOVA (nutrition intervention and time) was used to compare RFD between groups. **Results:** At time of analysis there were no significant difference for maximal RFD in the maximal isometric squat between the interventions. RFD data from CMJ and SJ are yet to be determined. **Conclusion:** Supplementation with vitamin C-enriched collagen prior to training throughout a 3-week explosive power-based training program does not improve maximal RFD compared to exercise alone. More comprehensive analysis of all RFD parameters is required to fully interpret results from this study and will be completed prior to abstract presentation.

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Ketone Ester Supplementation Affects Neither Muscle Glycogen Utilization Nor Performance In A Simulated Cycling Race

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PURPOSE: Some recent literature data indicate that ketone bodies inhibit glycolysis in contracting muscles. Therefore, we investigated whether exogenous ketosis by oral ketone ester (KE) intake during prolonged cycling can induce a glycogen sparing action and thereby improve performance during the final phase of the event.

METHODS: In a randomized cross-over design, 12 highly-trained male cyclists and triathletes completed a simulated cycling race consisting of 3h submaximal exercise (EX₁₈₀) combined with 60g carbohydrates per h, immediately followed by a 15-min time-trial (TT₁₅) and a maximal sprint test (time to exhaustion at 175% of the anaerobic threshold). Subjects received 20-25g doses of either KE or a non-caloric placebo (CON) at 1h and 20 min before, and at 30 min during EX₁₈₀. Blood samples were collected at regular intervals. Biopsies from m. vastus lateralis were obtained before and after EX₁₈₀ and at the end of TT₁₅. **RESULTS:** KE intake transiently increased blood D-β-hydroxybutyrate to ~3 mM (range: 2.6-5.2 mM) during EX₁₈₀ (p<0.001 vs. CON). Blood pH concomitantly decreased from ~7.42 to 7.36 (range: 7.29-7.40), whilst bicarbonate dropped from 26.0 to 21.6 mM (range: 20.1-23.7) (p<0.001 vs. CON). EX₁₈₀ depleted muscle glycogen to the same degree in both groups (KE: -78 ± 9; CON: -60 ± 6 mmol/kg ww, p>0.05). Mean power output during TT₁₅ (KE: 273 ± 11; CON: 272 ± 11 W, p>0.05) and time-to-exhaustion in the sprint (KE: 59 ± 5; CON: 58 ± 5 s, p>0.05) also were similar between the groups. **CONCLUSION:** KE intake during a simulated cycling race does not cause glycogen sparing, neither does it affect performance in the final stage of the race.

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Effect Of Water-loading On Weight Cutting And Performance In Elite Judo Athletes
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 (No relevant relationships reported)

The use of water-loading to enhance weight cutting is getting increasingly popular in combat and weight category sports. Athletes are overdrinking water in order to increase urine production before engaging in a fluid restriction period in the belief that it will maximise fluid driven body mass loss. Research into this practice is lacking and further investigation is needed.

PURPOSE: Determine the impact of a water-loading protocol in combination with dietary adjustments on acute body mass loss, natremia, urinary markers of hydration and arm crank performance in elite judo athletes.

METHODS: Using a crossover design, 18 elite male judo athletes underwent 2, 6 days interventions interspersed by a washout period of 2 weeks. While following a controlled diet, athletes consumed either 40 mL/kg (control condition (CON)) or 80 mL/kg (water loading condition (WL)) on days 1-3, followed for both conditions by a fluid intake of 20 mL/kg on day 4. On day 5, fluid was restricted until 11h00, body mass was then measured and for the remaining of the day athletes consumed 60 mL/kg of fluid. On day 6, fluid was consumed *ad libitum* and arm crank performance measured between 9h00-12h00.

RESULTS: Water-loading ($2.4 \pm 0.5\%$) produced a significantly ($p = 0.03$, effect size = 0.7) greater decrease in body mass, compared with CON ($1.8 \pm 0.5\%$). Urine specific gravity and osmolality became progressively lower over time with WL ($p < 0.05$), compared with CON. However, whole blood sodium concentration remained within the physiological range of 135-145 mmol/L throughout the WL condition. There were no significant differences in arm crank performance for maximum power (CON: 663 ± 103 , WL: 677 ± 95 W) and mean power (CON: 330 ± 32 , WL: 335 ± 35 W).

CONCLUSION: Our results indicate that the water-loading protocol used in this study 1) improves acute body mass loss without affecting health or arm crank performance and; 2) should be considered by combat sports athletes looking to improve their weight cutting practices.

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1) Own the Podium i4G applied research program 2) INS Quebec PRIDI research grant

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Consumption Of Multi-ingredient Supplement With Resistance Training Enhances Gains In Muscle Fibre And Muscle Area In Men And Women
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Resistance exercise training (RET) is a well-known stimulus for muscle protein synthesis. Protein supplementation in conjunction with RET has been shown to yield a superior combinatory effect, fostering greater accretion of lean body mass. Few studies have compared multi-ingredient with isonitrogenous supplements of differing protein quality. **PURPOSE:** We compared a whey protein-based supplement (containing leucine, creatine monohydrate, calcium citrate, and vitamin D), to an isonitrogenous collagen-containing protein supplement with regards to muscle fibre and whole muscle mass increases. We aimed to determine whether the multi-ingredient supplement would enhance lean body mass gains in young adults involved in a RET program. **METHODS:** Twenty-six healthy, recreationally active men and women (22 ± 2 years [mean \pm SD]) were randomly assigned to either the supplementation (SUPP, $n=13$) or control beverage (CON, $n=13$) group, ingesting their respective supplements twice daily. Participants underwent a 10-week linear RET program. Dual-energy X-ray absorptiometry (DXA), one-repetition maximum (1RM), and biopsies from the *vastus lateralis* muscle were performed. **RESULTS:** There were significantly greater increases in type II fibre cross-sectional area (CSA) in the SUPP group compared to the CON group (SUPP: $+47 \pm 24\%$, CON: $+34 \pm 25\%$; $p < 0.05$; $d = 0.53$), while changes in type I fibre CSA was not different between groups (SUPP: $+37 \pm 25\%$, CON: $+25 \pm 21\%$; $p = 0.08$; $d = 0.52$). Ultrasound *biceps brachii* CSA increase was significantly greater in the SUPP group (SUPP: $+42 \pm 39\%$, CON: $+14 \pm 10\%$, $p < 0.05$; $d = 0.98$), while increases in *vastus lateralis* CSA was not different between groups (SUPP: $+43 \pm 23\%$, CON: $+26 \pm 31\%$; $p = 0.06$; $d = 0.62$). **CONCLUSIONS:** The consumption of a multi-ingredient nutritional supplement increased type II fibre CSA and *biceps brachii* CSA, but not type I fibre CSA or *vastus lateralis* CSA in healthy young men and women.

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Comparable Exogenous Carbohydrate Oxidation With Lactose Or Sucrose Feeding During Endurance Exercise
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 Reported Relationships: **O.J. Odell:** Industry contracted research; Volac International.

Purpose:

Endogenous carbohydrate (CHO) availability can limit endurance exercise performance. CHO ingested during exercise such as glucose, glucose polymers and sucrose are readily oxidized and can improve endurance performance. The extent to which lactose can be utilized as a fuel source during exercise is unknown. The purpose is to elucidate the metabolic response to lactose ingestion during endurance exercise, compared to sucrose or water.

Methods:

11 participants (mean \pm SD: 22 ± 4 years, 50.9 ± 4.7 mL \cdot min $^{-1}$ \cdot kg $^{-1}$) cycled for 150 min at 50% of W_{max} on 3 occasions. During exercise participants ingested, in a randomized order, water (WAT), lactose (LAC) or sucrose (SUC) containing beverages; a CHO dose of 0.8 g \cdot min $^{-1}$ (48 g \cdot h $^{-1}$) was used. Indirect calorimetry was used to calculate fat and total CHO oxidation and stable isotope tracer methodology (natural high ^{13}C abundance CHO ingestion, $^{13}C:^{12}C$ ratio determination in expired breath by isotope-ratio mass spectrometry) was used to quantify exogenous CHO oxidation. Venous blood samples were taken throughout exercise and analyzed for glucose, lactate and non-esterified fatty acids (NEFA).

Results:

Mean exogenous CHO oxidation rates in LAC (0.55 ± 0.19 g \cdot min $^{-1}$) and SUC (0.58 ± 0.10 g \cdot min $^{-1}$) were similar ($P = 0.68$). Endogenous CHO oxidation contributed less to energy expenditure (EE) in LAC ($39 \pm 14\%$) than in WAT ($50 \pm 11\%$, $P = 0.01$) and SUC ($50 \pm 8\%$, $P = 0.04$). Fat oxidation contributed most to EE in WAT ($50 \pm 11\%$), which was significantly greater than in LAC ($42 \pm 8\%$, $P = 0.04$) and SUC ($28 \pm 6\%$, $P < 0.01$), with fat oxidation higher in LAC than SUC ($P < 0.01$). Plasma glucose was significantly higher in LAC (5.2 ± 0.4 mmol \cdot L $^{-1}$) and SUC (5.3 ± 0.5 mmol \cdot L $^{-1}$) than WAT (4.6 ± 0.5 mmol \cdot L $^{-1}$, $P < 0.01$). Plasma lactate was significantly higher in SUC (1.7 ± 0.5 mmol \cdot L $^{-1}$) than WAT (1.5 ± 0.4 mmol \cdot L $^{-1}$, $P < 0.01$). Plasma NEFA were significantly higher in WAT (1.1 ± 0.4 mmol \cdot L $^{-1}$) than SUC (0.5 ± 0.3 mmol \cdot L $^{-1}$, $P < 0.01$), and tended to be higher in WAT than LAC (0.7 ± 0.4 mmol \cdot L $^{-1}$, $P = 0.08$).

Conclusions:

Exogenous CHO oxidation during exercise was comparable from ingested lactose and sucrose. However, lactose ingestion promoted higher fat and lower endogenous CHO oxidation during exercise than sucrose. This suggests that lactose may be at least as efficacious as commonly used CHO sources for improving exercise performance.

B-17 Clinical Case Slide - Head Injury and Concussion

Wednesday, May 27, 2020, 1:00 PM - 3:00 PM
Room: CC-3014

657 Chair: John Leddy. *University at Buffalo Sports Medicine Institute, Buffalo, NY.*
(No relevant relationships reported)

658 Discussant: Julie Wilson. *Children's Hospital Colorado, Aurora, CO.*
(No relevant relationships reported)

659 Discussant: Eugene Hong. *Medical University of South Carolina, Newtown Square, PA.*
(No relevant relationships reported)

660 May 27 1:00 PM - 1:20 PM
Oh Snap! I Got Hit In The Face.
Christina S. Gutta. *Prisma Health, Greenville, SC.* (Sponsor: Dr. Franklin Sease, FACSM)
(No relevant relationships reported)

HISTORY: 20 y.o. collegiate baseball player presents to physician in training room 1 hour after a resistance band snapped off a hook and hit him across the bridge of the nose and both eyes. He complains of immediate swelling around his eyes, difficulty opening eyelids and blurry vision for 20 minutes with tearing, difficulty opening his eyes and retro-orbital headache. He has a history of Hemophilia A with severe phenotype for which he administers Factor VIII every 2 days; with chest or head trauma, he administers an emergency dose of Factor VIII.

PHYSICAL EXAMINATION: He appears moderately distressed and uncomfortable; bilateral eyelids are swollen with tearing of clear fluid bilaterally, no periorbital ecchymosis, no proptosis, no hyphema. Bilateral subconjunctiva injection present. EOM intact but has pain in right eye when looking up. Left pupil is equal and reactive to light. Right pupil is oblong pointing towards 9 o'clock. Monocular diplopia present in both eyes. Vision 20/40 with corrective lens. No flashers or floaters. Cranial nerve exam is otherwise normal.

DIFFERENTIAL DIAGNOSIS: traumatic mydriasis, open globe injury, post-traumatic iritis, vitreous hemorrhage, retinal detachment, Retrobulbar hematoma, ocular contusion

TEST AND RESULTS: Intraocular pressure Right 15, Left 13. Fundus exam shows normal vitreous macula and intraorbital vessels. No evidence of retinal detachment. CT head WO contrast: No acute intracranial hemorrhage or infarct, no masses or midline shift. CBC 7.0>15.7/46.9<337 Factor VIII inhibitor negative. Factor VIII Clotting Activity: 61 (nl 50-180) PT 14. INR 1.1 PTT 33

FINAL WORKING DIAGNOSIS: ocular contusion

TREATMENT AND OUTCOME: He administered an emergency dose of Factor VIII immediately after the injury. Then he was admitted to the ICU for IOP monitoring and serial cranial nerve exams; was treated with Factor VIII 40 U/kg, or 3600 U q8h for 48 hours then resumed home Factor VIII dosing every 2 days. At discharge, he had normal IOP and reassuring neurologic exam. He used eye drops q2-4 hours for comfort. At ophthalmology follow up 1 week later, he had normal IOP and fundus exam. There is risk of developing angle recession glaucoma up to several months after injury and anticipatory guidance for sudden vision loss or eye pain discussed. He returned to full sport participation 2 weeks later.

661 May 27 1:20 PM - 1:40 PM
Abstract Withdrawn

662 May 27 1:40 PM - 2:00 PM
Concussion: Bouncy House
Angela Rufo. *Maine Dartmouth, Augusta, ME.* (Sponsor: James Dunlap, FACSM)
(No relevant relationships reported)

HISTORY

10 y/o M football player was referred by PCP for a concussion. Patient was jumping on a bouncy house four days earlier when he fell off and hit his head on the hardwood floor. No LOC. Brought to the ED and diagnosed with a concussion and sent home.

Over the next couple of days, had multiple episodes of emesis. Brought back to the ED, CT head showed a right occipital comminuted calvarial fracture with displacement fragment of bone intracranially and with an extra axial hemorrhage that was concerning for a subdural or epidural hematoma. Transferred to Maine Medical Center for a neurosurgical evaluation. Seen by neurosurgery and pediatric rheumatology and discharged home given stable exam. Admits to headache, photophobia, phonophobia, feeling slower, fatigue, drowsiness, difficulty falling asleep, irritability. No history of learning disorders and no previous concussions. Symptom Score 36.

PHYSICAL EXAM

General: NAD

HEENT: TTP right occiput large hematoma. PEERLA,

Neck: No TTP Full ROM. Spurling (-)

Neuro: CN2-12 intact, Sensation/Motor in all extremities intact

Memory short term: word recall (5/5) x 3. long term: intact

Cognitive: Recite months backwards 12/12, Days 7/7, Numbers 3/3, 4/4, 5/5

VOMS: intact, convergence 6cm, finger to nose intact

BESS: two leg no errors, one leg 4 errors, Tandem 2 errors

Psych: mood normal

DIFFERENTIAL DIAGNOSIS

Concussion, TBI, Subdural hematoma, Epidural hematoma, Subarachnoid, Migraine, Basilar Fracture, Occipital Fracture, Seizure Disorder

TEST AND RESULTS

CT head: Right occipital comminuted calvarial fracture with displaced fragment of bone intracranially with extra-axial fluid collection which could be a subdural or epidural hemorrhage component.

FINAL DIAGNOSIS

Concussion, Occipital bone fracture, and Subdural hemorrhage

TREATMENT AND OUTCOME

Return to school with accommodations, avoid bright lights and loud noises, limit screen time, avoid. Per Neurosurgery: Avoid any physical activity for 2-3 months

Follow at 2 weeks: Symptom Score 3. Patient much improved. Exam remarkable for poor balance

Pending Neurosurgery follow up next month. Follow up in clinic office 1 month.

663 May 27 2:00 PM - 2:20 PM

Eye Injury- Baseball

Erika Leigh Cohen, Lisa Odendal, Danielle Hirsch. *Johns Hopkins All Children's Hospital, Saint Petersburg, FL.* (Sponsor: Dilipkumar R Patel, MBBS, MBA, MPH, FACSM)
Email: erika.shuster@jhmi.edu
(No relevant relationships reported)

HISTORY: A 12 year-old male sustained an injury to left eye during a baseball game. While playing first base, the outfielder threw a ball to him so patient could tag the runner out. When catching the ball, he missed, and instead the ball struck him in the face in the area of the left eye. There was no loss of consciousness, vomiting, hematoma or altered mental status. He initially had difficulty seeing out of the eye, but vision returned soon after and appeared blurry.

PHYSICAL EXAMINATION: Normocephalic. With the exception of limitation in upward gaze of left eye, the remaining extraocular movements were intact. Hyphema of left eye noted. Pupils equal, round and reactive to light bilaterally. Moderate left periorbital edema and ecchymosis. Vision intact to left eye. Sensation intact in V1-V3 distribution, facial nerve function intact bilaterally. Normal occlusion, midface stable. Hearing to spoken voice intact and TM's clear with no evidence of hemotympanum. Remainder of examination was normal.

DIFFERENTIAL DIAGNOSIS:

1. Orbital Ridge Fracture
2. Orbital Blowout Fracture
3. Hyphema
4. Retinal detachment
5. Commotio Retinae
6. Globe Rupture

TEST AND RESULTS:

CT facial bones:

- Blowout fracture of left inferior and medial wall of left orbit
- Left orbital emphysema with small contusion vs hematoma within the retrobulbar fat
- Minimal blood within the left ethmoid and maxillary sinus

Ophthalmology Consult:

- Visual Acuity 20/30 Right, 20/200 Left
- 3 mm Hyphema of left eye
- Commotio Retinae of left macula
- Normal intraocular pressure

FINAL/WORKING DIAGNOSIS: Left orbital floor fracture, Traumatic Hyphema,

Commotio Retinae involving the macula

TREATMENT AND OUTCOMES:

1. CT scan without significant displacement and no ocular muscle entrapment on repeat exam, no operative repair needed; follow-up with plastic surgery 1-2 weeks
2. Per ophthalmology recommendations:

- a. Ongoing observation for cataract, retinal detachment, and glaucoma due to increased risk from blunt ocular trauma
- b. Bed rest with bathroom privileges 3-4 days
- c. Ophthalmic prednisolone and ophthalmic atropine for hyphema with monitoring for absorption and rebleed
- d. Monitor for macular hole as increased risk secondary to commotio retinae
- e. Follow-up in 1-2 days

664 May 27 2:20 PM - 2:40 PM

Head Injury - Soccer

Mark Sederberg, Melinda Loveless. *University of Washington, Seattle, WA.* (Sponsor: Stanley Herring, MD, FACSM)

Email: mseder@uw.edu

(No relevant relationships reported)

HISTORY:

A 16 year-old male presented to an outpatient sports medicine clinic one month after a head-to-head collision during a soccer match with concern for concussion. There was no loss of consciousness, and he continued to play the rest of the game with a mild headache. He felt normal and asymptomatic that evening and was able to complete homework. The following morning he felt tired, but was able to perform adequately at school. Over the coming weeks, he noticed progressive worsening of his cognitive symptoms and tiredness. His athletic trainer became concerned for a concussion and held him from practice. One week prior to presentation he noted midline lower lip numbness, teeth pain while chewing, hearing his pulse in his left ear, and poor sleep due to sweatiness. He also felt progressive lethargy and difficulty concentrating and missed the last three days of school due to these symptoms. His medical history was significant only for a recently diagnosed inguinal hernia.

PHYSICAL EXAMINATION:

Mild cognitive deficits in attention and memory, impaired balance on BESS, normal motor strength. Cranial nerve exam showed ptosis of the left eye, mild left facial nerve palsy, decreased hearing in the left ear, and altered sensation to light touch over the middle lower lip. There was no focal tenderness or deformity of the skull or scalp.

DIFFERENTIAL DIAGNOSIS:

Mild traumatic brain injury

Intracranial hemorrhage

Cerebral mass

Bell's palsy

TESTS AND RESULTS:

MRI Brain with and without contrast: Asymmetric enhancement of the left 7th cranial nerve, asymmetric nodular enhancement along the left 5th nerve with enhancement of muscles of mastication, diffuse bilateral pachymeningeal enhancement.

Complete Blood Count: WBC 19k, platelets 80, hematocrit 30.4

CT Chest, Abdomen, Pelvis: Large abdominal soft-tissue mass herniating through the inguinal canal, most consistent with a lymphoma

CSF Cytology: Enlarged B-cells most consistent with Burkitt lymphoma.

FINAL DIAGNOSIS:

Stage IV Burkitt lymphoma, with primary lesion in abdomen, and perimeningeal spread, causing cranial nerve V and VII palsies.

TREATMENT AND OUTCOMES:

- 1. Admitted for prompt initiation of chemotherapy.
- 2. Cranial nerve symptoms resolved with chemotherapy and steroids.
- 3. After multiple rounds of chemotherapy, there is no evidence of residual lymphoma.

665 May 27 2:40 PM - 3:00 PM

A Head-Scratching Head-to-Head Case

Priya Veda Nagarajan, Carrie A. Jaworski, FACSM. *University of Chicago NorthShore, Chicago, IL.*

(No relevant relationships reported)

HISTORY: A 16-year-old high school defensive linebacker with a history of two prior concussions sustained a head injury with impact on the left side of his head. He immediately fell to the ground and with loss of consciousness for 1-2 seconds. Once he awoke, he was able to stand and be assisted off the field. He noted bilateral upper extremity numbness and weakness along with right-sided facial "heaviness." He was assessed on the sideline and did not show signs of focal deficits but was symptomatic after vestibular testing and was held from playing the rest of the game. Approximately one hour after the injury, he became increasingly fatigued with return of his bilateral upper extremity numbness and right facial heaviness. He was transported to the emergency department at this point. **PHYSICAL EXAMINATION:** Sideline exam at time of injury revealed symmetric and normal cranial nerve exam, no C-spine tenderness, and symmetric upper and lower extremity strength and sensation. He exhibited dizziness with VOMS testing but no irregular eye movements. In the ED, he had right-sided facial droop, decreased sensation in the right cheek and jaw, and an otherwise normal exam. **DIFFERENTIAL DIAGNOSIS:** 1. Intracranial hemorrhage 2. Cranial nerve palsy 3. Cervical neuropraxia 4. Concussion **TEST AND RESULTS:** CBC, CMP, and coagulation tests all normal. CT head and neck: normal MRI brain and neck: normal. MRA brain and neck: irregular petrous segment of right

internal carotid artery lumen with concern for stenosis, possibly due to artifact versus nonocclusive arterial dissection, CTA recommended. CTA head and neck: normal. **FINAL WORKING DIAGNOSIS:** 1. Concussion 2. Neuropraxia of cervical spine 3. Neuropraxia of right marginal mandibular nerve (CN V) and zygomatic and buccal branches of right facial nerve (CN VII) versus entrapment of CN VII **TREATMENT AND OUTCOMES:**

- 1. Hospitalized for two days with evaluation by neurosurgery, trauma surgery, plastic surgery, and neurology 2. 5-day course of oral steroids 3. School accommodations given related to concussion symptoms 4. Right-sided facial droop fluctuated and persisted for 2 weeks with subsequent resolution 5. Cleared to start return to play protocol by neurosurgery at 3 weeks once exam returned to baseline 6. Finished seasons with no additional issues related to injury

B-18 Clinical Case Slide - Running I

Wednesday, May 27, 2020, 1:00 PM - 3:00 PM

Room: CC-3020

666 **Chair:** Kentaro Onishi. *University of Pittsburgh, Pittsburgh, PA.*

(No relevant relationships reported)

667 **Discussant:** Adam Tenforde, FACSM. *Spauling Rehabilitation Hospital, Charleston, MA.*

(No relevant relationships reported)

668 **Discussant:** Brian J. Krabak, FACSM. *University of Washington, Seattle, WA.*

(No relevant relationships reported)

669 May 27 1:00 PM - 1:20 PM

Buttock Pain - Marathoner

Allison N. Schroeder, Allison Bean, Kentaro Onishi. *University of Pittsburgh Medical Center, Pittsburgh, PA.* (Sponsor: Tom Best, MD, PhD, FACSM)

Email: aschroel@alumni.nd.edu

(No relevant relationships reported)

HISTORY: History and Physical Examination: A 50-year-old competitive marathoner presented with sudden onset right buttock pain that started while sprinting during a pub run 3 days prior to presentation. He described the pain as a deep ache that localized just medial to the right ischial tuberosity. Pain was worse with truncal flexion and knee flexion. It was most apparent when walking, but improved when he applied pressure over his ischial tuberosity while walking. He denied weakness and numbness/tingling that radiated down the leg.

PHYSICAL EXAMINATION: On examination, gait was not antalgic. There was no bruising, swelling, or change in muscle bulk of the right buttock and posterior thigh. Right hip range of motion was full but end range hip flexion induced pain. He was tender to palpation in the medial and cephalad aspect of the ischial tuberosity with no tenderness over the conjoint tendon or hamstring head of the adductor magnus at the ischial tuberosity. Strength was 5/5 in the bilateral lower extremities, but he had pain with resisted right knee flexion. Sensation was intact in the bilateral lower extremities.

DIFFERENTIAL DIAGNOSIS: 1. Hamstring tear or tendinopathy 2. Piriformis syndrome 3. Tear or tendinopathy of the deep hip internal rotators (obturator internus, super gemellus, inferior gemellus) 4. Gluteus maximus muscle injury 5. Sacrotuberous ligament sprain or tear 6. Ischial femoral impingement 7. Sciatic neuropathy 8. Atypical L5 radiculopathy

TEST AND RESULTS: Limited diagnostic ultrasound of the right ischial tuberosity region was performed with a 15-6 MHz linear array transducer and showed a normal hamstring without sonopalpation tenderness. The area just proximal and medial to the conjoint tendon origin was exquisitely tender on sonopalpation at the expected site of the sacrotuberous ligament. Cortical irregularity was present on the superior medial ischial tuberosity.

FINAL WORKING DIAGNOSIS: Right sacrotuberous ligament sprain

TREATMENT AND OUTCOMES: He was referred to physical therapy for right sacrotuberous ligament sprain focused on core strengthening and frequent gentle hamstring stretching. He was pain free after one month and was able to return to running.

670 May 27 1:20 PM - 1:40 PM

Abstract Withdrawn

671 May 27 1:40 PM - 2:00 PM

Bilateral Foot Pain--Cross CountryBrian F. Allen. *University of Minnesota, Minneapolis, MN.*

(Sponsor: David E. Olson, FACSM)

Email: allen793@umn.edu

(No relevant relationships reported)

HISTORY: A 15-year-old cross-country runner presented with 6 months of bilateral foot pain. Patient described "burning" pain over lateral aspect of both feet that would occur predictably after running 1-2 miles, then gradually resolve with rest within 2 hours. No symptoms reported at rest. She denies any associated back pain, lower extremity numbness or weakness. Prior treatments included changing shoes, orthotics, therapy for plantar fasciitis, and extended rest without any improvement.

PHYSICAL EXAM:

Bilateral pes planus. No deformity, swelling, or erythema. Full ankle range of motion. 5/5 strength. Nontender palpation over the first through fifth metatarsals, tarsals, phalanges, metatarsal pads, intermetatarsal spaces, base of 5th metatarsal, or navicular. She is nontender over the medial or lateral plantar fascia. Manipulation of the foot cannot reproduce the patient's pain. She has intact sensation and strong pedal pulses.

DIFFERENTIAL DIAGNOSIS:

1. Bilateral S1 radiculopathy
2. Lateral plantar nerve compression
3. Chronic exertional compartment syndrome
4. Bilateral bone stress injury
5. Intermetatarsal neuroma

TESTS AND RESULTS:

XR Foot bilateral: Normal

MRI Left Foot: Bone marrow edema around lateral cuneiform, cuboid, and base of 3rd and 4th metatarsal.

MRI Right Foot: Bone marrow edema of the cuboid, base of 3rd and 4th metatarsals.

EMG: Normal study. Exam limited to right side due to patient tolerance.

Running Analysis: Significant hindfoot hypomobility, lack of pronation moment, decreased proximal hip strength and core control

FINAL/WORKING DIAGNOSIS:

1. Lateral plantar nerve compression secondary to impaired running mechanics
2. Bilateral bone stress injuries

TREATMENT AND OUTCOMES:

1. Activity modification and relative rest
2. Continued to recommend manual therapy and subtalar joint mobilization
3. Neuro re-education and therapeutic exercise program
4. Return to run protocol

672 May 27 2:00 PM - 2:20 PM

Achilles Tendon - RunningJulie B. Barnett¹, Annette M. Zaharoff². ¹UT Health San Antonio Texas, San Antonio, TX. ²The Non-Surgical Center of Texas, San Antonio, TX. (Sponsor: Alexis Ortiz PT, PhD, SCS, FACSM, FACSM)

Email: barnettj3@uthscsa.edu

(No relevant relationships reported)

BACKGROUND

The Achilles tendon is a common site for chronic tendinosis, a condition characterized by overuse and degeneration of a tendon due to repeated micro-trauma and eccentric demands commonly used in athletic demands such as running. This can lead to pain and functional limitations for an athlete. There is a growing interest in non-surgical forms of treatment for this condition including provision of regenerative injection therapy (autologous blood and platelet rich plasma injections, PRP). In this case study, a runner with an Achilles tendon injury treated with PRP later underwent an MRI after her re-injury. The MRI finding corroborate healing and in this case read as a "surgical repair" when surgery had not been performed.

PURPOSE

The study objective was to discuss an MRI finding on a prior Achilles tear treated with PRP. The Achilles was reinjured and on the subsequent MRI, the findings said that the Achilles tendon had been previously surgically repaired when the treatment had been PRP injections only and not surgery.

METHODS

A review of literature for Achilles tear reveals data in support of eccentric strengthening and platelet rich plasma injections vs surgical repair if not a complete tear. Re-injury rates and rehabilitation protocol timelines for ankle tendon injuries in sports medicine are critical for successful outcomes.

RESULTS

The Achilles tendon initial injury was treated non-surgically with regenerative injections and physical therapy. The athlete returned to sport and reinjured the same tendon. The subsequent MRI read that the tendon had been surgically repaired.

CONCLUSION

Regenerative injection therapy results in MRI changes that appear to be of surgical repair imaging. Re-injury rates need to be evaluated in regards to return to play and rehabilitation protocols post regenerative injections with the inclusion of eccentric rehabilitation. True tissue healing, without scar tissue repair, has been discussed at the cellular level of healing for soft tissue injuries with the use of regenerative injections.

673 May 27 2:20 PM - 2:40 PM

Bilateral Foot Pain-Middle Distance RunnerDimitri Constantinou, FACSM¹, Paulo Ferrao², Nickiforos Saragas². ¹University of the Witwatersrand, Johannesburg, South Africa. ²Netcare Linksfield Medical Centre, Johannesburg, South Africa.

Email: dimitri.constantinou@wits.ac.za

(No relevant relationships reported)

HISTORY: A 14-year-old female middle-distance athlete presented with a history of unilateral (right) foot pain, diagnosed as a navicular stress fracture which was managed non-surgically and made a full clinical recovery. Nine months later she sustained a suspected traumatic spring ligament injury on the opposite side, with subsequent recurrence of pain in the right foot due to overload from the non-weight bearing management of the left foot injury. She therefore presented with bilateral athletics-related foot pain, one-sided apparently traumatic in nature and the other an overload injury.

PHYSICAL EXAMINATION: On clinical examination she was noted to have bilateral mild cavus feet with an antalgic gait pattern. Right foot: Calf and Achilles tendon did not reveal any abnormalities (Silfverskiold negative). Ankle was asymptomatic. The hindfoot joints were mobile and non-tender. There was significant tenderness over the talar navicular bone ("N" spot). The mid and forefoot examination did not reveal any abnormalities. The foot was neurovascularly intact. Left foot: Calf and Achilles tendon did not reveal any abnormalities (Silfverskiold negative). The ankle was asymptomatic. The hindfoot joints were mobile and non-tender. There was once again significant tenderness over the talar navicular bone with mild swelling. The spring ligament was not tender. The mid and forefoot examination did not reveal any abnormalities. The foot was neurovascularly intact. **DIFFERENTIAL DIAGNOSIS:** Navicular stress fractures, tendinopathy of the posterior tibialis tendons, tear of the spring ligament, separation of an accessory navicular

TEST AND RESULTS: Imaging with MRI revealed bilateral navicular stress fractures (figure 1), as indicated by bony edema and a fracture line. On close inspection, the navicular fracture lines were visible on x-ray (Figure 2). Further imaging with CT scans confirmed the navicular fractures and demonstrated sclerosis along the fracture borders with no cross trabeculation, suggestive of a non-union (figure 3). **FINAL WORKING DIAGNOSIS:** Bilateral navicular stress fractures

TREATMENT AND OUTCOMES: Open reduction and internal fixation (ORIF) and bone grafting. Postop rehabilitation and graded return to activity. Back to sports with no pain or swelling in her feet 1 year post surgery.

674 May 27 2:40 PM - 3:00 PM

Return To Activity After Exertional Heat Stroke - 14 YO RunnerWilliam O. Roberts, FACSM. *University of Minnesota, Minneapolis, MN.*

Email: rober037@umn.edu

(No relevant relationships reported)

HISTORY: 14 yo CC runner in for RTP recommendation 3 wks following collapse during his 1st race. 15 min into the race his legs felt tingly & he collapsed to the ground; he could feel the grass on his face & had a hard time opening his eyes; his breathing was labored & shallow; skin was blotchy & pale. His parents transported him car to the local hospital. The ED team started cooling immediately. He was confused, combative, swearing profusely, and throwing punches at staff. As his rectal temp decreased from 41.2°C to <39°C; his behavior improved, his skin color returned to NRL, & his HR dropped from 170 bpm to NRL. ED labs were Na 140, K 4.2, & glc 89. When he arrived at Children's Hospital by helicopter, his rectal temp was 37°C. He felt a little groggy his first day back to school, but quickly returned to baseline. He participated in a low level flag football game during gym class & was told that his cheeks became flushed & blotchy. He returned to cross country practice doing the warm up, which caused him no trouble. He was eating & sleeping normally & doing his school work.

PAST MEDICAL HISTORY: No prior heat injury or heat stroke. Normal cardiac workup (2015) for palpitations; his EKG no pre-excitation.

FAMILY HISTORY: No EHS, malignant hyperthermia, or genetic issues.

PHYSICAL EXAMINATION: BP 112/75; Pulse 68; Temp 37.1°C (O); Ht 157.5 cm; Wt 54.1 kg; SpO2 99%; BMI 21.8 kg/m²; APPEARANCE: Healthy NAD. SKIN: Color NRL. CV: RR no S3, S4, or murmur. LUNGS: Clear
DIFFERENTIAL DIAGNOSIS: EHS; EHI; He with dehydration
TESTS & RESULTS: Slight SGOT elevation, transient bump in CK level, no myoglobinuria; sickle cell trait negative; EKG & echocardiogram normal
FINAL WORKING DIAGNOSIS: EHS
TREATMENT & OUTCOMES: Risk factors for EHS include a previous history & lack of acclimatization. He had 7 practices prior to the meet & he may not have been fully acclimatized. He tends to go all in during competition & that may be part of his EHS collapse. Plan to return to practice at low level exercise & gradually progress his effort over the next 3 weeks; he was already doing warm-ups; add a quarter of a workout for week 1, half the workout for week 2, & full workout for week 3. If he tolerates progressive training, he can go back into competition in about 3 weeks. The weather conditions will cool as the CC season progresses. If he has another EHS episode, will get genetic & heat lab testing.

B-19 Rapid Fire Platform - Posture and Balance in Older Adults

Wednesday, May 27, 2020, 1:00 PM - 2:20 PM
Room: CC-Exhibit Hall

675 **Chair:** Jean L. McCrory, FACSM. *West Virginia University, Morgantown, WV.*
(No relevant relationships reported)

676 May 27 1:00 PM - 1:10 PM Hip Abductors And Adductors Explosive Capacity Correlate With Step Reaction Time In Older Adults

Marcel B. Lanza, Odessa Addison, Alice Ryan, Vicki Gray.
University of Maryland Baltimore, BALTIMORE, MD.
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(No relevant relationships reported)

A loss of strength and explosive capacity (the ability to produce force as quickly as possible) may be risk factors for falls in older individuals. However, it is poorly understood if the explosive capacity of an older individual correlates with the reaction time (RT) of a predictable or unpredictable response. **PURPOSE:** Our primary aim was to investigate the relationship between rate of torque development (RTD) of the hip abductors and adductors with anticipatory postural adjustments (APA) and RT to a simple (SRST) and choice reaction step (CRST). **METHOD:** Nine older adults (5 females; 73 ± 4 y; 1.66 ± 0.07 m; 74 ± 12 kg; X ± SD) performed maximal voluntary isometric contractions (MVIC) in a standing position at 30° hip abduction. Participants performed the test as hard and fast as possible and held for ~5s. RTD was measured at 50, 100, 200 and 300 ms from torque onset (RTD₅₀, RTD₁₀₀, RTD₂₀₀ and RTD₃₀₀) and normalized to body weight and height. For the SRST and CRST a visual stimulus displayed at eye level in front of the participants indicated when to step laterally as fast as possible. APA was calculated as the first time when the difference in vertical force under the two feet increased by 5% of body weight while RT was the time between the visual stimulus and removal of the foot from the force plate. **RESULTS:** No significant correlations were found between RTD₅₀ and APA or RT. Hip abductors APA did not correlate with RTD while adductors APA correlated with RTD₂₀₀ and RTD₃₀₀ for both SRST and CRST (r = -0.71, P ≤ 0.032). Hip abductors RT correlated with RTD₁₀₀, RTD₂₀₀ and RTD₃₀₀ during CRST (r = -0.73, P = 0.025; r = -0.783, P = 0.013 and r = -0.74, P = 0.025; respectively) which was similar between hip adductors RTD₂₀₀ and RTD₃₀₀ during CRST (r = -0.85, P = 0.004; r = -0.93, P < 0.001; respectively). Hip adductors RT at RTD₃₀₀ correlated with SRST (r = -0.70, P = 0.036). **CONCLUSION:** Older adults hip abductors and adductors explosive capacity may be important when responding rapidly to an unpredictable stimulus while hip adductors also appear important in reacting to an expected stimulus. Therefore, older individuals that are not able to produce torque as fast as possible, especially during the late phase of contraction, in order to initiate the step possibly present larger risk of falls.

677 May 27 1:10 PM - 1:20 PM

Do Muscle Strength And Functional Mobility Underpin Balance Confidence In Older Adults?

Ying Liu¹, Yujie Tong¹, Xinyi Xu¹, Gordon Waddington², Roger Adams², Jeremy Witchalls², Jia Han¹. ¹*Shanghai University of Sports, Shanghai, China.* ²*University of Canberra, ACT, Australia.*

(No relevant relationships reported)

PURPOSE: Physiological, psychological and social factors are the three major determinants of falls in older adults. Psychological factors, especially balance confidence, have been suggested to be strongly associated with falls. However, it is unclear whether strength and mobility are associated with balance confidence. The purpose of the current study was to explore whether muscle strength and functional mobility reflect balance confidence in the elderly. **METHODS:** A group of 27 healthy community-dwelling adults (8M, 19F, 70.22±4.9yrs old) were recruited. Balance confidence was evaluated by using the Falls Efficacy Scale International (FES-I); functional mobility was measured by single-task Timed Up and Go test (TUG), motor dual-task TUG and cognitive dual-task TUG tests; upper limb muscle strength was measured by grip strength with a hand dynamometer; lower limb muscle strength was measured by the 30-second Sit to Stand test (30STS). SPSS was used to analyze data, with Pearson's correlation and independent samples t-test employed to examine the relationships among the measures. **RESULTS:** Pearson's correlation showed that FES-I scores for the group were moderately correlated with single TUG (r=0.569, p=0.002), cognitive TUG (r=0.463, p=0.015) and motor TUG scores (r=0.562, p=0.002). However there was no significant correlation between FES-I scores and upper or lower limbs strength (both p>0.05). According to the FES-I cut-point score of 23 for low balance confidence, participants were divided into "high balance confidence" subgroup (n=12) and "low balance confidence" subgroup (n=15). Independent samples t-tests showed significantly worse scores for the low balance confidence subgroup in single task TUG (p=0.035) and motor dual task TUG (p=0.025). **CONCLUSIONS:** The findings from this preliminary study suggest that balance confidence is associated with functional mobility, but not with muscle strength. Thus, in order to improve balance confidence, interventions based on improving functional mobility, rather than strength, should be particularly targeted involved in physiotherapy programs.

678 May 27 1:20 PM - 1:30 PM

The Relationship Between Power Production And Fall Risk

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(No relevant relationships reported)

Falls can lead to prolonged periods of hospitalization and increased medical costs. Balance has commonly been defined as a three-system model (visual, vestibular, proprioception). However, there is a normal degeneration of these systems as we age which can increase fall risk (FR). Power production is required to catch oneself from a fall, therefore it may be an important aspect to consider in the treatment of those at risk of falling. **Purpose:** The purpose of this study is to explore the relationship between isokinetic average power production (IPP), of the knee extensors (KE) and ankle plantar flexors (APF), and FR utilizing the Fall Risk Questionnaire (FRQ), Five Times Sit to Stand (5xSTS), and the Dynamic Gait Index (DGI). **Methods:** 14 Older Adults (age: 74.8±9.1 yrs., height: 172.1±10.5 cm, body mass: 77.7±14.4 kg, 11 ♀) volunteered to participate in the study. Subjects began by completing the FRQ, thereafter, in a randomized manner, subjects were assigned to one of four tests: KE IPP, APF IPP, the 5xSTS, and the DGI. IPP was performed at 4 speeds (60, 120, 180 and 240°/s) for 5 repetitions, respectively with 5 min rest between trials. The highest average power (AP) for KE and APF was recorded. The 5xSTS was timed using an Apple iPhone stopwatch and the DGI was scored by a licensed Physical Therapist. **Results:** Statistical analysis by Pearson's r correlation with 95% confidence level revealed significant r values (p<.05) between variables. Mean FRQ scores, 5xSTS times, and DGI scores were 2.4±2.8, 9.2±5.1 sec, and 19.9±2.8, respectively. Mean KE-AP and APF-AP were 114.6±54.6 W and 55.2±25.1 W, respectively. Mean AP normalized per kg body weight were 1.45±.64 W/kg for KE-AP and .71±.3 W/kg for APF-AP. The FRQ demonstrated a significant r = .768 and r = -.896 with the 5xSTS and DGI, respectively. APF-AP was significantly correlated with FRQ and DGI (r = -.557; r = .610). Significant correlations were noted between APF-AP/kg and the FRQ and DGI (r = -.618; r = .691) along with KE-AP/kg and the 5xSTS (r = -.559). **Conclusion:** For one to complete these FR assessments, significant lower extremity power must be generated to maintain upright positions and promote a dynamic balance strategy. KE-AP and APF-AP demonstrate critical importance in successfully maintaining an adequate balance strategy, which is associated with decreased fall risk.

679 May 27 1:30 PM - 1:40 PM

Mental Workload During Balance Training In Older Adults With Fall RiskLauren Q. Higgins. *University of North Carolina at Greensboro, Greensboro, NC.*

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(No relevant relationships reported)

The attentional demand of postural control is greater for older adults and increases further for older adults with balance impairments or who experienced a recent fall. Training interventions have examined balance and fall risk in older adults; focusing on improving physical factors related to balance. Further benefit to these interventions may be observed by incorporating cognitive factors such as attentional focus. It has been proposed that an external focus (EF) of attention uses automatic processing, reducing the attentional demand of postural control. This may be reflected in the mental workload (MWL) required for task execution. **PURPOSE:** This study investigated if EF of attention reduces MWL during balance training in older adults with fall risk.

METHODS: Older adults (N = 15, 4 males; 78.5 ± 7.0 yrs) who reported a fall in the past year were randomly assigned to either an EF group (N=9) or internal focus (IF) group (N=6). Participants completed 12 weeks of balance training on balance boards, twice per week for 20 minutes (20 trials; 30s balance, 30s rest). Prior to each trial, groups received respective attentional focus cues. At weeks 1, 3, and 6, heart rate variability (HRV) during balance training, and the NASA Task Load Index (NASA-TLX) were used as an assessment of MWL. HRV, R-R interval data was collected using a heart rate monitor chest strap.

RESULTS: Two-way repeated measures ANOVA's revealed a significant effect of time on four HRV outcomes: SDNN (F(2, 10) = 6.66, p = .015, partial η^2 = .571), RMSSD (F(2, 10) = 9.18, p = .015, partial η^2 = .647), (F(2, 10) = 4.18, p = .048, partial η^2 = .455), and DFA short term fluctuation slope (F(2, 10) = 6.84, p = .013, partial η^2 = .578). A significant interaction effect was observed for the NASA-TLX (F(2, 10) = 4.22, p = .047, partial η^2 = .458). Follow-up analysis revealed no significant main effects due to a cross over interaction with EF means decreasing and IF increasing from week 1 to 6. **CONCLUSIONS:** Preliminary findings suggest objective measures of MWL represent a practice effect of balance training with attentional cues. Additionally, the observed cross over interaction for MWL proposes that an external focus of attention may be an advantageous training strategy for reducing perceived MWL.

FUNDING: NIH National Institute on Aging, Grant #: 1R15AG053866

680 May 27 1:40 PM - 1:50 PM

Effects Of Resting Posture On Gait Features During Timed Up And Go In Older AdultsEryn N. Murphy. *New Mexico State University, Las Cruces, NM.*

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(No relevant relationships reported)

Altered gait mechanics and longer time to complete a 3-meter timed up and go (TUG) task are risk factors for falls in older adults. While acute change in posture influences static balance, it remains unclear if a supine resting position alters gait patterns, compared to seated rest in older adults. **PURPOSE:** The purpose of the present study is to explore the effects of resting postures on TUG performance and gait features during the TUG task. **METHODS:** In this within-subject design study, thirty-eight older adults (73.55 ± 1.04 yrs, 71.89 ± 2.31 kg, 1.64 ± 0.01 m) completed the TUG under two randomly ordered resting conditions; following 10 minutes of seated rest (SEAT) and following 10 minutes of supine rest (SUP). Participants were instructed to begin on "go" and "begin when they were ready", with time starting when they reached a seated position in SEAT and SUP conditions respectively. Total time (TUG_{TOT}, s), averaged gait velocity (TUG_{VEL}, cm/s), cadence (TUG_{CAD}, spm), and active propulsion (TUG_{APT}, %) of the percentage of gait time when the center of gravity extends beyond the base of support until contralateral heel contact) over the single trial were calculated. TUG trials were calculated using Tekscan Walkway system. Paired sample t-tests were used to determine gait differences between two resting conditions. **RESULTS:** TUG_{TOT} was significantly longer after the SUP compared to the SEAT (12.14 ± 4.35 s vs. 10.52 ± 2.65 s, p=0.001). TUG_{VEL} was significantly slower after the SUP compared to the SEAT (85.28 ± 28.73 cm/s vs. 102.03 ± 21.43 cm/s, p<0.001). TUG_{CAD} was significantly lower after the SUP compared to the SEAT (108.94 ± 21.57spm vs. 119.44 ± 13.50 spm, p=0.001). TUG_{APT} was significantly less after the SUP compared to the SEAT (58.00 ± 25.53% vs. 71.72 ± 22.14%, p=0.012). **CONCLUSIONS:** Clinical standards identify older adults that take longer than 12 seconds to complete the TUG at increased risk of falling. Our results indicate that a sudden postural change from supine resting position results in increased falls risk. These findings have potential to inform patient, provider, and caregiver efforts to lower risk of falls in older adults.

681 May 27 1:50 PM - 2:00 PM

Rate Of Force Development Parameters In Young And Older Males During A Chair RiseTyler M. Smith, Phuong L. Ha, Alex A. Olmos, Matthew T. Stratton, Trisha A. VanDusseldorp, Alyssa R. Bailly, Yuri Feito, FACSM, Micah J. Poisal, Joshua A. Jones, Benjamin E. Dalton, Garrett M. Hester. *Kennesaw State University, Kennesaw, GA.*

(Sponsor: Yuri Feito, FACSM)

(No relevant relationships reported)

Assessing vertical ground reaction forces (VGRF) during a chair rise may yield insight regarding age-related differences in physical function, but a comprehensive assessment of rate of force development (RFD) during this task is lacking. **PURPOSE:** To compare RFD parameters during a chair rise in young (YM) and older (OM) males, and examine correlates of chair rise time. **METHODS:** Healthy, YM (n=15, age=20.7±2.2 yrs) and OM (n=15, age=71.6±3.9 yrs) performed a single chair rise as quickly as possible on a force plate without upper-body assistance. Peak VGRF (PF), as well as peak (highest 100 ms rolling average), early (minimum VGRF to 50% PF), late (50% PF to PF), and overall (minimum VGRF to PF) RFD were recorded. RFD was calculated as the linear slope of the force-time curve (Δ force/ Δ time) during the corresponding time spans. All force measures were derived from the normalized (body mass) force signal. Chair rise time was also obtained and the trial with the shortest time was used for subsequent analysis. Independent samples t-tests were used for group comparisons, and Pearson correlation coefficients were calculated for each group to examine select relationships. **RESULTS:** Chair rise time was similar between groups (p=0.256). Early RFD was similar (p=0.051), while PF (YM=1.57±0.13 vs. OM=1.33±0.10 N/kg; p<0.001), peak (YM=12.60±1.56 vs. OM=9.05±1.46 N/s/kg¹; p<0.001), late (YM=8.12±1.63 vs. OM=4.97±1.10 N/s/kg¹; p<0.001), and overall RFD (YM=7.57±1.24 vs. OM= 5.49±1.16 N/s/kg¹; p<0.001) were lower in the OM. For OM, only PF (r=-0.875; p<0.001) and peak RFD (r=-0.783; p=0.001) were correlated with chair rise time, while no correlations were present in YM. **CONCLUSION:** PF and RFD, especially peak and late RFD, were dramatically diminished during a chair rise in OM. PF and peak RFD demonstrated a strong inverse relationship with chair rise time in OM.

682 May 27 2:00 PM - 2:10 PM

Comparison Of Age, Gender, And Sport On Performance Of Stability Test In Senior ParticipantsRomina Villamonte¹, Dennis Eggert², Brent J. Feland². ¹*New Zealand Institute of Sport, Epsom, Auckland, New Zealand.* ²*Brigham Young University, Provo, UT.* (Sponsor: Ty Hopkins, FACSM)

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(No relevant relationships reported)

PURPOSE: The purpose of this study was threefold: to observe the differences in performance variables of the Modified Clinical Test of Sensory Interaction in Balance in active elderly participants and to compare results by age (50-59, 60-69, 70-79, 80+), sports (aerobic, basketball, golf, tennis, volleyball, and none), and gender. **METHODS:** Analyses were based on a sample of 525 World Senior Games attendees who were age 50 and over. Data were obtained from voluntary participation in balance and mobility screening as part of the health fair offered to all participants at the annual Hunstman World Senior Games. Of the 525 participants tested, 383 were participants in at least one sporting event at the games and 142 were non-participants. All modified CTSIB were performed on the NeuroCom Balance Master. The measured variables (center of gravity sway (degrees/sec)) were; firm surface with eyes open, firm surface with eyes closed, foam surface with eyes open, and foam surface with eyes closed. **RESULTS:** All data were analysed using SAS, version 9.4. An initial analysis of gender and age category was performed. A final model was run with the significant variables from the initial analysis plus sports category. Post hoc Tukey pairwise comparisons were also performed. A significant difference ($p < 0.0001$) was found between stratified age groups in all balance test variables. No significant differences were found between gender nor sports categories for the 4 balance variables.

Age (years)*	Participants (n)	*Firm Eyes Open	*Firm Eyes Closed	*Foam Eyes Open	*Foam Eyes Closed
50 - 59	140	0.2004	0.2494	0.6561	1.5904
60 - 69	237	0.2306	0.2816	0.7635	1.8823
70 - 79	128	0.2804	0.3448	0.8736	2.0625
80 +	20	0.3426	0.4966	1.1106	2.4164

CONCLUSION: While balance sway significantly increases with age in all 4 variables, they remain similar when comparing between gender and sports. This test may not be sensitive enough to detect differences between sports in our participants. Also,

our participants are probably too active to detect differences in the variables tested regardless of sports category. Further research is needed to better differentiate between active and non-active individuals and performance on the modified CTSIB.

683 May 27 2:10 PM - 2:20 PM
Balance Assessments In Older Adults After A Six-week Walking Intervention With Different Gait Devices

Abbie Payne, Megan Ruppert, Lana Prokop, Joshua Guggenheimer. *St. Catherine University, St. Paul, MN.* (Sponsor: Mark Blegen, FACSM)
(No relevant relationships reported)

Older adults have a relatively high incidence of falls, which are costly for both the individual and the medical system. Falls result not only in physical injury or death, but also can lead to a decreased quality of life - both mentally and socially. Measuring different aspects of balance can help predict the risk for falling. **PURPOSE:** This study investigated how walking with no device, walking poles, or a gait trainer impacted balance measures in older adults. **METHODS:** Fourteen participants (3 men, 11 women, aged 77.53 +/- 7.28 years) were randomized to one of three walking groups: Control (C) (n=4), Walking Poles (WP) (n=5), or Gait Trainer (GT) (n=5). The gait trainer is a new device aimed at preventing age-related gait decline. Assessments were performed at three separate times: prior to the intervention (Pre-test), immediately after the intervention (Post1), and six weeks after Post1 (Post2). Assessments included subjective measures of balance confidence during activities of daily living (Falls Efficacy Scale International and Activities-Specific Balance Confidence), and physical measures of balance (Berg Balance Scale (BBS) and the Timed Up and Go (TUG)). For the six-week intervention, all participants walked three times per week for 30 minutes in their assigned walking group. **RESULTS:** An ANOVA showed there were no statistically significant differences between the groups at Pre-test for all metrics ($p > 0.05$). All groups were below the cut off score of a high fall risk (≥ 14 s) for the TUG at Pre-test: C 9.00 ± 2.18 s, WP 9.41 ± 2.41 s, and GT 11.29 ± 4.99 s. All groups were above the cut off score (<45 out of 56) for greater risk of falls on the BBS at Pre-test: C 51.5 ± 1.29, WP 52 ± 5.00, and GT 48.4 ± 5.03. Between group measurements across time were analyzed using linear regression models for all metrics, with an alpha set at $p < 0.05$. There were no statistically significant differences between groups across time. **CONCLUSION:** This study found that the walking group did not impact balance measurements over time with the six-week walking intervention. All three groups were relatively high-functioning compared to age norms, which may have impacted scoring sensitivity on the TUG and BBS. Future studies may consider using more challenging interventions and balance assessments for higher-functioning older adult populations.

B-44 Thematic Poster - Biomechanics During Military Tasks

Wednesday, May 27, 2020, 3:15 PM - 5:15 PM
 Room: CC-2009

768 **Chair:** Richard W. Willy. *University of Montana, Missoula, MT.*
(No relevant relationships reported)

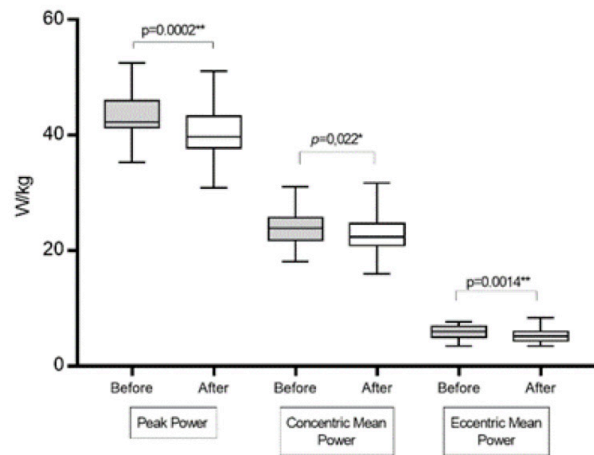
769 Board #1 May 27 3:15 PM - 5:15 PM
Military Parachuting Effects In Kinetic Variables From Countermovement Jump In Kinetics From Colombia

Jenner Cubides¹, Rodrigo E. Argothy², Maria Alejandra Dias³, Daniel Cohen⁴. ¹Militar school of cadets "General José María Córdova, Bogota, Colombia. ²Ministry of Sports, Bogota D.C., Colombia. ³Militar school of cadets "General José María Córdova, Bogota D.C., Colombia. ⁴University of Santander (UNDES), Bogota D.C., Colombia.
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The military parachuting course (MPC) is one of the combat courses offer during the Colombian military career. A literature research shows that this type of courses presents a high incidence and prevalence of injuries in the lower limbs in the landing phase. Additionally, different studies show that the injury rate in the lower limbs is 2-20 every 1000 jumps performed. The most compromised areas are the ankle and knee (ligament and sprains), where 80% of the injuries occur. Moreover, the militaries present a higher injury risk because of variable conditions: high wind speeds, external load and ground conditions. Then, a good landing is very important and it requires a good stability at the knee and a good distribution of the energy at the time of contact with the ground. **PURPOSE:** Identify the effects of the military parachuting course on the muscular performance of the lower limbs **METHODS:** Descriptive observational

study with an analytical component, in 43 male cadets of the Military School from Colombia, who participated in the MPC for 4 weeks. The performance of the lower limbs was evaluated by using uniaxial force platforms before and after the course. A statistical analysis was performed using the student T test and the Wilcoxon test statistic was used to evaluate changes after the MPC **RESULTS:** Significant differences were found in the jump height (29.32 ± 3.8 vs. 26.03 ± 3.6 cm, $p = 0.0001$), peak power (43.29 ± 3.4 vs. 40.62 ± 4.3 W/kg, $p = 0.0002$), peak landing force (57.65 ± 9.8 vs. 65.15 ± 12.4 N, $p = 0.002$), eccentric peak velocity (-1.09 ± 0.1 vs. -1.01 ± 0.2 m/s, $p = 0.005$), concentric mean power (23.72 ± 2.5 vs. 22.78 ± 2.8 N/kg, $p = 0.022$) and eccentric mean power/BM (5.88 ± 1.03 vs. 5.36 ± 1.09 N, $p = 0.001$). **CONCLUSIONS:** There is an impact on neuromuscular performance that affects the strength and power of the lower limbs, and increases the ground reaction forces in the landing phase. It could become a risk factor for injuries due to a change in the mechanism of acceptance of load at the landing stage.

Kinetic Changes of Countermovement Jump Test



770 Board #2 May 27 3:15 PM - 5:15 PM
Medial Compartment Gap Is Decreased During Forced Marching And Running Load Carriage Tasks

Camille C. Johnson, Kellen T. Krajewski, Dennis E. Dever, Ajinkya Rai, Katelyn F. Allison, Mita Lovalekar, William J. Anderst, Christopher Connaboy. *University of Pittsburgh, Pittsburgh, PA.*
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Medial compartment cartilage thickness can provide an indication of early stage osteoarthritis (OA), so determining tibiofemoral joint space during dynamic loading tasks is an important step in investigating potential long-term joint degeneration. Women experience higher rates of knee OA than men and military personnel are at an even greater risk, so understanding how military-relevant load carriage tasks will affect tibiofemoral arthrokinematics in a female population is of great importance in order to inform training strategies and prevent injury. **PURPOSE:** The purpose of the study was to determine the effects of load carriage and locomotion pattern on tibiofemoral dynamic joint space. **METHODS:** Twelve physically active females (age: 24.5±2.4 years) walked (WK), ran (RN), and force marched (FM, or walking at a high velocity) on a treadmill while unloaded (bodyweight, or BW) and while loaded with an additional +25%BW or +45%BW (14.3±2.0 kg, 25.6±3.5 kg). Synchronized biplane radiographs of the right knee were collected at 150 images/second for 1 second during each movement trial. A validated model-based tracking system determined femur and tibia motion (accuracy: 0.9°, 0.7 mm). Subchondral bone distances were calculated. Two-way RMANOVA with post-hoc Bonferroni correction were used to analyze the interactions and within-subjects effect of load (BW, +25BW, +45%BW) and percent of right leg support (0%, 10%, 20%, 30%) on minimum medial and lateral compartment gap during WK, RN, and FM, independently ($\alpha=0.05$). **RESULTS:** No significant interactions were observed between load and percent support. Medial and lateral gap was lower at initial contact vs. 10% and 20% support for FM (Medial: 38%, 33% decrease, Lateral: 26%, 23% decrease). Medial gap was 23% lower at 30% vs. 20% support for FM. For RN, medial gap was lower at 30% support vs. 10% and 20% (35%, 19% decrease). No significant changes in joint space were observed for lateral RN or medial/lateral WK. No significant differences due to load were observed. **CONCLUSION:** Changes in knee dynamic joint space appear to be more sensitive

to differences in knee kinematics rather than additional load magnitude and suggest kinematics plays a vital role in knee cartilage loading and potentially the development of OA. Supported by the Freddie Fu Student Research Grant.

771 Board #3 May 27 3:15 PM - 5:15 PM
The Effects Of External Loading On Lower Extremity Landing Biomechanics In College Rotc Cadets

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(No relevant relationships reported)

Military personnel performs in combat and physical training with extensive external loading from combat gear that may increase risk for lower extremity musculoskeletal injury. Lower extremity musculoskeletal injury risk is high in this population and can threaten deployment, completion of duty, and quality of life. However, there is limited research determining the effects of external loading on landing biomechanics in military situations. **PURPOSE:** To determine if external loading affects lower extremity landing biomechanics during a jump landing task in ROTC cadets.

METHODS: Twenty five ROTC cadets (age: 20.2±1.3yr; height: 174.4±11.3cm; mass: 77.0±5.1kg) were recruited and performed two conditions of three jump landings (baseline vs loaded landing with an additional 35% body weight (BW) vest) from a 30cm high box. The box was placed a distance of 50% of their height from the landing zone of two force plates. Lower extremity angular joint kinematics and ground reaction forces (GRFs) were compared between the two conditions using paired t-tests ($\alpha < .05$).

RESULTS: The loaded landing compared to baseline landing, resulted in decreased knee (16.8±3.7 and 19.4±4.7°) and hip (30.4±6.3° and 32.7±5.4°) flexion at initial contact (IC), and increased maximal joint flexion displacements for ankle (36.0±11.5° and 31.4±9.9°), knee (56.2±7.2° and 49.0±6.5°), and hip (23.8±5.6° and 18.5±4.9°). Furthermore, loaded landings, compared with baseline landings, exhibited significantly lower vertical GRF (2.3±0.5 N·kg⁻¹ and 2.7±0.5 N·kg⁻¹) and posterior GRF (0.6±0.1 N·kg⁻¹ and 0.7±0.1 N·kg⁻¹). **CONCLUSION:** Loaded landings increased key injury risk landing biomechanics. Less knee and hip flexion at IC have been associated with potential anterior cruciate ligament (ACL) injury risk and may increase ACL loading during landing. However, the less peak vertical and posterior GRFs with greater displacement of all three lower extremity joints on during loaded landing suggests cadets employed a compensation strategy that may reduce ACL loading after IC.

772 Board #4 May 27 3:15 PM - 5:15 PM
Sex-related Differences In Patellofemoral Joint Stress With Fighting And Approach Load Carriage

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(No relevant relationships reported)

PURPOSE: Female Soldiers have 2.2x greater risk for patellofemoral pain (PFP) compared with male Soldiers. Females may experience larger increases in knee loads, versus males, with added load carriage, which is standardized in the military across sexes. Thus, we assessed sex-related differences in patellofemoral joint stress (PFJS) metrics with the addition of fighting (20 kg) and approach (35 kg) load carriage.

METHODS: Via motion capture procedures, 34 healthy, well-trained individuals with load carriage experience (17 male(M):26.8 yrs±4.3, 78.9kg±6.8; 17 female(F): 23.8yrs±4.6, 64.3kg±8.1) completed instrumented treadmill trials (1.35 m/s) with and without 20-kg and 35-kg load carriage. Peak PFJS and PFJS loading rate were estimated with a musculoskeletal model and analyzed via repeated measure ANOVAs [Sex(2) x Load(3)]. Standard mean differences (SMD) were calculated on the relative change rate of PFJS metrics in males versus females with added load carriage.

RESULTS: Significant Sex X Load interactions ($p < .01$) were found for both peak PFJS and PFJS loading rate. While moderate SMDs were found between 0kg and 20kg carriage, large SMDs were found between 0kg and 35kg carriage indicating larger relative increases in PFJS metrics in females versus males. TABLE: Mean and standard deviations for variables. *corresponds to $p < .05$ between 0kg and 20kg; †Corresponds to $p < .05$ between 0kg and 35kg.

Variable	0 kg	20 kg	SMD 0 kg =>20kg	35 kg	SMD 0 kg =>35kg
Peak PFJS	M: 2.2 mPa± 0.6 F: 2.0 mPa± 0.6	M: 2.6 mPa± 0.9* F: 2.7 mPa± 0.6*	d=0.39	M: 2.9 mPa± 0.9*† F: 3.4 mPa± 1.0*†	d=1.03
PFJS Loading Rate	M: 22.8 mPa/s ±9.7 F: 18.7 mPa/s ±10.0	M: 25.8 mPa/s ±11.8 F: 25.9 mPa/s ±13.0*	d=0.42	M: 29.2 mPa/s ±12.1*† F: 34.5 mPa/s ±12.8*†	d=0.96

CONCLUSIONS: Females experienced greater relative increases in PFJS metrics with added load carriage compared with males, but only the approach load (35 kg) resulted in large SMDs. Thus, training volume, e.g., march distances, with approach loads should be increased more cautiously in females compared with males whereas fighting loads (20kg) appear less risky and may require minimal adjustments in training volume between sexes. These findings provide insight into why females have a disproportionately higher rate of PFP in the military than the general population.

773 Board #5 May 27 3:15 PM - 5:15 PM
Compromised Perception-action Coupling Performance In Military Personnel May Be Related To Increased Deep Sleep

Alice D. LaGoy¹, Shawn R. Eagle¹, Aaron M. Sinnott¹, Meaghan E. Beckner¹, William R. Conkright¹, Shawn D. Flanagan¹, Brian J. Martin¹, Bradley C. Nindl, FACSM¹, Fabio Ferrarelli², Anne Germain², Christopher Connaboy¹. ¹University of Pittsburgh, Pittsburgh, PA. ²University of Pittsburgh School of Medicine, Pittsburgh, PA.

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(No relevant relationships reported)

Operational stressors, such as caloric and sleep restriction and physical fatigue, may compromise perception-action coupling, the cooperative function of the sensory and motor systems, in military personnel. Prior sleep may protect against performance decrements and different sleep stages may conserve different aspects of performance.

PURPOSE: To investigate changes in perception-action coupling during simulated military operational stress and understand the role of sleep stages on performance. **METHODS:** As part of a 5-day study assessing resilience to simulated military operational stress, thirty-three (6 female) active duty and reserve status service members (25.8 ± 4.7 years) completed three trials of a novel perception-action coupling task (PACT) at 1700 after a night of baseline sleep (BASE), two nights of sleep restriction (T1) and a night of recovery sleep (T2). Participants had 8-hr for baseline and recovery sleep (2300-0700) and 4-hr disturbed sleep on intervention nights (0100-0300 and 0500-0700). Polysomnography was used to identify sleep stages. The tablet-based PACT requires participants make quick, accurate perceptual judgments and responses about whether varying sized virtual balls fit through virtual apertures. Outcomes of interest included response time (RT) and accuracy (ACC). Percent time in stage 2 (N2), slow wave (SWS) and rapid-eye movement (REM) sleep were median split to form high (more sleep in a stage) and low sleep groups. Differences in PACT performance between sleep groups across time were assessed using multiple mixed model (2 x 3) ANOVA. **RESULTS:** No significant sleep group x time interaction or main effect of time were found for RT or ACC. A significant main effect of SWS sleep group was found for RT ($F_{1,31} = 4.898, p = .034, \eta^2_p = .136$). The high SWS group had slower (worse) RT than the low SWS group (.886 ± .023 vs .814 ± .024 s). No other significant main effects of sleep group were found. **CONCLUSION:** Perception-action coupling was maintained during simulated military operational stress. Participants with more baseline SWS had worse PACT performance but other sleep stages, N2 and REM, did not relate to perception-action coupling. This suggests a specific effect of SWS, which is deep sleep, on perception-action coupling abilities and behaviors.

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774 Board #6 May 27 3:15 PM - 5:15 PM

Stroboscopic Effect On Functional Balance Performance In Special Operations Forces Combat Soldiers

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Reported Relationships: J.P. Mihalik: Ownership/interest/stock; Dr. Mihalik has an equity interest in Senaptec Inc., the company that manufactures and sells the stroboscopic eyewear used in this study.

Previous work has identified that standard concussion balance measures (e.g., BESS) do not differentiate Special Operations Forces (SOF) combat soldiers with and without concussion history. Recent evidence also associates incident concussion with a subsequent increased musculoskeletal injury risk. There is a need to study functional balance performance tasks designed to challenge this military population.

PURPOSE: To study the interaction between concussion history and increasing visual occlusion on functional balance performance in SOF combat soldiers. **METHODS:** 74 SOF combat soldiers (age=34.0±4.7 yrs) participated in our study and self-reported concussion history (33 no, 41 yes). All participants completed the Y-Balance Test (YBT) under 3 different counterbalanced visual conditions: 1) eyes-open, 2) low occlusion, and 3) high occlusion. Low (level 2) and high (level 6) occlusion conditions were produced using stroboscopic eyewear. Dependent variables included the right and left composite reach distance (percentage) for each vision level. Mixed model ANOVAs evaluated differences in composite reach distance between visual conditions and concussion history. **RESULTS:** Increasing vision occlusion affects right ($F_{2,144}=11.93$; $p<0.001$) and left ($F_{2,140}=14.41$; $p<0.001$) limb YBT performance regardless of concussion history, with both low (103.5%, 95%CI: 101.2,105.8) and high (102.3%, 95%CI: 100.1,104.4) occlusion resulting in diminished YBT performance compared to eyes open (105.3%, 95%CI: 103.1,107.5). SOF combat soldiers with no concussion history demonstrated better right ($F_{1,72}=5.28$; $p=0.025$) and left ($F_{1,70}=8.49$; $p=0.005$) limb YBT performance compared to those self-reporting concussion history regardless of vision occlusion. There was no interaction effect between visual occlusion and concussion history on right ($F_{2,144}=0.71$; $p=0.492$) or left ($F_{2,140}=0.01$; $p=0.993$) limb YBT performance in our sample. **CONCLUSION:** Increasing visual occlusion or self-reporting concussion history negatively affect SOF combat soldiers' YBT performance. These data suggest introducing stroboscopic eyewear and presenting SOF combat soldiers with a challenging balance task (e.g., YBT) may be an effective post-concussion assessment consideration. Funded by US Army Special Operations Command

775 Board #7 May 27 3:15 PM - 5:15 PM

Foot Acceleration Attenuation Reduces During Military Load Carriage

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Military personnel are at risk of stress fracture injuries, especially those in load carriage-based military occupational specialty, such as infantry. Recently, wearable inertial measurement unit (IMU)-based accelerometry has become a useful tool for identifying markers of lower extremity musculoskeletal injury risk in soldiers in field settings. **Purpose:** To compare differences in accelerometry between non-dominant and dominant foot using foot-worn IMU sensors during a 2km best effort run with heavy (20kg) load carriage. **Methods:** Acceleration data from six healthy participants (3 male: 30.33±6.7 y, 1.82±0.01 m, 77.80±11.0 kg and 3 female: 21.0±2.6 y, 1.66±0.1 m, 64.62±13.5 kg) were recorded using tri-axial IMU affixed to the dorsum of each foot. Participant performed a 2km best effort march (run and walk) across grass carrying 20 kg on their back. Data were divided into 200m +/- blocks from the beginning, middle and end of the exercise for analysis. The acceleration amplitudes from each trial were expressed as the root mean square (G_{RMS}), calculated as the average of the square of the acceleration over time, and were used to quantify the accelerations attenuation. The magnitude of the resultant acceleration signal Acc_x referred to as the "composite acceleration signal", was computed as: $\sqrt{acc_x^2 + acc_y^2 + acc_z^2}$, where acc_x , acc_y , and acc_z are obtained from each individual axis of the

tri-axial accelerometer. **Results:** The mean G_{RMS} values at the three phases obtained for the dominant and non-dominant feet of the men were 4.72, 5.15, and 5.23, and 4.93, 4.75, and 4.41 m/s^2 , respectively whereas those obtained for the dominant and non-dominant feet of the women were 3.91, 4.32, and 3.87, 4.42, and 4.71 m/s^2 , respectively. These findings revealed that the G_{RMS} values of the feet obtained for both sexes gradually increased during the load carriage task, except for the non-dominant foot of the men, which decreased. **Conclusion:** Increases in G_{RMS} during loaded marching suggest non-linear increases in culminative mechanical stress exposure as distance increases. Foot worn IMU-based measurement systems may provide means to accurately assess injury risk in real time. Supported by UK Ministry of Defence (WGCC 5.5.6-Task 0107) and US Dept. of Defense (W81XWH-17-2-0070).

B-45 Thematic Poster - Care of the Female Athlete

Wednesday, May 27, 2020, 3:15 PM - 5:15 PM
Room: CC-2007

776 **Chair:** Emily Kraus. Stanford Hospital and Clinics, Woodside, CA.
(No relevant relationships reported)

777 Board #1 May 27 3:15 PM - 5:15 PM

Practical And Applied Knowledge Of Athletic Trainers On The Female Athlete Triad

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BACKGROUND: The female athlete triad is the interrelation of low energy availability, menstrual dysfunction, and low bone mineral density. Athletic trainers are in a position to be able to identify the female athlete triad in athletes. However, limited research exists regarding practical and applied knowledge of the female athlete triad. **PURPOSE:** The purpose of this study was to determine the level of practical knowledge of athletic trainers on the female athlete triad and also determine if athletic trainers are applying this knowledge by properly screening athletes for the female athlete triad. **METHODS:** Certified athletic trainers (n=116) completed an online survey via Qualtrics that assessed both knowledge of the female athlete triad and current practical application of the female athlete. Linear-by-linear tests were used to find associations between practical knowledge and applied knowledge for related components of the triad. **RESULTS:** The athletic trainers mostly work with high school athletes (39%) and college athletes (32%). Fifty percent of the athletic trainers had at least 7 years of experience. Sixty-nine percent of the athletic trainers were female. While most of the general knowledge of the athletic trainers was high (for example 70% believe that increasing energy availability is key when returning an athlete back to sport and 73% believe that repeated stress fractures is a red flag for the female athlete triad) most of the applied knowledge was low (for example only 14% screen their athletes for eating disorders and only 36% ask about history of stress fractures). Linear-by-linear association ($p=0.050$) demonstrated an association between agreeing about importance of energy availability and always screening for eating disorders. However, we did not demonstrate linear-by-linear association ($p=0.354$) between agreeing that stress fractures are a red flag for the female athlete triad and asking about history of stress fractures. **CONCLUSION:** While general knowledge of the female athlete triad is high, a low percentage of athletic trainers appear to be applying their knowledge in prevention and detection of the female athlete triad. More education is need to help athletic trainers to implement screening, prevention, and return to play techniques to keep our athletes safe.

778 Board #2 May 27 3:15 PM - 5:15 PM

Prevalence And Impact Of Dysmenorrhea In Japanese Female Athletes

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(No relevant relationships reported)

Dysmenorrhea (menstrual cramps) is one of the big problems that many women suffers. It has been previously reported that dysmenorrhea is associated with lifestyle habit including sleep, exercise, smoking, and alcohol. Many female athletes have been reported to suffer with dysmenorrhea, however, the prevalence and impact of

dysmenorrhea and in relation to lifestyle in Japanese female athletes are not clarified yet. **Purpose** To investigate the prevalence and impact of dysmenorrhea in Japanese female athletes. **Methods** 98 collegiate female athletes participated in this study (mean age 21±1.6). Sports type in participants were soccer (n=23), track and field (n=31), kendo (n=13), wheel gymnastics (n=10), lacrosse (n=21). Demographic information questions addressed age, height, weight, length of sporting career, and training volume (training hour, training frequency per week, training hour per time). Lifestyle habits questions included daily wake-up time and bedtime, sleeping hours, dietary habit, coffee-drinking, alcohol-drinking and smoking habits. Age of menarche, day counts of menstrual cycle, day counts of menstruation, dysmenorrhea symptoms (e.g.; breast tenderness, abdominal pain, low back pain, headache), dysmenorrhea severity (from 0 to 10; none to very severe), and medication during menstruation were asked in the menstrual questionnaire. **Results** The dysmenorrhea symptom that many subjects complained were lower abdominal pain and fatigue. Length of sporting career, menarche age, training habits and lifestyle habits did not show significant correlation with severity of dysmenorrhea. However, the prevalence of severe dysmenorrhea positively correlated significantly with age ($p = 0.004$, $r = 0.29$). **Conclusions** In this study, we showed that severity of dysmenorrhea was associated with older age in Japanese female athletes. Therefore, in female athletes it is necessary to deal with dysmenorrhea considering age.

779 Board #3 May 27 3:15 PM - 5:15 PM

Female Athletes And Osteoporosis Risk

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Female athletes are participating in greater numbers than ever before. Across the last year, nearly 3.4 million female high school (NFSH, 2019) and 216,400 NCAA college-aged females (NCAA, 2018) competed in a variety of sports. Unfortunately, this phenomena has elevated concerns regarding the impact of relative energy deficiency in sport (RED-S) among such populations. The elevated energy expenditure required to drive such participation may lead to decreased energy availability, this coupled with hypothalamic disruption may place female athletes at greater risk of bone mineral density (BMD) loss than previously anticipated. **Purpose:** To evaluate BMD in female athletes. **METHODS:** Participants included 60 NCAA Division II college-aged female athletes from two southern universities and 13 participants aged 15 to 18 on a club team. The females identified themselves as Caucasian ($n = 59$), African American ($n = 8$), Latina ($n = 2$), or other ($n = 4$). BMD of the phalanges on the non-dominant hand was collected. Self-reported information about calcium intake, diet, and physical activity level were collected along with administration of the EAT-26. **Results:** The athletes ranged in age from 15-33 ($M = 19$, $SD = 2.2$) with a mean weight of 66.4 kg ($SD = 9.5$) and height of 1.7 m ($SD = .07$). The population was classified as asymptomatic and free of any self-reported disordered eating, and yet, not consuming the recommended amount of calcium daily (1200-1500 mg). Moreover, 31 (43.6%) participants currently had secondary amenorrhea, 15 participants (20.5%) reported a history of osteoporosis in their immediate family, and 12 participants (16.7%) had experienced a stress fracture. Of the 73 participants, 16 females (21.9%) were determined to have osteopenia. All 16 females were Caucasian. Consequently, there was a relationship between BMD and race ($r = .26$, $p < .05$) in addition to BMD and alcohol consumption ($r = .22$, $p < .05$). **Conclusion:** No relationship was found between the components of RED-S (amenorrhea and low energy availability) and BMD. However, Caucasian female athletes were at a greater risk for osteopenia than other races. This study was limited by the instrument utilized and site scanned. Further research should be conducted regarding site and sport specific adaptations on BMD employing scans from both the upper and lower body.

780 Board #4 May 27 3:15 PM - 5:15 PM

Comparing Bioelectrical Impedance Analysis To Air Displacement Plethysmography For Body Composition Assessment In Female Athletes

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(No relevant relationships reported)

PURPOSE: To compare bioelectrical impedance analysis (BIA) and air displacement plethysmography (ADP) for body composition assessment in female collegiate athletes.

METHODS: Retrospective review of body composition data for 61 NCAA female collegiate athletes (basketball $n = 14$, soccer $n = 31$, volleyball $n = 16$), measured by BIA and ADP on the same day. Paired t-tests, effect size using Cohen's d , Pearson's

correlation, and Bland-Altman plots were used to compare percent body fat (%BF) and fat-free mass (FFM) measurements from BIA and ADP for the whole sample, and within sports.

RESULTS: The sample included 61 female athletes ages 18-25 years ($\bar{x} = 19.5 \pm 1.4$ years), with heights ranging from 160-190.5 cm ($\bar{x} = 172.3 \pm 8.9$ cm), %BF measures ranging from 6.0-38.5% ($\bar{x} = 21.3 \pm 6.3\%$) for ADP and 13.4-36.0% for BIA ($\bar{x} = 22.5 \pm 4.7\%$) and FFM measures ranging from 36.2-69.3 kg ($\bar{x} = 53.4 \pm 6.8$ kg) for ADP, and 38.8-63.8 kg for BIA ($\bar{x} = 52.4 \pm 5.8$ kg). Overall, BIA and ADP had strong positive correlations for %BF ($r = 0.67$) and FFM ($r = 0.891$). BIA significantly underestimated FFM when compared to ADP (mean difference [MD] = -0.99 kg, $p = 0.016$, $d = -0.32$), while no significant difference was observed in %BF (MD = 1.17%, $p = 0.056$, $d = 0.25$). Linear regression on the Bland-Altman plots revealed small but significant negative trends for both %BF ($\beta = -0.34$, $p = 0.004$) and FFM ($\beta = -0.166$, $p = 0.01$) estimation by BIA in the total sample. This indicates possible proportional bias, in which BIA is more likely to overestimate %BF and FFM at low values, and underestimate %BF and FFM at high values. When comparing sports, BIA significantly overestimated %BF (MD = 5.42%, $p = 0.001$, $d = 1.14$) and underestimated FFM (MD = -3.71 kg, $p = 0.001$, $d = -1.07$) for basketball players and significantly underestimated %BF (MD = -2.06%, $p = 0.04$, $d = -0.56$) in volleyball players, when compared to ADP. No significant measurement differences were found in soccer players.

CONCLUSIONS: BIA gives comparable body composition results to ADP for soccer players, but gives conflicting results regarding over and underestimation of %BF and FFM in basketball and volleyball players. Conflicting conclusions based on sport may indicate the need for specialized equations when extrapolating body composition measures using BIA for athletes at the higher and lower ends of the spectrum of %BF and FFM.

781 Board #5 May 27 3:15 PM - 5:15 PM

Urogenital Dysfunction Among Female And Male High School Cross-country Runners

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(No relevant relationships reported)

While urinary stress incontinence or dysfunctions associated with this condition has been reported in various adult and female sport populations, less is known on their prevalence among distance runners, particularly adolescent female and male distance runners. **PURPOSE:** To determine the prevalence of urogenital dysfunction (UD) among female and male high school cross-country runners. **METHODS:** Participants consisted of 104 runners (48 females, 56 males; age: 15.7 ± 1.2), who competed in interscholastic cross-country in southern California. Each runner completed the Urinary Distress Inventory 6 (UDI-6) to assess urinary dysfunction. The UDI-6 is a six-symptom inventory that allows participants to categorize their symptoms during activities. Runners were identified as having had UD if they reported experiencing any of the six symptoms during the past 3 months. The runners completed the UDI-6 separately for symptoms during running and non-running activities. If a runner reported any of the six symptoms with "somewhat", "moderately", or "quite often", they were considered to have demonstrated UD. Relative risks (RR) and 95% confidence intervals (CIs) were calculated to examine associations between sex and UD. **RESULTS:** Overall, the number of runners reporting at least one UD symptom was twice as high during non-running activities (56.5%) than running activities (28.3%). Females were more likely than males to report two or more different UD symptoms during non-running activities (39.2% vs. 19.4%; $p=0.06$) and running activities (13.7% vs. 8.1%; $p=0.04$). Two female runners reported all 6 UD symptoms during running. Overall, frequent urination and leakage related to feeling of urgency were the most common urogenital dysfunction symptoms reported by the runners; and were reported more commonly during non-running activities compared to running activities (i.e., 45.2% vs. 13.5%, 21.2% vs 7.7%; respectively). Females were twice as likely (RR=2.06, 95% CI: 1.4-3.0; $p=0.001$) than males to report leakage related to feeling of urgency during non-running activities. **CONCLUSIONS:** Our findings indicated that urinary dysfunction symptoms are prevalent during non-running and running activities in high school cross-country runners; more so for females.

782 Board #6 May 27 3:15 PM - 5:15 PM

Physiological Parameters Of Bone Health In Elite Ballet Dancers

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(No relevant relationships reported)

Stress fractures are common among elite ballet dancers whereby musculoskeletal health may be affected by energy balance and overtraining. **PURPOSE:** To characterize bone health in relation to stress fracture history, body composition, and

eating disorder risk in professional male and female ballet dancers. **METHODS:** A single cohort of 59 professional ballet dancers (M=30, 24±6yr; F=29, 23±5yr) was recruited. All participants underwent bone and body composition measures using dual-energy-xray-absorptiometry (DXA). A nutritional screen and stress fracture history was also collected. Aged-matched Z-scores were calculated for bone mineral density (BMD) and body composition. A 1x3 ANOVA and Chi-Square test was used to compare BMD and frequency for history of stress fractures for those scoring 0-1, 2-6, and 7+ using the EAT26 questionnaire for eating disorder risk. Regression was used to predict BMD from body composition and demographic information. **RESULTS (Table):** Female dancers demonstrated reduced spinal (42nd percentile, 10%Z<-1) and pelvic (16th percentile, 72%Z<-1) BMD. Several anthropometric and demographic measures were predictive of BMD (p<0.05, r²=0.66-0.90, SEE=0.08-0.10g/cm²). Those with a 7+ EAT26 score were observed to have a higher frequency for history of stress fracture (p<0.05). Higher EAT26 scores were also associated with lower total and spine BMD. **CONCLUSIONS:** Professional female ballet dancers exhibit reduced BMD (particularly in the pelvis) and body mass compared to the general population whereby low BMD and stress fractures tend to be more prevalent in those with a higher risk of disordered eating. When considering only total BMD, regions of high BMD (legs) were found, in some cases, to mask areas of low BMD (spine, arms, pelvis). Lastly, anthropometric and demographic variables are predictive of BMD in this population and may be used as a field proxy in the absence of DXA.

A - BONE MINERAL DENSITY (All Dancers)

BODY REGION	TOTAL BODY		ARMS		LEGS		SPINE		PELVIS	
	M	F	M	F	M	F	M	F	M	F
BMD (g/cm ²)	1.37 ±0.02	1.16* ±0.02	1.04 ±0.17	0.76* ±0.11	1.47 ±0.02	1.2* ±0.02	1.27* ±0.02	1.04* ±0.02	1.3* ±0.02	1.07* ±0.02
Age, Gender - Matched Population Percentile Rank	85.86 ±2.5	62.42* ±4.59	88.99 ±2.47	54.88* ±5.06	81.25 ±3.14	62.58* ±4.10	88.15 ±1.96	41.55* ±5.65	38.01 ±3.84	15.67* ±3.56
Age Matched Z-score	1.5 ±0.11	0.39* ±0.17	1.88 ±0.20	0.29* ±0.23	1.24 ±0.15	0.43* ±0.16	1.52 ±0.13	-0.21* ±0.20	-0.29 ±0.11	-1.39* ±0.15
Freq. Osteopenia	0%	0%	0%	10.34%	0%	3.45%	0%	10.34%	0%	72.41%*

B - BMD FIELD PREDICTION MODELS

REGRESSION COEFFICIENTS	CONSTANT	Gender (±0.1, M±1)	Age (years)	Height (cm)	Weight (kg)	BMI	%BF	R ²	SEE
Total Body	-0.300		0.003	0.007		0.022	-0.006	0.703	0.080
Arms	0.405	0.081			0.007		-0.006	0.849	0.065
Legs	0.350	0.047	0.003	0.003	0.006		-0.007	0.758	0.088
Spine	-0.563	-0.093	0.007	0.007		0.034	-0.013	0.659	0.098
Pelvis	-0.715	-0.071	0.01	0.010		0.027	-0.012	0.658	0.100

EXAMPLE: Total Body BMD = -0.300 + (0.003 x AGE) + (0.007 x Height) + (0.022 x BMI) + (-0.006 x %BF)

C - EAT 26 SCORING & STRESS FRACTURE HISTORY (FEMALE DANCERS)

EAT 26 Score	TOTAL BODY (BMD)			SPINE (BMD)			STRESS FRACTURE HISTORY (%)		
	0-1	2-6	7+	0-1	2-6	7+	0-1	2-6	7+
	1.2 ±0.05	1.12* ±0.04	1.13 ±0.03	1.09 ±0.04	0.99* ±0.03	1.00* ±0.03	20%	0%	66%*

A - Data are presented as means ± SEM for sex-based comparisons of total and regional bone mineral density (BMD, g/cm³) between ballet dancers relative to population norms and frequency of low BMD by either age-matched Z-score (AM Z-score). * = Significantly different from male dancers. B - Regression analysis results for the prediction of BMD using standard anthropometric measures, gender, and age. C - Data are presented as means ± SEM for total and spine BMD grouped by EAT26 scores of 0 or 1, 2 to 6, and 7+. Data are also presented as frequencies for percentage of dancers within each EAT26 category that have a known history of stress fractures. ** = significantly different from 0-1 group. Type I Error for all analyses = p<0.05

783 Board #7 May 27 3:15 PM - 5:15 PM
Parameters Of The Athlete Triad In Male Ncaa Division I Athletes
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 (No relevant relationships reported)

Male athletes are at risk of developing a condition similar to the female athlete triad that is characterized by low bone mineral density (BMD), low energy availability (EA), and reduced reproductive hormones. However, the triad has not been well studied in males.

PURPOSE: The purpose of this study was to assess BMD and EA in male NCAA division I athletes participating in leanness emphasized sports (cross country and wrestling) and non-leanness sports (soccer and basketball). We hypothesized that EA and BMD would be lower in XC and wrestling compared to soccer and basketball and EA would be positively correlated with BMD.

METHODS: Participants included 27 NCAA division I male athletes (20.3 ± 0.3 yr) participating in soccer (n = 5) or cross country (XC, n = 7), wrestling (n = 10), or basketball (n = 5). Following a 12 hr fast and abstinence from physical activity, a resting metabolic rate test, dual energy X-ray absorptiometry scan, and 24-hour food intake recall was performed during an early morning testing session. Two unannounced follow-up food intake recalls were performed over the phone and used to determine mean daily energy intake. Activity energy expenditure was assessed using an Actigraph accelerometer for 7d. Low EA was defined: [(energy intake - activity energy expenditure) / fat free mass (kg)] ≤ 20 kcal/kg.

RESULTS: XC had lower BMI, fat free mass, total, lumbar spine, and dual femur BMD (g/cm²) compared to soccer, wrestling, and basketball. XC athletes also had lower total BMD, lumbar spine, and dual femur Z-scores compared to wrestling and basketball, but not soccer. XC had significantly greater EA than basketball.

CONCLUSIONS: In support of our hypothesis, BMD was lower in athletes participating in XC, a leanness sport, compared to all other sports. Surprisingly,

EA was highest in XC and negatively correlated with BMD. These data suggest the interrelationship between components of the athlete triad is complex and low EA may not be the primary cause of low BMD in male athletes.

	XC	Wrestling	Soccer	Basketball	Overall Sports
BMI (kg/m ²)	20.6 ± 1.1 ^b	25.7 ± 1.1 ^a	25.1 ± 1.0 ^a	26.9 ± 1.0 ^a	24.9 ± 0.7
Total Body Mass (kg)	64.3 ± 3.4 ^b	77.7 ± 4.3 ^{b,c}	81.2 ± 4.3 ^a	92.8 ± 5.2 ^a	78.9 ± 2.8
Fat Mass (kg)	7.6 ± 1.0	10.7 ± 1.2	11.3 ± 1.5	11.1 ± 1.6	10.4 ± 0.7
Lean Mass (kg)	53.8 ± 2.7 ^b	63.4 ± 3.1 ^b	66.3 ± 2.9 ^{b,c}	77.2 ± 4.2 ^a	64.9 ± 2.2
Body Fat Percentage (%)	12.4 ± 1.2	14.1 ± 0.9	14.2 ± 1.2	12.5 ± 1.5	13.5 ± 0.6
Energy Availability (kcal/kg FFM)	42.2 ± 9.0 ^b	27.1 ± 4.1	26.3 ± 3.6	23.7 ± 3.7	29.5 ± 2.8
Total Bone Mineral Density (g/cm ²)	1.2 ± 0.1 ^{b,c}	1.4 ± 0.0 ^{b,c}	1.4 ± 0.0 ^{b,c}	1.6 ± 0.0 ^a	1.4 ± 0.0
Total BMD Z-score	0.9 ± 0.4	2.1 ± 0.3 ^c	1.5 ± 0.2	2.5 ± 0.4 ^c	1.8 ± 0.2
Lumbar BMD Z-score	-0.2 ± 0.5	1.8 ± 0.4 ^c	0.9 ± 0.3	2.3 ± 0.4 ^c	1.3 ± 0.2
Dual Femur BMD Z-score	0.5 ± 0.3	2.3 ± 0.4 ^c	1.8 ± 0.2	2.6 ± 0.7 ^c	1.9 ± 0.2

Table 1. Results. Data are presented as mean ± SEM. ^asignificantly different vs. basketball (p < 0.05). ^bsignificantly different vs. XC (p < 0.05).

784 Board #8 May 27 3:15 PM - 5:15 PM
Weekly Training Volume Impacts On The Prevalence Of Iron Depletion In Female Athletes
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 (No relevant relationships reported)

Female athletes undergo rigorous training, travel, and competition schedules, and therefore may be susceptible to iron deficiency (ID), with further progression to stages 2 [iron-deficient erythropoiesis (IDE)] and 3 [ID anemia (IDA)]. **PURPOSE:** To investigate whether sporting discipline and training volume (≥ 10 h/week) impacted the prevalence of ID, IDE, and IDA in female athletes.

METHODS: A total of 85 athletes involved at higher levels of competition were assigned into groups according to sporting discipline (volleyball, n=36; handball, n=24; soccer, n=19; judo, n=6) and training volume (≥ 10 h/week, n= 47; <10h/week, n=38). The following iron depletion categorization was used: first stage-ID defined as serum ferritin <35 µg/L, transferrin saturation >16%, and hemoglobin >115 g/L; second stage-IDE defined as serum ferritin <20 µg/L, transferrin saturation <16%, and hemoglobin >115 g/L; and third stage-IDA defined as serum ferritin <12 µg/L, transferrin saturation <16%, and hemoglobin <115 g/L.

RESULTS: The prevalence of ID, IDE, and IDA were not significantly different between sporting disciplines (p>0.05). According to training volume, there was no difference (p = 0.53) at stage 1 between the groups (<10 h/week=49% vs. ≥ 10 h/week=42%). However, the results indicate that training volume ≥ 10 h/week significantly compromised iron status at stage 2 (39% vs. 17%, p=0.02) and 3 (3% vs. 0%, p=0.05) compared to lower training volume.

CONCLUSIONS: A similar prevalence of ID, IDE, and IDA suggests that female athletes competing in volleyball, handball, soccer, and judo are at a similar risk of disturbance in iron metabolism. A weekly training volume ≥ 10 h has an impact on iron status, promoting a higher prevalence of IDE and IDA in female athletes.

B-46 Thematic Poster - Hormones and Cytokines
 Wednesday, May 27, 2020, 3:15 PM - 5:15 PM
 Room: CC-2011

785 Chair: Linda E. May, FACSM. *East Carolina University, Greenville, NC.*
 (No relevant relationships reported)

786 Board #1 May 27 3:15 PM - 5:15 PM
Menstrual Cycle And Menopause Influence On Creatine Kinase Response After Exercise-induced Muscle Damage
 Nuria Romero-Parra, Rocío Cupeiro, Víctor M. Alfaro-Magallanes, Beatriz Rael, Laura Barba-Moreno, Cristina Maestre-Cascales, Eliane A. Castro, Ana B. Peinado.
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Studies with animals have demonstrated that estrogens contribute to limit exercise-induced muscle damage. However, this effect is not entirely clear in humans, despite some benefits have been observed. For instance, estrogen replacement therapy

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has shown to increase strength and reduce exercise-induced muscle damage in postmenopausal women. **PURPOSE:** To evaluate the influence of sex hormones on creatine kinase (CK) response after an eccentric squat-based workout in well-trained females with different hormonal profiles. **METHODS:** Nineteen eumenorrheic females (28.6±5.9 years, 163.4±6.1 cm, 59.6±5.8 kg) and thirteen postmenopausal females (51.7±3.7 years, 161±5.31 cm, 56.6±8.1 kg) participated in this study. A resistance-based workout was performed by the eumenorrheic females in the early follicular phase (EFP), late follicular phase (LFP) and mid-luteal phase (MLP) of their menstrual cycle, in a counterbalanced and randomized order. Postmenopausal females performed the protocol in a single visit. Blood samples were obtained at baseline and 2h, 24h and 48h after the eccentric workout to analyse serum CK. An unpaired t-test was performed to compare CK values between postmenopausal and eumenorrheic females. **RESULTS:** At baseline, postmenopausal showed higher CK concentrations (136.2±45.5 U·L⁻¹) in comparison to eumenorrheic women in the LFP (105.7±33.1 U·L⁻¹, p=0.039) and MLP (100.7±29.8 U·L⁻¹, p=0.012). However, these differences were not observed between postmenopausal and eumenorrheic women in the EFP (108.6±48.0 U·L⁻¹, p=0.114). No differences were observed in post-exercise time-points between postmenopausal and eumenorrheic women in any of the menstrual cycle phases analysed. **CONCLUSION:** Lower estrogen and progesterone concentrations may elicit higher CK values at rest. However, the lack of post-exercise differences between groups may indicate that the supposed protective role of sex hormones is not as determinant as other factors like intensity or training status. The IronFEMME Study is supported by the Ministerio de Economía y Competitividad (Contract DEP2016-75387-P).

787 Board #2 May 27 3:15 PM - 5:15 PM
Influence Of Aerobic Exercise On Select Cytokine And Hormone Levels In Pregnant Women.

Samantha Michelle McDonald, Cody Strom, Mary Remchak, Alec Chaves, Nicholas Broskey, Linda May, FACSM. *East Carolina University, Greenville, NC.* (Sponsor: Linda E May, FACSM)
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 (No relevant relationships reported)

PURPOSE: To determine the effects of prenatal aerobic exercise on select maternal cytokines and hormones.

METHODS: Data from an ongoing, 24+ week aerobic exercise intervention trial were used. Thirty-one participants of 128 randomized to aerobic (150 min of moderate weekly aerobic exercise) or control (no exercise) groups had fasted blood samples drawn at 16 and 36 weeks gestation and were eligible for analysis. Levels of NGF, IL-1 α , IL-6, IL-8, TNF- α , IL-10, Leptin, Insulin, Glucagon and GLP-1 Active were analyzed.

RESULTS: At baseline, women in the aerobic group had lower levels of TNF- α (p=0.01). At 36 weeks of gestation, aerobic-trained women had higher levels of IL-1 α (p=0.04) and lower levels of IL-10 (p=0.01). No statistical differences in the change of these biomarkers were found.

CONCLUSIONS: Prior to prenatal exercise, participants in the aerobic exercise group possessed lower inflammatory cytokines, however at 36 weeks of gestation, aerobic-trained women had higher levels of different inflammatory cytokines. The complexity of these biomarkers and their differing patterns of change during pregnancy may explain the null and unanticipated findings of higher inflammatory biomarkers following chronic exercise.

788 Board #3 May 27 3:15 PM - 5:15 PM
Sex Difference On Arterial Stiffness And Measures Of Pulse Wave Reflection Response To Weight Machines

Rebecca Schmidt, Erica M. Marshall, Jason C. Parks, Derek J. Kingsley, FACSM. *Kent State University, Kent, OH.*
 (No relevant relationships reported)

PURPOSE: To evaluate sex-specific responses to acute bout of machine weight resistance exercise on arterial stiffness and measures of pulse wave reflection.

METHODS: Resistance-trained men (n=21; Mean±SD: Age: 23±3yrs) and women (n=20; Age: 22±3yrs) volunteered to participate in the study. Arterial stiffness, measured via pulse wave velocity, and measures of pulse wave reflection, were evaluated at rest, and 10 minutes following an acute bout of weight machine exercise composed of 3 sets of 10 reps at 75% 1RM on the chest press, leg press, lat pulldown, leg flexion and leg extension. Two minutes of rest was given between sets and exercises. A 2x2x2 ANOVA was used to analyze the effects of sex (men, women) across condition (acute resistance exercise, control) and time (rest, recovery (Rec)).

RESULTS: There were no significant three-way interactions for any variable, as well as no sex specific responses. Acute resistance exercise had no effect on arterial stiffness (p=0.07), or augmentation pressure (p=0.16). A significant condition by time interaction (p=0.001) was noted for Alx@75 (Alx@75: Men: Rest: 7.0±8.1%; Rec: 19.4±9.2%; Women: Rest: 11.0±16.0%; Rec: 14.0±6.0%) such that it was increased in response to the acute resistance exercise, but not the control. A

significant (p=0.0001) condition by time effect was also noted for the subendocardial viability ratio (SEVR: Men: Rest: 141.0±24.0%; Rec: 82.1±38.0%; Women: Rest: 136.0±13.4%; Rec: 91.3±28.0%) in that the acute resistance exercise reduced SEVR during recovery, but not the control. There was also a significant (p=0.007) main effect of time for myocardial workload (Ew: Men: Rest: 809.0±639.2 dynes s/cm²; Rec: 984.0±896.0 dynes s/cm²; Women: Rest: 985.0±965.0 dynes s/cm²; Rec: 364.0±540.0 dynes s/cm²) in that it was reduced during recovery from the acute resistance exercise compared to rest, as well as the control.

CONCLUSIONS: These data suggest that weight machines may not significantly alter arterial stiffness or measures of pulse wave reflection differently between the sexes. However, an acute bout of resistance exercises consisting of weight machines may reduce function of the left ventricle for at least 10 minutes.

789 Board #4 May 27 3:15 PM - 5:15 PM
Effects Of Menstrual Cycle Phases On Measures Of Body Composition

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 (No relevant relationships reported)

Many women complain about weight fluctuation across the span of a month as a result of hormonal changes that accompany their menstrual cycle (MC). Specific research regarding the menstrual cycle phases of females and their effects on body composition measures have been limited to examining these changes as a subset of other variables. As water makes up approximately 73% of lean body tissue, fluctuations in body water due to changes in a women's MC may impact measurements of body composition

PURPOSE: To investigate whether phases of the MC have an impact upon common measures of body composition **METHODS:** 51 apparently healthy females between the ages of 18-45 participated in data collection sessions held weekly, at the same time of day, seven days apart, for a month. Each week, participants self-reported the presence or absence of menses during that week, including starting or ending days. Participants completed three body composition assessments: bioelectrical impedance analysis (BIA), dual-energy X-ray absorptiometry (DXA), and air displacement plethysmography (ADP) according to manufacturer's instructions, and also reported their exercise habits for the previous week. **RESULTS:** RMANOVA revealed no differences in physical activity levels between sessions for participants and that total body water amounts in participants did not change across time when measured via BIA. A 3 (device) x 4 (MC phase) RMANOVA demonstrated no significant device by phase interaction effects, nor were changes in body weight, body fat percentage, or lean body mass seen across time. However, significant differences in lean body mass measures (p = .001) between DXA and BIA (\bar{x} difference = 1.62 ± 0.4 kg) and DXA and ADP (\bar{x} difference = 1.74 ± 0.36 kg) measures were seen. **CONCLUSION:** Although there were no changes in body composition across the MC phases, there were differences in body composition values among the three types of devices used to quantify body composition. These findings suggest that differences in the technology used to quantify body composition may explain varying results across studies.

790 Board #5 May 27 3:15 PM - 5:15 PM
Transitioning From Daytime To Nighttime Operations During Military Training Negatively Impacts Dynamic Balance And Vertical Jump Performance In Elite Male Army Soldiers

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 (No relevant relationships reported)

PURPOSE: Investigate the impact transitioning from daytime to nighttime operations during military training has on dynamic balance and vertical jump performance in elite Army Soldiers. **METHODS:** This study was part of a larger study investigating the impact sleep loss and circadian desynchrony during military training have on the health and performance of elite Army Soldiers. Elite Army Soldiers (all male) performed a cognitive/motor battery (pre-test), including the Y-Balance Test (YBT) and a vertical jump assessment, approximately 2 weeks prior to switching from daytime to nighttime operations during military training (getting on a "reverse sleep cycle"). After the first night into the nighttime operation training (after a full night of sleep loss), the Soldiers were reassessed (post-test) on the YBT (n=74, 26.0 ± 4.1 years) and vertical jump (n=75, 26.2 ± 3.9 years). **RESULTS:** Compared to pre-test, the elite Army Soldiers demonstrated a significant decrease during the posteromedial reach bilaterally (Right = -2.4 ± 6.5 cm, p = .003; Left = -2.9 ± 7.1 cm, p = .001), and a significantly lower composite score bilaterally (Right = -4.4 ± 15.8 cm, p = .018; Left = -4.6 ± 14.7 cm, p = .009) on the YBT at post-test. In addition, at post-test, asymmetry in the posterolateral direction was significantly worse (1.3 ± 3.9 cm, p =

.004) compared to pre-test. No other significant pre- to post-test differences were noted on the YBT. The vertical jump height was also significantly lower (-1.0 ± 3.0 inches, $p = .004$) at post-test, compared to pre-test. **CONCLUSION:** Transitioning from daytime to nighttime operations during military training negatively impacts dynamic balance and vertical jump performance in elite male Army Soldiers. Considering the post-test was conducted after the first night into the nighttime operation training, where Soldiers missed their normal sleep opportunity, sleep loss and fatigue were likely contributing factors to the decreased performance. Investigating strategies that may limit these physical impairments during the transition from daytime to nighttime operations is warranted. Future research should also to investigate whether the noted impairments have any impact on this population's injury risk considering impaired dynamic balance has been associated with injury risk in other athletic populations.

791 Board #6 May 27 3:15 PM - 5:15 PM
Effect Of Sex And Neuromuscular Training On Lower Limb Stiffness Characteristics And Jump Performance

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(No relevant relationships reported)

Stiffness is potentially related to sports injury and athletic performance. Higher stiffness within a certain range may represent lower sports injury risk and better athletic performance. It is not clear whether a sex difference existed in lower limb stiffness changes induced by neuromuscular training.

PURPOSE: To investigate the effect of neuromuscular training on lower limb stiffness in both male and female young recreational athletes.

METHODS: Eleven recreational athletes (5 females: 24.4 ± 3.4 yr; 6 males: 24.0 ± 3.9 yr) underwent neuromuscular training 3 times a week for continuous 6 weeks, including plyometric training (e.g. squat jump, wall jump et al.) and strength training (e.g. barbell squat, bench press et al.) with progression every two weeks. Pre- and post-intervention measurements included: gastrocnemius lateralis (GL), gastrocnemius medialis (GM), soleus muscle and the Achilles tendon (AT) stiffness on both lower limbs by Myometer; vertical stiffness (Kvert), jump height and reactive strength index (RSI) by force plate during drop vertical jump from a 40 cm step.

RESULTS: Two-way repeated measures ANOVA was conducted and found no significant interaction between time and sex in all the variables mentioned above, but significant results on time in left GL stiffness ($p=0.021$), left GM stiffness ($p=0.008$), right AT stiffness ($p=0.040$), Kvert ($p=0.019$), jump height ($p=0.012$), and RSI ($p=0.008$). Paired-T test was further conducted and identified jump height in females increased significantly from pre (0.14 ± 0.04 m) to post (0.18 ± 0.05 m) intervention ($p=0.037$). After intervention, left GL stiffness had a downward tendency in males ($\Delta=39.69 \pm 68.24$ N/m) and females ($\Delta=70.00 \pm 60.46$ N/m); left GM stiffness tended to increase in males ($\Delta=34.17 \pm 82.22$ N/m) and decrease in females ($\Delta=29.60 \pm 63.53$ N/m); right AT stiffness ($\Delta=52.17 \pm 215.48$ N/m) and Kvert ($\Delta=199.33 \pm 207.36$ N/m) tended to decrease in males; RSI in males ($\Delta=0.16 \pm 0.15$ m/s) and females ($\Delta=0.162 \pm 0.146$ m/s) tended to increase.

CONCLUSIONS: Males and females may achieve similar benefits from neuromuscular training. Neuromuscular training can improve jump performance in females, with a tendency to decrease lower limb stiffness in males and females.

Supported by Shanghai University of Sports A1-3G02-19-000209

792 Board #7 May 27 3:15 PM - 5:15 PM
Cardiorespiratory Variables During A Maximal Running Test In Well-trained Females With Different Hormonal Profiles

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(No relevant relationships reported)

Differences in estrogen and progesterone levels along a natural menstrual cycle and an oral contraceptive (OC) cycle may influence female's performance. Previous literature reported lower strength, maximal oxygen consumption (VO₂ max) and systolic volume in OC users. According to postmenopausal women, their low and stable levels of sex hormones may affect them in a different way than in young women.

PURPOSE: To elucidate the effect of different hormonal profiles on maximal VO₂, heart rate (HR) and ventilation (VE) in well-trained females. **METHODS:** Thirty-three eumenorrheic females (30.1 ± 6.2 years, 59.3 ± 8.4 kg, and 164.1 ± 6.3 cm), twenty-three monophasic OC users (24.8 ± 4.3 years, 58.6 ± 5.8 kg, and 163.3 ± 5.1 cm) and thirteen postmenopausal women (51.0 ± 3.7 years, 54.9 ± 4.1 kg, and 161.5 ± 5.4 cm) participated in the study. A maximal graded test with a computerized treadmill was performed. Expired gases were measured breath-by-breath with the gas analyser Jaeger Oxygen Pro. HR was continuously monitored with a 12-lead ECG. Participants began with a

warm-up of 3 minutes at 6 km/h. Then, the speed was set at 8 km/h, increasing 0.2 km/h every 12 seconds until exhaustion. **RESULTS:** One way ANOVA reported lower values in post-menopausal females compared to the other two groups (eumenorrheic and OC users) for all variables measured: VO₂ max (2924.2 ± 389.7 ml/min for the eumenorrheic; 2808.8 ± 366.7 ml/min for the OC; and 2455.15 ± 281.04 ml/min for the postmenopausal; $p=0.001$), maximal HR (184.2 ± 10.3 ; 189.9 ± 8.4 ; and 172.1 ± 12.9 bpm respectively; $p<0.001$) and maximal VE (111.8 ± 17.5 ; 114.7 ± 15.1 ; and 96.4 ± 10.4 l/min, respectively; $p=0.003$). Nonetheless, no significant differences in VO₂max, HR and VE were found between eumenorrheic females and OC users. **CONCLUSION:** The drastic decrease of sex hormones in postmenopausal females, along with other hormonal and physiological changes caused by the age, may explain the drop in VO₂ max, HR and VE in this population. In terms of young women, despite literature reported lower values in OC users, the lack of difference observed in this study may be due to the lower concentrations of sex hormones that OC pills have nowadays, or because of the fact that all were well-trained participants.

Funding: DEP2016-75387-P (Spanish National Plan 2013-2016)

793 Board #8 May 27 3:15 PM - 5:15 PM
Work-matched High-intensity Interval And Moderate-intensity Continuous Training Adaptations On 17 Lactate Threshold Methods In Females

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(No relevant relationships reported)

PURPOSE: to compare exercise training effects on 17 lactate threshold methods to 6 weeks (3x/week) of high-intensity interval training (HIIT) or moderate-intensity continuous training (MICT) in females. **METHODS:** 24 healthy sedentary females (mean \pm SD: peak oxygen uptake 30.0 ± 3.2 mL·kg⁻¹·min⁻¹, peak power output 151 ± 21 W, body mass index 23.4 ± 2.6 kg·m⁻²) were randomly assigned to either HIIT or MICT. Participants performed a step-incremental test on a cycle ergometer (3-min stages of 25-W increments, starting at 25 W) pre- and post-training. The HIIT group (N = 12) performed a 10-min warm-up (power output (PO) at 70% of the maximal heart rate (HR_{max})), and four 4-min intervals (PO at 90% HR_{max}) interspersed with 4-min recovery at 30 W. The MICT group (N = 12) performed 60-min continuous cycling (PO at 90% of the first lactate turning-point (LT1)). Lactate thresholds were analyzed as: Log-log, onset of blood lactate accumulation (OBLA, N = 5), fixed value above baseline (Bsln+, N = 3), D_{max} and its modified versions (N = 5), lactate turning-points (LT1 and LT2), and the minimal lactate-intensity ratio (LT_{ratio}). A two-way analysis of variance was used to test differences within (post versus pre) and between groups. Additionally, the width of confidence intervals (CI_{width}) from the delta change was calculated for each method and group. **RESULTS:** In the HIIT group, the intensity derived from all the methods significantly increased after training ($p < 0.01$), except for LT_{ratio} ($p = 0.6$). In the MICT group, the intensity from OBLA, Bsln+, and the modified D_{max} methods significantly increased after training ($p < 0.05$), whereas Log-log, D_{max}, LT1, LT2, and LT_{ratio} did not improve significantly ($p > 0.05$). The HIIT group showed a higher increase in intensity from the D_{max} methods, and in LT1 and LT2 compared with the MICT group ($p < 0.05$). No differences were observed between the groups in the improvements of Log-log, OBLA, Bsln+, and LT_{ratio}. OBLA at 3.5 and 4.0 mM, and D_{max} presented the narrowest CI_{width} (range 7 - 12 W), while Bsln+ 0.5 mM, Bsln+ 1.0 mM, and Log-log had the widest CI_{width} (range 24 - 32 W). **CONCLUSIONS:** In healthy sedentary females, improvements of the D_{max} methods, LT1, and LT2 were superior in the HIIT group. The lowest intra-individual variability in response to training was observed in the D_{max} and OBLA at 3.5 and 4.0 mM methods.

B-47 Thematic Poster - Responses to Combined Heat and Hypoxia

Wednesday, May 27, 2020, 3:15 PM - 5:15 PM
 Room: CC-2010

794 Chair: Roy Salgado. *US Army Research Institute of Environmental Medicine, Natick, MA.*
 (No relevant relationships reported)

795 Board #1 May 27 3:15 PM - 5:15 PM
The Separate And Combined Effects Of Acute Simulated Altitude And High Ambient Temperature On Cycling Time Trial Performance

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 (No relevant relationships reported)

Simulated altitude and high ambient temperature independently compromise endurance performance, although there is limited evidence on the combined exposure to both stressors. In addition, the effect of corresponding underlying key mechanisms has yet to be quantified. **PURPOSE:** To investigate the separate and combined effects of acute simulated altitude and high ambient temperature on time trial (TT) performance, VO_{2max} , the ventilatory threshold (VT) and gross efficiency (GE). **METHODS:** Ten trained male cyclists performed 4 maximal incremental exercise tests (GXT) and GE-tests, both at sea-level (0 m; 20.93% O_2) and simulated altitude (2000 m; 16.3% O_2) in high environmental temperature (36.00 ± 1.4°C, 42.58 ± 0.8% RH) and temperate conditions (16.00 ± 0.32°C, 40.20 ± 1.2% RH). The GXT included 3 min at 100 W, followed by 25 W·min⁻¹ until volitional fatigue. GE was determined at 50% of the power attained at VO_{2max} in relative conditions, prior to and following 4000m TT performances. **RESULTS:** Although average PO was significantly reduced during TT performance at simulated altitude (31 ± 18 W, $p < .001$, $n_p^2 = .795$) and high ambient temperature (9 ± 16 W, $p = .007$, $n_p^2 = .570$), no significant interaction was found ($p = .137$). At simulated altitude, VO_{2max} (3.77 ± 2.1 ml·kg⁻¹·min⁻¹, $p < .001$, $n_p^2 = .925$), VT (3.39 ± 2.9 ml·kg⁻¹·min⁻¹, $p < .001$, $n_p^2 = .795$) and GE (0.72 ± 0.97%, $p = .021$, $n_p^2 = .555$) were significantly reduced compared to sea level. However, VO_{2max} (3.33 ± 3.1 ml·kg⁻¹·min⁻¹, $p = .005$, $n_p^2 = .608$) and VT (2.05 ± 3.1 ml·kg⁻¹·min⁻¹, $p = .021$, $n_p^2 = .462$) were significantly increased at high ambient temperature, although no effect on GE ($p = 0.240$) was found. **CONCLUSION:** The reduction in TT performance at acute simulated altitude is associated with a decline in VO_{2max} , VT and GE, likely because a lower SpO_2 . VO_{2max} and VT are significantly higher at acute high ambient temperature, likely because the metabolic cost of physiological heat stress increases relative exercise intensity at similar absolute PO. GE was unaffected by acute high ambient temperature, likely because heat exposure during the GE-test was too short to increase T_{core} . VO_{2max} , VT and GE were not compromised during combined exposure, which corresponds with the absence of a significant interaction effect in endurance performance.

796 Board #2 May 27 3:15 PM - 5:15 PM
Impact Of Heat Acclimation On Steady-State Exercise And Time-Trial Performance In Hypobaric Hypoxia (3500m)

Beau R. Yurkevicius, Kirsten E. Coffman, Karleigh E. Bradbury, Adam J. Luippold, Katherine M. Mitchell, Thomas A. Mayer, Nisha Charkoudian, FACSM, Charles S. Fulco, Robert W. Kenefick, FACSM, Roy M. Salgado. *USARIEM, Natick, MA.*
 (No relevant relationships reported)

Heat acclimation (HA) has been reported to improve endurance exercise performance in normobaric hypoxia. However, the impact of prior HA on exercise performance in hypobaric hypoxia (HH) is unclear. **PURPOSE:** To determine whether HA alters steady-state (SS) exercise responses and time-trial (TT) cycle performance during a 30 hour exposure to HH. **METHODS:** Thirteen sea level (SL) resident men (mean ± SD; age: 21 ± 3 years; height: 173 ± 8 cm; weight: 75 ± 12 kg; SL cycle ergometer VO_{2peak} : 43 ± 5 ml·kg⁻¹·min⁻¹) participated in two 30 hour HH exposures in a hypobaric chamber (496mmHg or ~3500m, 20°C, 20% RH). The HH exposures were separated by a 14 day washout period during which volunteers completed an 8-day exercise-HA protocol (2 hours of treadmill walking: 5km·h⁻¹, 2% grade; 40°C, 40% RH). During each HH exposure, volunteers completed 30 min of SS exercise followed by a 15 min cycle TT at ~2 and

24 hours of exposure. SS exercise consisted of cycling at ~50% SL VO_{2peak} while gas exchange (oxygen consumption (VO_2), minute ventilation (V_E), end tidal partial pressure of oxygen ($P_{ET}O_2$), and oxygen saturation (SpO_2)) were recorded. For the TT, volunteers completed as much work (kJ) as possible in 15 min, with heart rate (HR), SpO_2 , and Rating of Perceived Exertion (RPE, Borg Scale) recorded at the end of exercise. A two way repeated measures ANOVA was used to compare the effects of condition (Pre HA and Post HA) and time (~2 and 24 hours).

RESULTS: There were no condition x time interaction effects among the SS or TT variables. For main effect of condition, from Pre HA vs. Post HA, SS VO_2 tended to be lower (1.63 ± 0.00 L·min⁻¹ vs. 1.60 ± 0.01 L·min⁻¹; $p = 0.05$), $P_{ET}O_2$ was higher (75.7 ± 1.0 mmHg vs. 76.8 ± 0.7 mmHg; $p < 0.01$), and V_E and SpO_2 did not differ ($p > 0.05$ for both). For the TT, there was no main effect of HA on total work completed (106.8 ± 23.0 kJ vs. 103.8 ± 21.3 kJ), HR (159 ± 13 bpm vs. 158 ± 13 bpm), SpO_2 (83 ± 3% vs. 83 ± 3%), or RPE (17 ± 2 vs. 17 ± 2) ($p > 0.05$, for all).

CONCLUSIONS: Our results suggest that although HA may augment some aspects of ventilation during low-intensity SS exercise, exercise performance measured by a 15 min cycle TT in HH is not affected by HA.

Supported by USAMRDC; author views not official US Army or DoD policy

797 Board #3 May 27 3:15 PM - 5:15 PM
Effects Of Short-term Heat Exposure On Time Trial Performance In Moderate Hypoxia With Trained Athletes

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 (No relevant relationships reported)

PURPOSE: To examine the effect of a 5-day training protocol in the heat on physiological acclimation, perceptual responses, and 16 km time-trial performance in moderate hypoxia. **METHODS:** Twelve well-trained, healthy male participants (age = 27 ± 8 years; VO_{2peak} = 66.52 ± 4.94 ml·kg⁻¹·min⁻¹) were randomly assigned to a hot (HOT; 40°C, 35% RH) or control (CON; 18°C, 35% RH) group, and completed five consecutive days of cycling for 60 min at 50% VO_{2peak} . Participants completed a 16 km time-trial in hypoxia ($F_{O_2} = 0.165$; $S_{pO_2} = 86.00 ± 2.64$), pre- (TT1) and post-training (TT2), to determine if heat training enhanced hypoxic cycling performance. Rectal core temperature (T_{re}), heart rate, and rating of perceived exertion were assessed through the training protocol. **RESULTS:** Time to completion from TT1 (HOT = 1637 ± 110 s, CON = 1684 ± 117 s) to TT2 (HOT = 1617 ± 118 s, CON = 1671 ± 109 s) was reduced ($p = 0.029$); however, there was no interaction between groups ($p = 0.599$). There was no difference in mean ($p = 0.443$) or peak heart rate ($p = 0.651$) between TT1 and TT2 across both groups. Training resulted in a reduction in resting heart rate (Day 1: HOT = 61 ± 14 beats·min⁻¹, CON = 72 ± 4 beats·min⁻¹ vs. Day 5: HOT = 58 ± 11 beats·min⁻¹, CON = 66 ± 6 beats·min⁻¹; $p = 0.049$) and rating of perceived exertion (Day 1: HOT = 4 ± 1, CON = 3 ± 2 vs Day 5: HOT = 3 ± 1, CON = 2 ± 1; $p = 0.001$); however, there was no interaction between the groups. There was no significant difference in T_{re} ($p = 0.836$), mean exercising T_{re} ($p = 0.127$), or peak exercising T_{re} ($p = 0.152$) responses between Day 1 and Day 5 of the training protocol. **CONCLUSION:** This study found that the 5-day training protocol improved time-trial performance in hypoxia; however, there was no perceptual, physiological or performance benefits associated with training in the heat compared to normoxic conditions.

798 Board #4 May 27 3:15 PM - 5:15 PM
Heat Acclimation Does Not Alter Cutaneous Blood Flow During Steady-state Cycling Exercise At 3500 M Altitude

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 (No relevant relationships reported)

Cutaneous vasodilation is attenuated when exercise is performed in a hypoxic environment, which may impair convective heat loss. Heat acclimation (HA) improves cutaneous blood flow in response to an increase in core temperature; however, the effect of HA on cutaneous blood flow during exercise in hypobaric hypoxia has not been examined. **PURPOSE:** The aim of this study was to test the hypothesis that cutaneous blood flow would be augmented during steady-state exercise at 3500 m altitude (hypobaric chamber) following 8 days of exercise-HA. **METHODS:** Thirteen healthy men (21 ± 3 yr; ht: 173 ± 8 cm; wt: 75.1 ± 12.2 kg; sea-level VO_{2peak} : 42.9 ± 4.6 ml/kg/min) participated in two 30 h altitude exposures (495 mmHg / ~3500 m, 20°C, 20% RH) separated by a 14 day washout period in which they completed 8 days of exercise-HA (2 h of treadmill walking in 40°C, 40% RH). At hour ~24 of each altitude exposure, subjects performed a 30-min bout of steady-state submaximal cycling exercise (~50% sea-level VO_{2peak}). Red blood cell flux (laser-Doppler flowmetry) was continuously measured during a 5 min seated baseline period and minutes 20-25 of exercise. Cutaneous vascular conductance (CVC = red blood cell flux/mean arterial

pressure) was calculated and normalized to a percentage of maximum (local skin heating to 42°C). **RESULTS:** Compared to Day 1 of HA, core temperature (Day 1: 38.1 ± 0.3 vs Day 8: 37.8 ± 0.3 °C; p<0.01) and heart rate (Day 1: 134 ± 17 vs Day 8: 121 ± 13 bpm; p<0.01) were significantly lower at min 120 of exercise on Day 8, indicating HA was achieved. Baseline cutaneous blood flow at altitude was reduced after HA (pre: 7.3 ± 1.2 vs post: 5.1 ± 0.7 %CVCmax; p=0.03). During steady-state exercise at altitude, cutaneous blood flow was not different pre- and post-HA (pre: 23.5 ± 4.4 vs post: 20.9 ± 4.4 %CVCmax; p=0.53). **CONCLUSION:** These data suggest that HA does not alter cutaneous blood flow during steady-state exercise at 3500 m altitude. However, while the magnitude of the blood flow response is unchanged, cutaneous blood flow may be elevated relative to core temperature following HA. Future studies examining potential benefits of HA on the relation between cutaneous blood flow and core temperature during exercise at altitude are warranted. Supported by USAMRDC; author views not official US Army or DoD policy

799 Board #5 May 27 3:15 PM - 5:15 PM
Muscle Metabolic Responses To Repeated Sprint Exercise In Combined Heat And Hypoxic Condition
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 (No relevant relationships reported)

Hypoxia causes nitric oxide-induced vasodilatation and increases muscle blood flow during exercise as intensity dependent, which may mediate promoted training adaptations. On the other hand, exposure to heat stress also increases muscle blood flow during exercise. However, combined effects of heat and hypoxia on muscle metabolic responses to repeated sprint exercise are unclear. **PURPOSE:** To determine the effects of combined heat and hypoxic condition on muscle blood flow and muscle oxygen consumption following repeated sprint exercise. **METHODS:** Eleven male athletes (19.4 ± 0.4 years, 173.0 ± 2.3 cm, 72.8 ± 2.0 kg) completed repeated sprint exercise (three sets of 5 × 6 s maximal pedaling) under 3 different conditions, consisting of normoxia (NOR; 23 °C, FiO₂ = 20.9%), hypoxia (HYP; 23 °C, FiO₂ = 14.5%), and combined heat and hypoxia (HH; 35 °C, FiO₂ = 14.5%) with single blind, randomized crossover design. Power output, arterial oxygen saturation, skin and rectal temperature were monitored during the exercise. We also measured muscle blood flow and muscle oxygen consumption in vastus lateralis immediately after the exercise using venous/arterial occlusion and near infrared spectroscopy. **RESULTS:** Average power output was not different significantly among three conditions (NOR: 692 ± 18 W, HYP: 679 ± 17 W, HH: 685 ± 20 W). Arterial oxygen saturation was significantly lower in HYP and HH compared with NOR (NOR: 92.4 ± 0.7%, HYP: 82.6 ± 1.3%, HH: 82.2 ± 1.5%, p<0.05), while skin (NOR: 31.9 ± 0.3 °C, HYP: 31.7 ± 0.2 °C, HH: 34.7 ± 0.1 °C) and rectal temperature (NOR: 37.2 ± 0.1 °C, HYP: 37.2 ± 0.1 °C, HH: 37.4 ± 0.1 °C) were significantly higher in HH than in NOR and HYP (p<0.05). HH showed significantly greater muscle blood flow immediately after the first set of exercise compared with NOR (NOR: 0.61 ± 0.10 mL/min/100g, HYP: 0.81 ± 0.13 mL/min/100g, HH: 0.99 ± 0.16 mL/min/100g, p<0.05). However, muscle oxygen consumption did not differ significantly among conditions (NOR: 0.36 ± 0.04 mL O₂/min/100g, HYP: 0.42 ± 0.07 mL O₂/min/100g, HH: 0.44 ± 0.06 mL O₂/min/100g). **CONCLUSIONS:** Combined heat and hypoxic condition augmented exercise-induced increase in muscle blood flow during the initial phase of repeated sprint exercise in spite of similar power output compared with thermoneutral normoxic and hypoxic conditions.

800 Board #6 May 27 3:15 PM - 5:15 PM
Effect Of Heat Acclimation-induced Plasma Volume Expansion On Arterial Oxygen Content During Exposure To Hypobaric Hypoxia
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 (No relevant relationships reported)

INTRODUCTION: Exposure to high altitude results in a loss in plasma volume (PV) which augments hemoglobin (Hb) and thus arterial oxygen content (CaO₂). Conversely, heat acclimation (HA) results in plasma volume (PV) expansion. However, it is unclear whether HA-induced PV expansion impacts the change in PV and CaO₂ during a hypobaric hypoxia (HH) exposure. **PURPOSE:** To determine whether HA-induced PV expansion alters CaO₂ during HH exposure. **METHODS:** Thirteen sea-level natives (mean ± SD; men, age: 21 ± 3 yr; ht: 172 ± 0.8 cm; wt: 76 ± 13 kg; sea level VO_{2peak}: 42.9 ± 4.6 ml·kg⁻¹·min⁻¹) participated in a three phase study consisting of: a) 1) 30 hour HH exposure (HH1; 3,500 m, 495mmHg), 2) 14-day washout period in which volunteers completed an 8-day exercise-HA protocol (treadmill walking: 5 km·hr⁻¹, 2% grade; 40°C and 40% RH), and 3) second 30 hour HH exposure (HH2). After 20 minutes of seated postural control, venous and

arterialized capillary blood samples were collected pre- and post-HA and after 22 hours of HH1 and HH2. Samples were analyzed for Hb, Hct, arterialized oxygen saturation (SaO₂), and arterialized partial pressure of oxygen (PaO₂). The percent change in plasma volume (%ΔPV) was calculated in accordance with the Dill and Costill equation while CaO₂ was calculated using the following formula: CaO₂ = (1.34*Hb*SaO₂/100) + (0.0031*PaO₂). A t-test was used to assess differences in the %ΔPV, Hb, SaO₂, PaO₂, and CaO₂ between HH1 and HH2. **RESULTS:** The %ΔPV from pre- to post-HA was 7 ± 9%. From HH1 to HH2, the %ΔPV decreased to a greater extent (-12 ± 3 vs -17 ± 5; P < 0.01). From HH1 to HH2, Hb (16.1 ± 0.9 vs 16.0 ± 0.9 mg/dl), SaO₂ (89 ± 4% vs 90 ± 4%), PaO₂ (56.7 ± 2.8 vs 57.6 ± 3.2 mmHg) and CaO₂ (19.4 ± 1.1 vs 19.4 ± 1.3 ml/l) were not different (P > 0.05). **CONCLUSION:** Our results suggests that although HA induced a PV expansion; and there was a greater change in PV during HH2, CaO₂ was not affected. Supported by USAMRDC; author views not official US Army or DoD policy

801 Board #7 May 27 3:15 PM - 5:15 PM
High Intensity Intervals Expands Plasma And Improves Cycling Performance In Acute Hypoxia
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 (No relevant relationships reported)

Introduction: Hypoxia cause decrements in submaximal and maximal exercise performance. Hypervolemia may improve O₂ delivery to the metabolically active tissue, thus lowering physiological and cardiovascular strain during moderate exercise at altitude. Since two weeks are needed to acclimate to exercise in hypoxia, we sought to expand plasma volume (PVE) through a single bout of high intensity intervals (HI) to attempt to expedite improvements in aerobic performance. **Purpose:** To determine if the hypervolemic response to a single bout of HI intervals was sufficient to mitigate the hypoxia associated declines in exercise capacity. **Methods:** In our randomized counterbalanced study, 7 males (24.4 ± 5.8 years, VO_{2max} 46.9 ± 5.8 ml·kg⁻¹·min⁻¹, 12.8 ± 4.4% body fat) performed two 15km cycling time-trials (TTs) in normobaric hypoxia (FiO₂ = 15%) before and 48 hours following HI (8x4 minutes at 85% VO_{2max} with 4 minutes rest between rounds) or a control bout (CON) performed at 50% VO_{2max}, in which duration was extended in order to assure workloads were matched between conditions (identical kilojoules between conditions). Pre-exercise blood samples were collected to quantify changes in plasma volume, while hemodynamic data were collected utilizing PhysioFlow. **Results:** Increased PVE was observed 24 hours (6.96% ± 4.84%) and 48 hours (9.77% ± 4.26%) (p<0.05) following the HI bout while the CON condition decreased plasma volume 48 hours post (-3.75% ± 2.62%). Under the HI condition, participants showed an improvement in TT performance (Time: 1880 ± 215s to 1840 ± 203s, Power: 164.8 ± 41.2W to 171 ± 39.5W) (p < 0.05) and lowered HR (164.5 ± 9.5 bpm to 161.9 ± 8.8bpm) (p < 0.05). SV and Q manifested an upwards trend during TT performance within the HI condition (p = 0.09 and p = 0.08, respectively). There was no difference in performance, Q, or SV in the CON condition. Hydration, RPE, SaO₂, and blood lactate were similar in both TTs in hypoxia. **Conclusion:** A single bout of HI intervals resulted in increased cycling performance in acute hypoxia, accompanied by an enhanced PVE both 24 and 48 hours following exercise. This observed enhancement in cardiac efficiency following intense exercise may be desirable in military populations or individual desiring to complete physical tasks at moderate altitude without the means or time to fully acclimatize.

802 Board #8 May 27 3:15 PM - 5:15 PM
Effect Of Heat Acclimation On Incidence Of Acute Mountain Sickness During Exposure To Hypobaric Hypoxia (3,500 M)
 Roy M. Salgado, Adam L. Luippold, Kirsten E. Coffman, Karleigh E. Bradbury, Beau R. Yurkevicius, Katherine Mitchell, Nisha Charkoudian, FACSM, Charles S. Fulco, Robert W. Kenefick, FACSM. *US Army Research Institute of Environmental Medicine, Natick, MA.*
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 (No relevant relationships reported)

INTRODUCTION: Adaptations gained from heat acclimation (HA) can induce protective responses to a different stressor, such as hypoxia. Rapid ascent to altitude (hypobaric hypoxia, HH) increases the risk for acute mountain sickness (AMS). However, it is unknown whether HA can protect against the development of AMS during exposure to HH. **PURPOSE:** To determine if prior HA reduces the incidence of AMS during a 30 hour exposure to HH (3,500 m). **METHODS:** Thirteen unacclimatized healthy men (mean ± SD; age: 21 ± 3 yr; ht: 172 ± 8 cm; wt: 75.1 ± 12.2 kg; sea level VO_{2peak}: 42.9 ± 4.6 ml·kg⁻¹·min⁻¹) participated in three study phases consisting of: Phase 1) baseline (pre HA) 30 hour HH exposure (HH1; 3,500 m), Phase 2) 14-day washout period during which volunteers completed an 8-day exercise-HA

protocol (treadmill walking: 120 minutes at 5 km·hr⁻¹, 2% grade; 40°C and 40% RH), and Phase 3) post HA 30 hour HH exposure (HH2). During the HA protocol, heart rate (HR) and core temperature (T_c) were recorded throughout exercise. AMS was assessed using the Environmental Symptoms Questionnaire after ~12, ~21, and ~23 hours of exposure during each HH phase. HR and pulse oxygen saturation (SpO₂) were measured at rest immediately after assessment of AMS. A t-test was used to assess difference in HR and T_c from Day 1 and Day 8 of HA. For the HH exposures, HR and SpO₂ data were analyzed by fitting a mixed effects model as implemented by GraphPad Prism 8.1.2. **RESULTS:** Heat acclimation was achieved as indicated by a lower T_c (Day 1: 38.1 ± 0.3 vs Day 8: 37.8 ± 0.3 °C; p<0.01) and HR (Day 1: 134 ± 17 vs Day 8: 121 ± 13 bpm; p<0.01) at the end of exercise on Day 8 compared to Day 1. Three of 13 volunteers developed AMS during HH1 but not during HH2. A fourth volunteer only developed AMS during HH2. From HH1 to HH2, resting HR (84 ± 6 vs 83 ± 7 bpm) and SpO₂ (87 ± 2 vs 88 ± 2%) were not different (both p >0.05). **CONCLUSION:** Our results suggest that in unacclimatized individuals, HA may be an effective, though not perfect training strategy for reducing the incidence of AMS during rapid exposure to 3,500 m. Changes in AMS incidence could not be explained by alterations in HR or SpO₂. Supported by USAMRDC; author views not official US Army or DoD policy.

B-48 Thematic Poster - Spine

Wednesday, May 27, 2020, 3:15 PM - 5:15 PM
Room: CC-2000

803 Chair: Ajit Mohan Worthen Chaudhari, FACSM. *The Ohio State University, Columbus, OH.*
(No relevant relationships reported)

804 Board #1 May 27 3:15 PM - 5:15 PM
Spinal Range Of Motion And Back Pain In Female Artistic Adolescent Gymnasts

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PURPOSE: Back pain is a common complaint among female gymnasts, but it is unknown if gymnasts with back pain demonstrate different movement patterns during gymnastics skills compared to those gymnasts without back pain. Our purpose was to evaluate gymnasts' movement patterns in their native environment using wearable sensors. Specifically, we examined three-dimensional spine range of motion (ROM) during back walkovers (BWOs) and back handsprings (BHSs) on the floor and balance beam. **METHODS:** Female artistic gymnasts ages 8 to 18 years were divided based on presence or absence of self-reported back pain within the last 12 months. Gymnasts performed BWOs and BHSs on floor and balance beam while wearing APDM Opal V2 sensors. Valid spine sagittal plane maximums, minimums, and ROM during trials for each skill were compared between groups via Kruskal Wallis analysis of variance. **RESULTS:** Seventeen participants (n=6 with back pain, mean age=13.9±2.6 years; n=11 without back pain, mean age=13.3±1.7 years) completed BWOs and BHSs. There were no demographic differences between groups for age, height, weight, competition level, or years of experience. Gymnasts with back pain had a greater maximum back extension (45.0±15.4° back pain vs. 34.6±7.1° no pain; p=0.011, Cohen's d=1.46) and range of motion (94.6±18.9° back pain vs. 80.9±19.6° no pain; p=0.032, Cohen's d=0.70) during BWOs compared to gymnasts without back pain. There were no differences between groups in peak extension, peak flexion, or ROM during BHS skills. **CONCLUSION:** Gymnasts with a history of back pain had increased spinal motion when performing BWO skills. To perform a BWO, gymnasts must have higher levels of shoulder, spine, and hip flexibility, which may relate to back pain. This study suggests the need for future studies to evaluate if increased spinal motion during gymnastics is a contributing factor to the development of back pain.

805 Board #2 May 27 3:15 PM - 5:15 PM
How Does The Dancer's Spine Move? Application Of A Multisegmented Model.

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(No relevant relationships reported)

How does the dancer's spine move? Application of a multisegmented model.
Purpose: Historically, most biomechanical studies of the spine used a rigid single segment model. However, recent studies show that spinal segments do not move together predictably and that a multi-segmental model improves discrimination between patients and healthy controls. Although professional dancers experience low back pain equal to or more than the general and sporting population, to date, no study has described multi-segmented spinal motion of the dancer during any dance specific tasks which may place unique mechanical demands on the spine. The purpose of this study was to describe spinal motions of professional dancers during a common dance task, the arabesque, using a multi-segmented spinal model. **Methods:** As part of larger study, 25 professional dancers (ages 24.8 +/-6.2; 5 males) performed two trials each of a right and left arabesque at their own pace while spinal kinematics were captured using a five-segment model (pelvis (PEL), lower lumbar (LL), upper lumbar (UL), lower thoracic (LT) and upper thoracic (UT). Motion was captured from initiation of vertical foot movement and ended at maximal foot height. Two trials were averaged and all values were time normalized. **Results:** Means and standard deviations of motion in all segments in three planes were identified. In all three planes, the two upper segments (UT-LT and LT-UL) contributed 69-87% of the total spinal motion. In the coronal plane, side-bending of all segments occurred ipsilateral to the lifted leg with 54% of all motion occurring at a single segment (LT-UL). In the sagittal plane the spine generally extended, however the upper segment (UT-LT), began and remained in a flexed position throughout the motion, although it extended during the motion. In the transverse plane all segments rotated contralateral to the lifted leg. However, the lower two spinal segments contributed almost no motion. **Conclusion:** This study demonstrated that segmental motion was not uniform in degree or direction across multiple spine segments during an arabesque. Most spinal motion occurred in the upper spine. Using a multi-segmental model may improve understanding of the biomechanical stressors experienced by professional dancers.

806 Board #3 May 27 3:15 PM - 5:15 PM
Appropriate Neck Flexion Without Head-hitting Decreases The Thrown Player'S Risk Of Brain Injury In Judo

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(No relevant relationships reported)

PURPOSE: Judo is one of the worldwide sports and its competitive athletic events have been held in Olympic Games. Serious brain injuries, however, have been occasionally noted in judo practices and/or competitions. Since the patterns and severities of brain injuries largely depend on the kinematics of the thrown players, it is essential to investigate the mechanism of brain injury from the biomechanical viewpoint in popular throwing techniques. The aim of this study is to evaluate the brain injury criterion (BrIC), an indicator of brain injury, with measuring the presence or absence of head-hitting on the anthropomorphic test device (ATD) in judo throwing technique Ouchi-gari.

METHODS: A male judo expert (thrower) threw an ATD for 6 times by Ouchi-gari with or without head-hitting, respectively. The ATD with a straight neck component necessarily hit the occipital region on the mat, whereas an angled component was designed for preventing the ATD's head-hitting. A 3-axis angular rate sensor, mounted in the gravity center of the ATD's head, assessed head axial angular velocity in each trial. To evaluate the ATD's head impact quantitatively, we calculated the BrIC from the head axial angular velocity. High-speed digital video cameras also recorded the kinematics of the ATD's whole body during trials.

RESULTS: In all trials, the largest angular velocities were recorded in the phase of the initial head (with head-hitting) or back (without head-hitting) contacting to the mat. The peak BrIC values of ATD ranged from 0.94 to 2.27 (with head-hitting) and 0.54 to 0.91 (without head-hitting). The average BrIC value with head-hitting (1.62 ± 0.22, mean ± S.E.) trials was significantly higher than those without head-hitting (0.73 ± 0.08) trials (p<0.05). Four out of six trials with head-hitting scored BrIC values larger than 1.0, which implies the human tolerance limit for serious brain injury. However, BrIC values were less than 1.0 in all other trials without head-hitting.

CONCLUSIONS: These results suggested that thrown player's break-fall technique, with appropriate neck flexion to avoid head-hitting, decreases the BrIC value effectively and the risk of serious brain injuries in judo.

807 Board #4 May 27 3:15 PM - 5:15 PM
The Effectiveness Of Electromyography Biofeedback At Improving The Upper Trapezius To Serratus Anterior Activation Ratio

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 (No relevant relationships reported)

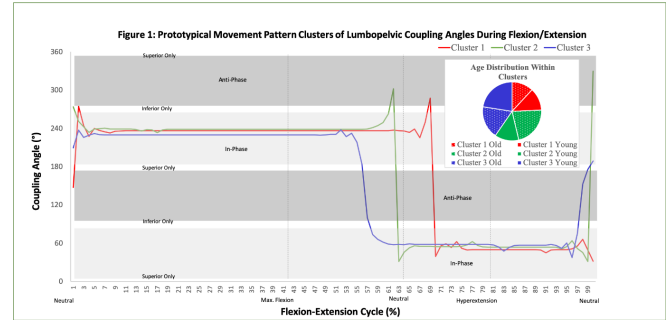
The upper trapezius (UT) to serratus anterior (SA) muscle activation ratio is essential for optimal shoulder function. An alteration of this ratio is a main area of focus in shoulder rehabilitation. Electromyography (EMG) biofeedback has been shown to be an effective technique used during rehabilitation but there is limited research on the retention of improvements. **Purpose:** To determine if EMG biofeedback can be used to improve scapular control by decreasing the UT to SA activation ratio. A secondary purpose was to determine if the predicted improvements can be retained beyond the treatment period of four weeks. **Methods:** 20 college aged (21.75±1.77 yrs) subjects participated in this study. Subjects were randomized to the exercise only (EO) group or EMG biofeedback group. Both groups performed 30 repetitions of three exercises twice a week for four weeks under supervision. The EMG biofeedback group performed them with the addition of EMG biofeedback. They were given the instructions to decrease the UT and increase the SA activation by adjusting the corresponding EMG trace on the monitor. The percent maximal voluntary contraction for each muscle during each exercise was measured on visit one, visit nine (after the four weeks) and visit 10 (after a two-week retention period) and presented as a percent change value. **Results:** There was no statistically significant effect of group on the ratio comparing visit one to visit nine (p=0.084), nor when comparing visit nine to visit 10 (p=0.065). The EMG biofeedback group had a significant decrease in UT activation (-10%) compared to the EO group (+27%) (p=0.007) at the end of the four weeks with no effect seen after the retention period (p=0.358). There was a significant increase in SA activation in the EMG biofeedback group (+196%) compared to the EO group (+29%) (p=0.000) comparing visit one to nine. There was a significant increase in SA activation comparing visit nine to visit 10 in the EMG biofeedback group (+14%) compared to the EO group (-12%) (p=0.001). **Conclusion:** EMG biofeedback was not found to decrease the UT to SA activation ratio, but the individual muscle activation changes indicate that EMG biofeedback can be effective at altering muscle activation rates in individual muscles and that those changes can be retained beyond the timeframe of the intervention.

808 Board #5 May 27 3:15 PM - 5:15 PM
Lumbopelvic Rhythm Prediction Using Machine Learning And Its Use As A Biomarker For Low Back Pain Identification

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Lumbopelvic (LUM-PEL) rhythm has the potential be used as biomarker for diagnosis and rehabilitation of athletes predisposed to mechanical low back pain (LBP). Studies till date have mostly focused on discrete variables from the time series to explain movement patterns. Machine learning algorithms provide opportunity to analyze continuous time series data for predictive classification of movement patterns into pathological and non-pathological, adding value to early diagnosis and clinical decision making for conditions such as LBP. **Purpose:** Use of machine learning to categorize healthy LUM-PEL rhythm. **Methods:** 79 participants with no LBP (Young: n=42; 18-40yr; 27.6±6.5yr; Older: n=37; 41-65yr; 51.7±7.3yr). 3D segmental kinematics of lumbar (LUM: L1-L5) and pelvis [PEL] were calculated for maximum trunk flexion-extension. Coordination patterns were divided into in-phase, anti-phase, superior and inferior-only based on the coupling angles of LUM and PEL. K-means clustering, an unsupervised machine learning algorithm, was employed to create clusters of movement patterns of the coupling and segmental angles based on dynamic time warping similarity. Sample distribution within each cluster was compared for different age groups. **Results:** LUM-PEL rhythm fell under k=3 major movement pattern clusters (Fig. 1). No difference between age groups was observed. Non-pathological LUM-PEL rhythm clusters suggest flexion movement initiation and return from hyperextension typically have segments in anti-phase (LUM leading: 40.4%), PEL/ LUM only (35.3%) and in-phase (LUM leading: 24.3%). The 2 segments predominantly move in-phase except at start and end of movement. Patterns were not apparent when using segment angles

or through discrete variable of mean coupling angles. **CONCLUSIONS:** Using the discovered movement pattern clusters, individuals with LBP could be identified and training prescriptions can be based on healthy segmental coordination.



809 Board #6 May 27 3:15 PM - 5:15 PM
Lumbo-pelvic Ratio And Conjunct Movements Differ Between Pain Intensity Groups In Low Back Pain Patients

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Back pain is linked to alterations in movement behaviour. Yet, the interaction between pain intensity and movement is not fully understood. In particular, it remains unknown if the movement quality differs between (chronic) pain intensities. **Purpose:** To compare trunk movement behaviour, assessed by lumbar/pelvic and conjunct lateral flexion contributions to the total range of motion (RoM) during trunk flexion, between people with low and moderate to high back pain intensities. **Methods:** A multi-centre study on 607 people with back pain was performed. Chronic pain intensity scores (INT [0-100]; sub-score of the Graded Chronic Pain Scale) were used to group participants into comparably low (LP; Score <30 points) and moderate to high pain intensity (HP; Score ≥ 30 points). Accordingly, 211 participants (49% f; 37±13y; 73±15kg; 174±9cm; INT 18±7) were allocated to LP and 393 participants (57% f; 41±14y; 75±16kg; 173±9cm; INT 46±13) were allocated to HP. Motion was assessed during maximal trunk flexion in upright standing. A mobile IMU system (six sensors), distinguishing between total, lumbar and pelvic motion in all three movement planes, was used. Outcome measures were total RoM, lumbo-pelvic ratio (LPR) and amount of conjunct lateral motion (CLM; sum of angular changes in lateral flexion, RoM-normalized). Between-group comparisons using adjusted unpaired t-tests/Mann-Whitney U test for RoM and LPR and two-way ANOVAs for CLM were performed. **Results:** Significant between-groups differences in trunk flexion movement were found for LPR (LP 0.92±0.65; HP 0.72±0.49; p<0.0001) but not for RoM (LP 101±27°; HP 104±25°; p=0.28). CLM differed significantly between groups during downward movements in lumbar (LP 8.0±3.1; HP 7.1±2.7; p<0.01) but not in pelvic segments (LP 7.6±3.5; HP 8.3±3.4; p=0.06). No significant difference was found (lumbar: LP 8.7±3.3 HP 8.5±3.2; p=0.62; pelvic: LP 8.5±4.1; HP 9.2±4.0; p=0.08) during upward movements of the trunk. **Conclusion:** Though total RoM between subclinical and clinical back pain patients is not different, lumbar contribution on total trunk flexion movement is reduced and conjunct lateral movements at the lumbar area are increased with higher pain intensities. This might reflect a strategy to reduce potential pain at the lumbar back during flexion movements of the trunk.

WEDNESDAY, MAY 27, 2020

810 Board #7 May 27 3:15 PM - 5:15 PM
Use Of Machine Learning To Predict Low-back Pain From Motion Capture Data Using Multi-segment Spine Model

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PURPOSE: Machine learning-based methods, which include Artificial Neural Networks [ANN], have been used successfully in varied classification problems. If these methods can successfully classify those vulnerable to musculoskeletal problems such as low-back pain [LBP], they may have utility in screening and management of such conditions and aid in identifying what assessment methods provide optimal information for practitioners. We examined whether ANN techniques could correctly classify whether subjects experienced LBP in a convenience sample of dancers. **METHODS:** 60 subjects [48 women], 36 of whom [24 women] reported an episode of back pain in the past two months, were instrumented with a multi-segment spine marker set [Swain et al., 2019] and recorded [Motion Analysis Corp Eagle, 250 Hz] while performing standing and seated rotations, walking and several functional and dance-related movements [step-over task, arabesque, passe]. The multi-segment model has five segments: pelvis, lower and upper lumbar [L/L], lower and upper thoracic [L/UT]. 3D rotations were computed both between adjacent segments, and with respect to the lab coordinate system. To determine variables of interest, 1-dimensional statistical parametric mapping [SPM1D; Pataky, 2008] analysis was performed. Features [min, max, time to min/max, and side-side difference] were extracted from these variables and used to train an ANN pattern recognition tool [MATLAB]. Approximately 75% of the data were used for training, with the remainder used for validation and testing. Because of the dearth of men, analysis was performed on the entire cohort, and of women only. **RESULTS:** Based on the SPM1D analysis, only approximately 10% of data were used for training the ANN. For example, for walking trials, LL and LT axial and UT coronal plane rotations were used. The ANN classifier was able to correctly identify incidence of LBP with approximately 65% accuracy. **CONCLUSIONS:** Based on our small sample, ANN techniques show promise for identifying subjects with LBP based on their movement patterns. A larger training set of data is needed for better results. Future work should optimize feature selection by focusing on areas of difference between data rather than by selecting fixed features [e.g., max value] and examine the effect of different ANN architectures.

811 Board #8 May 27 3:15 PM - 5:15 PM
Unilaterally Implemented Trunk Modification Associated With Asymmetrical Increase In Spinal Load

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Trunk modification (TM) is associated with reduced knee adduction moment during gait in both healthy and symptomatic individuals. Reported reductions are dependent on the magnitude of modification implemented. Evidence however suggests that increased trunk motion augments structural loading at the spine. Despite the positive adaptations at the knee, potential unanticipated changes in spinal load are yet to be investigated. **PURPOSE:** To investigate changes in trunk joint reaction force (JRF) during ipsilateral (IP) and contralateral (CT) stance phases subsequent to implementing unilateral subject-specific TM. **METHODS:** 19 healthy participants (26.7±4.8 years; 1.69±0.17 m; 72.3±11.8 kg) were recruited. Trunk lean was implemented towards the side of the preferred kicking limb. Participants average trunk angle (TA) was assessed during 10 baseline trials using a motion capture system (200Hz) and force plates (1000Hz). Subject-specific TA range was determined by adding 1-3 standard deviations (small), and 3-5 standard deviations (large) to baseline value. Participants completed 5 trials using both small and large subject-specific TM angles. Real-time TA projected as a line graph which was visible to participants during TM trials reinforced performance. Visual 3D was used to deliver feedback and determine trunk JRF (N/kg). Changes to trunk JRF was assessed using a Friedman test with Wilcoxon signed-ranked test and Bonferroni-adjusted significance level. Analyses were conducted using a significance level of p<0.017. **RESULTS:** Peak lateral JRF during IP and CT stance were significantly greater during TM trials ($\chi^2(2) = 32.9$, and 30.7 , p<0.001 respectively). Participants experienced increased lateral JRF during both IP (d=1.5,

and d=1.7, small and large TM respectively), and CT (d=1.6, and d=1.7, small and large TM respectively) compared to baseline. **CONCLUSION:** Changes in trunk JRFs are indicative of elevated spinal loads. During CT stance, lateral JRF in the direction of the modified side persisted which is indicative of continued asymmetric trunk load. Findings suggest TM could result in detrimental adaptations and may be contraindicated for certain individuals. Further research employing longitudinal design is needed to investigate if observed acute changes are transient in nature.

B-49 Free Communication/Slide - Health Interventions in Youth

Wednesday, May 27, 2020, 3:15 PM - 5:15 PM
 Room: CC-3014

812 Chair: John R. Sirard, FACSM. University of Massachusetts Amherst, Amherst, MA.

(No relevant relationships reported)

813 May 27 3:15 PM - 3:30 PM
Vigorous Physical Activity Is Protective Against Unfavorably Health Trajectory In Active Children

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Physical Activity (PA) guideline recommendations for young people are intended to increase fitness and prevent overweight and obesity. However, little is known about the heterogeneity in health-related outcomes experienced by guideline concordant children.

PURPOSE: To prospectively investigate the associations between PA intensity and unfavorable health trajectories among physically active children aged between 6 and 12 yrs.

METHODS: This prospective study (2.5 yrs) included 391 students (8.1 ± 1.4 yrs) from ten public schools participating in the Childhood Health, Activity, and Motor Performance School Study Denmark (CHAMPS-dk). All children performed a daily minimum of 60-min of moderate-to-vigorous physical activity (MVPA), measured by accelerometers, at baseline and 30 months. Trajectories of body mass index (BMI), waist circumference, and aerobic fitness were constructed with a group-based multi-trajectory model and associations between PA measures and health trajectories were modeled with logistic regression.

RESULTS: Overall, 9.1% of guideline-concordant children were classified as members of an unfavorable health trajectory with BMI and waist circumference indicating overweight/obesity, and lower aerobic fitness. Time in sedentary [OR 0.98 95%CI (0.94-1.02)] and moderate intensity activity were not associated with membership in an unfavorable health trajectory [OR 0.86 95%CI (0.71-1.04)]. Each 5-min in MVPA was associated with a 23% reduction [OR 0.77 95%CI (0.66-0.91)] in the odds of being in the unfavorable health trajectory group. For every 5-min spent in vigorous PA, there was a 39% reduction in the odds of being classified as a member of the unfavorable health trajectory [OR 0.61 95%CI (0.46-0.80)].

CONCLUSION: Additional 5-min in MVPA and vigorous PA are associated with better health-related outcomes among children who adhere to PA guideline recommendations. Vigorous PA was the strongest predictor of health outcomes. PA guidelines should place greater emphasis on vigorous intensity PA.

814 May 27 3:30 PM - 3:45 PM
An Intervention For Fundamental Motor Skills And Physical Activity In Pre-schoolers: A Cluster-randomized Controlled Trial

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 (No relevant relationships reported)

PURPOSE: Physical activity (PA) is important for health and development in preschool-aged children yet only 34% of Australian pre-schoolers achieve the

recommended levels. Fundamental motor skill (FMS) interventions have been shown to improve FMS proficiency and PA levels, however, whether these changes are maintained post-intervention is unknown. We aimed to determine if a 12-week FMS program improved FMS and PA in pre-schoolers; and if so, whether these improvements were maintained 12 weeks post-intervention. **METHODS:** The Physical Activity and Fundamental Motor Skills in Pre-schoolers (PLAYFun) Program was a cluster randomized controlled trial. Participants were recruited from 4 University pre-schools. The PLAYFun Program was a 12-week, games-based, FMS program delivered directly into the centers by an exercise physiologist. Primary outcomes included FMS proficiency, objective PA and parent perceived PA assessed at baseline, 12 weeks and 12 weeks after the completion of the intervention (week 24). Differences within and between groups were assessed via a one-way analysis of variance.

RESULTS: Forty-nine participants (mean age 4.0±0.6; 54% male) were recruited. Children attended on average 2.0±1.0 sessions per week for 40 minutes per session. Participants in the PLAYFun Program demonstrated a significantly greater increase in object control ($p=0.003$) and total FMS ($p=0.019$) proficiency at week 12 compared to controls. Locomotor skills score (M 14.83 95% confidence interval (95%CI) [3.90 to 25.75]; $p=0.012$), object control skills (M 24.11 [9.93 to 38.29]; $p=0.003$) and gross motor quotient (M 20.14 [8.33 to 31.96]; $p=0.003$) all significantly improved when children attended twice a week, but these improvements were not maintained at 24 weeks. Girls in PLAYFun significantly increased objective moderate to vigorous PA after the intervention ($P=0.015$), but not boys. This increase was also not maintained 12 weeks post-completion of PLAYFun. No significant relationships between FMS and PA outcomes were identified.

CONCLUSIONS: Motor skill programs delivered directly to preschool children by an exercise physiologist within their preschool is effective at improving FMS proficiency in boys and girls and PA in girls. However, these improvements are not maintained when the practice is not ongoing.

815 May 27 3:45 PM - 4:00 PM

Effectiveness Of School-based Program To Reducing Sedentary Behavior And Improving Physical Activity In Brazilian Students

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Reported Relationships: S.F. Santos: Other (please describe); This study was funded by The São Paulo Research Foundation (FAPESP Process: 2016/09260) and Coordination of Superior Level Staff Improvement – Brazil (CAPES Process: 88881.187941/2018-01)..

Regular high intensity physical activities have been associated with healthy outcomes in adolescents. Previous studies have reported positive changes on physical activity (PA) level and sedentary time (SED) in participants of multicomponent school-based programs. The main research question was whether School in Action program is effective on promote active life style in Brazilian adolescents. **PURPOSE:** To examine the effects of a multicomponent school-based program on students' PA and SED. **METHODS:** A cluster randomized controlled trial with 370 adolescents (aged 11.7 years, SD=0.6) from four public schools from Presidente Prudente-SP, Brazil, were randomized to either an intervention or control group. School in Action program was based on ecological and self-determination theory principles and strategies consisted of: (a) 15 minutes of PA program in physical education (PE) class, (b) PA practice during the lunch break, (c) active breaks during theoretical classes, (d) monthly participation of school's health education project, (e) parent's counseling during school meeting and (f) school playground adaptation and acquisition of material resources to improve moderate-to-vigorous physical activity (MVPA). Changes in PA and SED were measured. PA level was evaluated by wrist-worn accelerometers (Actigraph, gt3x+), and Chandler's cut-points were considered. Generalized linear mixed models were used and pre-specified interactions were tested (i.e., group*time). All analyses were adjusted by sex, peak height velocity, baseline data and social economic level on SPSS, 25.0 version, 95% of significance. **RESULTS:** Total of 70.27% (n=260) of data accelerometer was valid at baseline (600 minutes per day, minimum 3 days). The proposed intervention presents decreased SED (Δ intervention group 'baseline to post-test' = -3.8; Δ control group 'baseline to post-test' = 6.3; $p=0.04$) and minimize the reduction of vigorous PA (Δ intervention group of 'baseline to follow-up' = -0.2; Δ control group 'baseline to follow-up' = -0.4; $p=0.03$). Time spent in MVPA did not differ between the groups over time. **CONCLUSION:** The multicomponent program was effective to decrease SED and can maintain students' vigorous PA level.

816 May 27 4:00 PM - 4:15 PM

Effect Of A School-based Physical Activity Intervention On Academic Performance In Norwegian Adolescents: The School In Motion Study - A Cluster Randomized Controlled Trial

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(No relevant relationships reported)

There is increasing evidence of a positive association between physical activity (PA) and academic performance. However, few studies include adolescents.

PURPOSE: To investigate the effect of a nine-month, school-based PA cluster-randomized controlled trial, School in Motion (SciM), on academic performance in 14-year-old adolescents.

METHODS: 29 secondary schools (N=2084) in Norway were cluster-randomized into three groups A) the Physical active learning (PAL) intervention group (n = 10), B) the Don't worry - Be Happy (DWBH) intervention group (n = 9) or C) control (n = 10). Target dose in the PAL and DWBH group was 120 min/week of additional PA and physical education. Academic performance (secondary outcome) was assessed by standardized national tests in reading and numeracy at baseline (September 2017) and at the end of the intervention (May 2018). Test scores are reported as t-scores (mean = 50, standard deviation (SD) = 10). We used a linear mixed model with the means as a function of time and group-by-time interaction, with schools as random effects. Participants (n = 1682) from 27 schools with valid data at both timepoints were included in the analysis. **RESULTS:** At baseline, mean values in reading were 57 (SD 9.5) and 54 (SD 10.2) points for girls and boys respectively and 56 (SD = 9.7) points for numeracy in both genders. Performance in numeracy increased in both intervention groups. In favor of the PAL group, the mean difference in change in numeracy were 1.1 points (95% confidence interval (CI) 0.3-1.8, $p = 0.024$) and 2.6 points (95% CI 1.7-3.5, $p < 0.001$) for girls and boys respectively, when compared with controls. Similarly, in favor of the DWBH group, the mean difference in change in numeracy compared to the control group was 1.4 points (95% CI 0.5-2.2, $p = 0.005$) for girls and 2.8 points (95% CI 1.8-3.8, $p < 0.001$) for boys. A significant intervention effect for reading were only observed among boys in DWBH intervention with mean difference in change of 1.8 points (95% CI 0.6-2.9, $p = 0.008$) in favor of the intervention group.

CONCLUSIONS: The findings from the SciM intervention support the notion that additional PA in school is beneficial for students' academic performance especially in numeracy.

817 May 27 4:15 PM - 4:30 PM

Effects Of A Teacher Training Program To Promote Physical Activity Among Preschoolers With Autism

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(No relevant relationships reported)

Children with Autism Spectrum Disorder (ASD) are disproportionately impacted by childhood obesity, with one contributing factor being low levels of physical activity (PA). There is a paucity of interventions for promoting PA that are responsive to the unique needs of young children with ASD. One promising approach designed for teachers working with typically developing preschoolers is WE PLAY (Wellness Enhancing Physical Activity for Young Children), an online-based training system. It was adapted to be responsive to the needs of children with ASD through a stakeholder-engaged approach. **PURPOSE:** To determine the impact of WE PLAY-Autism on the moderate-to-vigorous PA (MVPA) of preschoolers with ASD during school hours.

METHODS: A multiple baseline design across participants was used, which allowed for a rigorous experimental evaluation of the impact of WE PLAY-Autism through the repeated measurement of children's MVPA as the intervention was implemented sequentially across classrooms. Children's (N = 5) MVPA was measured daily during school hours using accelerometers (ActiGraph GT9X Link) worn at the iliac crest. Data were analyzed using validated accelerometer count cut-points for preschoolers, with min/hour of MVPA as the dependent variable. **RESULTS:** Following current best practices in single case designs, visual analysis and effect size calculations were used, indicating higher average min/hour of MVPA among preschoolers with ASD in the intervention phase (Tau- $U_{A vs. B} = .53$, $p < 0.001$, Hedges' $g = 0.99$, 95% CI [0.56, 1.43]) and post-training phase (Tau- $U_{A vs. B} = .55$, $p < .001$, Hedges' $g = 1.17$, 95% CI [0.73, 1.60]) in comparison to the baseline phase. The average increase in min/hour of MVPA from baseline to post-training was 2.51 (range = 1.35 - 4.32), which translates to approximately 38 additional minutes of MVPA across the 15-hour preschool week.

CONCLUSION: This study is, to our knowledge, the first to implement and report the impact of a preschool PA intervention adapted to be responsive to the needs of preschoolers with ASD. The results provide preliminary evidence that WE PLAY-Autism increases MVPA among preschoolers with ASD to a similar magnitude as preschool-based interventions for typically developing children.

818 May 27 4:30 PM - 4:45 PM

Dearborn SHINES: The Impact Of A Comprehensive School Health Intervention

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(No relevant relationships reported)

PURPOSE: Arab Americans account for almost 3.7 million people in the U.S., however, limited health data is available on youth and adult populations. In order to better understand the health behaviors of Arab Americans and aid in the push for healthy lifestyles in children, more research should be conducted. Therefore, the purpose of this study was to implement a culturally relevant healthy eating (HE) and physical activity (PA) intervention known as D-SHINES in a primarily Arab-American school district and understand the impact it had on students' overall PA, attitude toward PA and HE, as well as PA and HE knowledge, and perceived social support. **METHOD:** Eight schools participated in the D-SHINES intervention over one school year, with 264 (Mage=11.1; Male = 106) randomly selected students participating in pre-post testing. The intervention consisted of physical education utilizing SPARK, PA afterschool clubs, gardening and nutrition programming, and classroom physical activity breaks. Students participated in a pre-post survey with validated measures for overall PA level, HE and PA attitude, knowledge, and perceived social support. Implementation of the garden, HE, and PA curriculum tools were also tracked for fidelity. **RESULTS:** T-tests were used to determine differences among students from pre-post intervention. Results showed that students significantly increased their HE and PA knowledge over the course of the year ($p < .001$), as well as their PA attitude ($p = .021$). There was no significant difference observed in overall PA levels ($p = .92$), vigorous PA ($p = .08$), and perceived social support. Additionally, MANCOVA's showed significant differences among the variables between grade and gender ($p < .001$). **CONCLUSIONS:** Although limitations exist, the results show that while the D-SHINES program was implemented in the school, students' significantly improved their attitudes and knowledge toward HE and PA, yet, failed to show a significant increase in overall PA. Additionally, great strides were made with teachers and schools to build and implement the garden curriculum. Additional research should be conducted to better understand successful comprehensive school programming among urban Arab American youth, a population that is often understudied.

819 May 27 4:45 PM - 5:00 PM

CHANGES IN PHYSICAL ACTIVITY, PHYSICAL FITNESS AND WELL-BEING FOLLOWING A SCHOOL-BASED HEALTH PROMOTION PROGRAM

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(No relevant relationships reported)

Purpose: School-based physical activity (PA) has mostly been examined in a preventive perspective. The purpose of this study was to examine the changes in physical activity, physical fitness and psychosocial well-being in early adolescents after the implementation of a school-based health promotion program in secondary school.

Methods: Four municipalities with 15 secondary schools in Telemark County, Norway, were recruited into an intervention or a control group. A total of 644 pupils participated in the study (response rate: 79%). The schools in the intervention group implemented the Active Healthy Kids program, where the physical activity component consisted of: (1) 120 min/week of physically active lessons (PAL), (2) 25 min/week of physical active breaks during classroom lessons and (3) 135 min/week of curriculum based normal physical education. Primary outcome was physical activity assessed by accelerometer and expressed as counts per minutes. Secondary outcomes were sedentary time, physical fitness, vitality, school effort and health-related quality of life in the five domains; physical health, psychological wellbeing, parent, peers and school environment.

Results: There was a Group X Time effect for school-based, but not full-day, physical activity ($p = 0.005$), and for cardiorespiratory fitness ($p = 0.02$) and vitality ($p = 0.008$). A Group effect was found for the perceived exerted effort in class ($p < 0.001$) and the health-related quality of life domains "psychological well-being" ($p = 0.04$) and "school environment" ($p < 0.001$).

Conclusions: A multi-component, school-based, health-promotion intervention with emphasis on the use of PAL led to positive changes in school-based physical activity,

cardiorespiratory fitness, vitality and health-related quality of life among early adolescents in a county with poor public health profile. This might have implications for the development and promotion of general health and well-being throughout adolescence.

Trial registration: Approved by the Norwegian Data Protection Services (ID 54327), and registered in ClinicalTrials.gov, (ID NCT03906851).

Keywords: School-based physical activity, adolescents, Physical activity, physical fitness, Health Related Quality of Life, Norway

820 May 27 5:00 PM - 5:15 PM

Bi-directional Prospective Associations Between Objectively Measured Physical Activity And Fundamental Motor Skills In Children: A Two-year Follow-up

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(No relevant relationships reported)

PURPOSE: The direction of the longitudinal relationship between physical activity (PA) and fundamental motor skills (FMS) remains unclear. We evaluated the bi-directional, prospective relationships between intensity-specific physical activity (PA) and domain-specific fundamental motor skills (FMS) over two years in young children. **METHODS:** A sample of 235 children (mean age at baseline 4.7 yr, 52 % boys) from the Sogn og Fjordane Preschool Physical Activity Study was measured two years apart. PA was assessed using ActiGraph accelerometers (GT3X+). FMS were evaluated by a test battery inspired by the "Test of Gross Motor Development 3" and the "Preschooler Gross Motor Quality Scale". PA outcomes were total PA (TPA [counts per minute]) and intensity specific PA and sedentary behaviour (SED) (min/day). FMS outcomes were total FMS score, locomotor-, object control-, and balance skills. Linear mixed model adjusting for potential co-variables was used to evaluate the bi-directional prospective associations between these variables, including the moderating effect of sex and age. **RESULTS:** Baseline total PA, moderate-to-vigorous PA (MVPA), and vigorous PA predicted higher total FMS score, locomotor-, object control-, and balance skills at follow-up (standardized regression coefficient (β): 0.15 to 0.26, $p = 0.002-0.031$). SED predicted lower FMS in all domains except balance (β : -0.10 to -0.27, $p = 0.008-0.026$). Baseline light PA did not predict FMS at follow-up. Baseline object control- and balance skills were not associated with PA or SED at follow-up. Total FMS score at baseline predicted lower light PA at follow-up (β : -0.14, $p = 0.041$), and locomotor skills at baseline predicted higher TPA in boys relative to girls (p for interaction=0.044). **CONCLUSIONS:** PA, especially MVPA, were positively associated with development of FMS in young children. In contrast, FMS was largely unrelated to future PA levels. Our results suggest promotion of MVPA is important for FMS development in young children.

B-50 Free Communication/Slide - Investigating Maternal and Child Health

Wednesday, May 27, 2020, 3:15 PM - 5:15 PM
Room: CC-3020

821 **Chair:** James M. Pivarnik, FACSM. Michigan State University, East Lansing, MI.

(No relevant relationships reported)

822 May 27 3:15 PM - 3:30 PM

Influence Of Maternal Exercise And DHA Levels During Pregnancy On Maternal Lipids

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(No relevant relationships reported)

Elevated levels of Total Cholesterol (TC), low-density lipoprotein (LDL) and triglycerides (TG) during pregnancy have been associated with risks of gestational diabetes, preeclampsia, fetal macrosomia and cardiovascular disease. Exercise is

known to decrease TC, LDL and TG, while increasing HDL within normal ranges. Similarly, Supplementation of polyunsaturated fatty acids (PUFA), such as DHA, help control and mitigate excessive triglycerides, while increasing HDL. Research has not investigated the potential relationship of maternal exercise and PUFA levels on maternal lipid profiles. **PURPOSE:** To determine the relationship between maternal exercise and plasma levels of DHA on maternal lipid levels at 16 and 36 weeks.

METHODS: 22 women with a singleton pregnancy (<16 weeks) were randomized to either aerobic (n=9) or non-exercising control (n=4) group. Participants exercised 3x50 minutes per week at moderate intensity for ~24 weeks, with average weekly METmins/wk calculated based on standard MET values*average minutes. Maternal plasma was collected at 16 and 36 weeks of gestation and analyzed for DHA and lipid levels. Multiple linear regression and Spearman correlation models were performed to determine relationships between maternal METmins/wk, DHA levels, and lipid levels. **RESULTS:** There is a significant negative correlation between DHA levels on HDL (-0.692, p=0.01) at 36 weeks. There are trends of significance with METmins/wk with DHA (0.500; p=0.08) and TG (-0.440, p=0.13) at 36 wks. There was not a significant regression equation found for TC (F=0.690, p=0.52) and TG (F=2.092, p=0.174), however METmins/wk showed a negative relationship to TC (-0.094, p=0.307) and trended to significantly predict TG (-0.185, p=0.081) while DHA Levels showed a positive relationship with TC (0.059, p=0.331) and TG (0.105, p=0.125).

CONCLUSION: The current suggests a potential relationship between exercise and DHA levels during pregnancy on maternal lipids. These findings showed a negative and stronger relationship with METmins/wk compared to DHA levels, thus suggesting exercise may be more important to control excessive increases in TC and TG during pregnancy.

823 May 27 3:30 PM - 3:45 PM

Physical Activity Knowledge And Sources Of Advice During Pregnancy

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(No relevant relationships reported)

Physical activity (PA) during pregnancy is known to be beneficial for the health of both the mother and foetus, but most pregnant women do not engage in the recommended volume of activity. Lack of personal and healthcare-professional knowledge is frequently cited as a barrier to PA participation during pregnancy in both low-activity and athletic populations.

PURPOSE: To explore the sources of advice used by women to guide their PA participation during pregnancy.

METHODS: Women who had recent experience of pregnancy in Ireland (n = 102, age 35±4 years) completed an online survey with questions regarding their activity type immediately pre-pregnancy (activities of daily life only (DAILY), recreational exercise (EXERCISE) or competitive sport (SPORT)), knowledge of PA guidelines, experiences of receiving PA advice from healthcare professionals during pregnancy, and perceptions regarding different sources of advice. Between-group comparisons were made by Chi-square analysis.

RESULTS: Knowledge of the recommended volume of activity for health was significantly poorer in EXERCISE than DAILY or SPORT ($X^2_8 = 16, p = 0.037, V = 0.283$); there were no differences in knowledge of recommended intensity or type. Women in the EXERCISE and SPORT groups were significantly more likely to have felt that they needed to initiate discussion about PA with their healthcare providers than those in the DAILY group, for whom the professional was more likely to initiate the discussion ($X^2_6 = 19, p = 0.004, V = 0.310$). While 48% of respondents perceived their healthcare professionals to be their most useful source of PA advice during pregnancy; the other 52% cited sources such as friends, exercise professionals or online media, with no between-group differences. Furthermore, many women reported that they never received PA advice during their pregnancy from their general practitioner (27% of women), midwife (45%) or obstetrician (46%).

CONCLUSION: Knowledge of guidelines for PA during pregnancy is low among pregnant women in Ireland; low levels of guidance from healthcare professionals may be a contributing factor.

824 May 27 3:45 PM - 4:00 PM

Maternal Physical Activity Correlates With Fasted And Postprandial Insulin Resistance And Lipids During Late Pregnancy

Rachel A. Tinius¹, Maire M. Blankenship¹, Kevin J. Pearson², W. Todd Cade³, Elizabeth Altizer⁴, Nikki B. Zite⁴, Jill M. Maples⁴.

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(No relevant relationships reported)

PURPOSE: Physical activity (PA) has been shown to be effective for lowering insulin resistance and blood lipid profiles during pregnancy. Recent evidence indicates sedentary time is also associated with poor pregnancy outcomes. The purpose of this study was to determine the relationships between sedentary time and moderate PA, assessed during late pregnancy, and insulin resistance (HOMA-IR) and triglycerides in fasting and postprandial conditions. Postprandial conditions are important to study as humans spend the majority of their time in a fed-state.

METHODS: Healthy pregnant women (N=61, 32-36 weeks gestation) were recruited for this study. Sedentary time and moderate intensity PA were objectively assessed using a wrist-worn Actigraph GT9X Link Accelerometer. The device was worn 24 hrs/day for 7 days. Fasting blood lipids, insulin, and glucose were assessed. A standardized high-fat breakfast was consumed and these measures were collected again 120-minutes post-meal (postprandial). All relationships were analyzed with Pearson Product Moment Correlation Coefficients while controlling for pre-pregnancy BMI.

RESULTS: Sedentary time was positively correlated with fasting and postprandial insulin resistance (fasting HOMA-IR: $r = -0.471, p = 0.001$; postprandial HOMA-IR: $r = -0.433, p = 0.002$), while these measures were negatively correlated with light PA (fasting HOMA-IR: $r = -0.395, p = 0.005$; postprandial HOMA-IR: $r = -0.364, p = 0.010$) and moderate PA (fasting HOMA-IR: $r = -0.520, p < 0.001$; postprandial HOMA-IR: $r = -0.477, p = 0.001$). Sedentary time was positively correlated with fasting triglycerides ($r = 0.296, p = 0.039$). Moderate PA was negatively correlated with fasting triglycerides ($r = -0.403, p = 0.004$) and postprandial triglycerides ($r = -0.343, p = 0.016$).

CONCLUSIONS: Decreasing sedentary time and adding any intensity PA may positively impact metabolic health during pregnancy by reducing fasting and postprandial insulin resistance, as well as reducing fasting and postprandial triglycerides. This is important as, during pregnancy, insulin resistance is associated with poor pregnancy and neonatal outcomes and increased triglycerides are associated with increased risk of preeclampsia, pre-term birth, and increased maternal cardiovascular risk later in life.

NIH NIGMS IDeA Grant 5P20GM103436

825 May 27 4:00 PM - 4:15 PM

Influence Of Physical Activity And Sedentary Behavior During Pregnancy On Labor And Delivery Type

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(No relevant relationships reported)

Physical activity (PA) during pregnancy is known to be safe and does not increase risk of medical intervention during labor and delivery. While it is known that sedentary behavior (SED) and PA have independent health effects, whether higher SED during pregnancy increases risk for medical intervention in labor and delivery is unknown.

PURPOSE: To examine the relationship of SED and PA patterns across pregnancy with labor and delivery outcomes. **METHODS:** In this prospective cohort study, objective SED (thigh-worn activPAL micro3) and physical activity (waist-worn ActiGraph GT3X-BT) were assessed in women for ≥ 4 days with ≥ 10 hours in each trimester of pregnancy. This secondary analysis includes women with available labor and delivery records, and PA and SED measures in ≥ 1 trimester (n=99). Trajectory analysis was used to identify patterns of PA and SED across pregnancy and assign women to the groups most closely related to their dominant activity patterns. Labor and delivery information was abstracted from participant medical records. Labor types were categorized as: spontaneous, induced-elective, or induced-medical. Delivery types were categorized as: vaginal, c-section-elective, c-section-medical. Differences in labor and delivery type by SED and PA trajectories were analyzed using Fisher's exact tests due to small cell sizes. **RESULTS:** Trajectory analysis resulted in and assigned women to high, medium, and low groups for PA and SED across trimesters of pregnancy. Approximately 60% of labor was spontaneous, followed by 27% medical induction, and 13% elective induction. Deliveries were 79% vaginal, 13% medically indicated c-section, and 8% elective c-section. Type of labor (L) or delivery (D) did not significantly differ by SED (L: $p = 0.185, D: p = 0.134$) or PA (L: $p = 0.756, D = 0.120$) trajectories. When elective induction and c-sections were removed to only consider risk for medical intervention, differences remained insignificant by SED (L:

p=0.136, D: p=0.088) or PA (L: p=0.527, D: p=0.128) trajectories. **CONCLUSION:** Objectively-measured patterns of SED or PA across pregnancy were not related to type of labor or delivery, including risk of medical intervention. Future research with larger samples could expand to the entire birth experience including duration of labor, medication use, or fetal complications.

826 May 27 4:15 PM - 4:30 PM
Effect Of Exercise During Pregnancy And Lactation In Obese Wistar Rats On Offspring Glycemic Control

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 (No relevant relationships reported)

PURPOSE: To determine the effect of maternal exercise in pregnant and lactating obese Wistar rats on the glycemic control of their offspring at time of weaning. **METHODS:** Two days following impregnation, 24 obese Wistar rats were separated into 2 groups. One group received 30 minutes of treadmill exercise (E) at 15-20 m/min each day while the other group received no exercise (NE). The groups were maintained after the birth of the offspring (21 days) through lactation (21 days) for a total of 6 weeks. At weaning an oral glucose tolerance test (OGTT) was performed on 12 randomly selected pups from each group. A t-test was utilized to determine differences in total glucose area under the curve (t-AUC) (mean and standard error) between groups ($p \leq 0.05$). **RESULTS:** There was an effect of maternal exercise on the glycemic control of the offspring. The ability to dispose of glucose following a glycemic load was significantly greater in the offspring of E dams (513.1 ± 11.7 mmol/L) compared to the offspring of NE dams (542.7 ± 7.1 mmol/L) ($p \leq 0.05$). **CONCLUSIONS:** Initiating moderate exercise early during the pregnancy of obese rats and maintaining exercise through lactation can positively impact glycemic control in offspring.

827 May 27 4:30 PM - 4:45 PM
The Effects Of An Antenatal Lifestyle Intervention On Pregnancy Outcomes In Overweight And Obese Pregnant Women

Jihong Liu, Sara Wilcox, FACSM, Ellen Wingard, Brent Hutto. *University of South Carolina, Columbia, SC.* (Sponsor: Sara Wilcox, FACSM)
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 (No relevant relationships reported)

Three reviews of antenatal behavioral lifestyle interventions did not find significant intervention effects on maternal complications and adverse neonatal outcomes, perhaps due to the inclusion of low to medium quality studies. **PURPOSE:** To evaluate the effect of a lifestyle intervention program on pregnancy outcomes in overweight and obese pregnant women. **METHODS:** This study was a randomized controlled trial. Overweight and obese pregnant women were recruited from Columbia, South Carolina and were randomized to a behavioral intervention group (n=110) or to a standard care group (n=104). The antenatal intervention was designed to target weight self-monitoring, increasing physical activity, and increasing healthy dietary behavioral practices. Intervention contents were delivered through one in-depth counseling session, followed by phone counseling, behavioral podcasts, and social media support. Standard care women received monthly mailings and a match number of podcasts on non-weight related topics. **RESULTS:** Our study population was racially diverse (56% white, 44% African American) with a mean prepregnancy BMI of 32.2 ± 5.9 and was 12.7 ± 2.4 wks gestation at baseline. Compared to standard care women, women in intervention group had lower percentages of gestational hypertension (9.1 vs. 21.2%, $p=0.01$) and delivering a low birth weight baby (<2500g) (1.9 vs. 10.6%, $p=0.009$). These women also had lower percentages of gestational diabetes (7.3 vs. 12.5%) and delivering a preterm baby (<37 wks of gestation) (2.8 vs. 7.7%), although these differences were not significant at the 0.05 level. No group differences were found in other outcomes (i.e., cesarean deliveries, macrosomia births (birthweight ≥ 4000 g), and Apgar scores). **CONCLUSIONS:** An antenatal behavioral lifestyle intervention designed to reduce gestational weight gain was beneficial in improving pregnancy outcomes in overweight and obese pregnant women. Future analyses will examine mechanisms for this effect.

828 May 27 4:45 PM - 5:00 PM
Change In Physical Activity In The Health In Pregnancy And Postpartum (HIPP) Randomized Controlled Trial (RCT)

Sara Wilcox, FACSM, Jihong Liu, Brent Hutto, Ellen Wingard. *University of South Carolina, Columbia, SC.*
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 (No relevant relationships reported)

Despite the known benefits of physical activity (PA) in pregnancy, PA is consistently shown to decrease from early to late pregnancy. Very few antenatal interventions have targeted PA and included sensor-measured outcomes in overweight and obese pregnant women.

PURPOSE: To examine whether a lifestyle intervention increased moderate- to vigorous-intensity PA (MVPA), light PA, and steps or reduced their decline from early to late pregnancy compared to a standard care condition. **METHODS:** HIPP is a RCT comparing the effects of a lifestyle intervention vs standard care on gestational weight gain (primary outcome) and health behaviors including PA (secondary outcomes) among women entering pregnancy overweight or obese. The lifestyle intervention was grounded in social cognitive theory and, during pregnancy, included an introductory behavioral counseling session followed by telephone counseling calls, behavioral podcasts, and a private Facebook group. Usual care participants received usual care from their obstetrician and received mailings and podcasts focused on a healthy pregnancy. Participants wore a SenseWear armband ≥ 21 hrs/d for ≥ 5 d at baseline (early pregnancy, n=205) and 32-wk gestation (n=167). We tested Randomization x Time interaction effects (SAS PROC MIXED) for min/d of MVPA, min/d of light PA, and steps/d. **RESULTS:** Participant demographics were: 30 ± 5 years, 44% African American, 56% white, 60% college graduate, 61% employed full-time, 67% married, 42% nulliparous, and 13 ± 2 wk gestation at baseline. While the time main effects indicated that MVPA ($p=0.07$), light PA ($p=.04$), and steps ($p<.0001$) decreased significantly, intervention effects (Randomization x Time) were not significant for these PA variables (see Table).

Table. Changes in MVPA, Light PA, and Steps Over Time, by Randomization Group, Least Square Means (SEs)

	Intervention		Standard Care		p
	Baseline	32-wk	Baseline	32-wk	
MVPA, min/d	38 (2)	36 (3)	35 (2)	28 (3)	.17
Light PA, min/d	219 (8)	206 (8)	200 (8)	194 (8)	.43
Steps/d	5574 (196)	5041 (209)	5114 (196)	4363 (211)	.34

CONCLUSION: A behaviorally based lifestyle intervention did not significantly lessen the decline in PA typically seen from early to late pregnancy. Assessments will be repeated at 6- and 12-mo postpartum.
 Funded by NIH/NICHD.

829 May 27 5:00 PM - 5:15 PM
A Healthy Lifestyle Intervention During Pregnancy: Key To Preventing Chronic Disease Risk?

Roberta Bgeginski¹, Taniya S. Nagpal², Harry Prapavessis¹, Barbra de Vrijer¹, Christina G. Campbell³, Karishma Hosein¹, Stephanie Paplinski¹, Mollie Manley¹, Michelle F. Mottola, FACSM¹. ¹University of Western Ontario, London, ON, Canada. ²University of Ottawa, Ottawa, ON, Canada. ³Iowa State University, Ames, IA. (Sponsor: Michelle F. Mottola, FACSM)
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 (No relevant relationships reported)

Gestational hypertension disorders and diabetes affect 6-15% of all pregnancies worldwide and are associated with adverse maternal and neonatal outcomes that can have a programming effect on future chronic disease risk. Pregnant women who receive lifestyle interventions, including healthy eating and/or physical activity, may have a decreased risk of developing complications. **PURPOSE:** To analyze the effects of a supervised healthy lifestyle intervention (nutrition and exercise) during pregnancy on diagnosis of gestational diabetes, hypertension, caesarean delivery, stillbirth, macrosomia (babies > 4500g), and low birth weight (babies < 2500g) in a cohort in London, Canada. **METHODS:** From 2016 to 2019, 111 women were enrolled at 12-18 weeks gestation in the Nutrition and Exercise Lifestyle Intervention Program (NELIP; Clinical Trials #NCT02804061) up to delivery. The nutrition goals for the intervention were: 1) Submit a weekly 24 hour-food intake record; 2) Consume approximately 1800-2200 kcal/d; and 3) Consume 200-250 g carbohydrates/d (40-55% of total energy intake). The exercise goals were: 1) Duration of session: Walk for 25 minutes and add 2 minutes each week until 40 minutes were achieved and then maintain this walking duration until delivery; 2) Frequency: 3-4 times per week; and 3) Submit a weekly step log (pedometers were provided to each participant). **RESULTS:** As of October 2019,

the average duration of the intervention was 20.9 ± 3.9 wks. Out of the 75 participants that completed the intervention, maternal age was 32.2 ± 3.3 yrs, self-reported pre-pregnancy weight was 71.2 ± 15.3 kg, and gestational age at delivery was 278.1 ± 9.0 days. No participants were diagnosed with gestational diabetes or hypertension. Data from 52 babies indicated: birth weight was 3456.0 ± 442.4 g and length was 50.7 ± 3.1 cm. None were born with low birth weight and there were no cases of stillbirth. The rate of macrosomia was 1.9% (n = 1) and caesarean delivery was 27% (n = 14). **CONCLUSION:** A healthy lifestyle intervention during pregnancy may help to prevent gestational diabetes and hypertension, and help to reduce the prevalence of stillbirth, macrosomia, low birth weight, and caesarean deliveries. Taken together, these findings may have major positive implications for the long-term health of both mothers and babies.

B-51 Clinical Case Slide - Cardiovascular

Wednesday, May 27, 2020, 3:15 PM - 4:35 PM
Room: CC-2005

830 Chair: Paul D. Thompson, FACSM. *Hartford Hospital, Hartford, CT.*
(No relevant relationships reported)

831 Discussant: Benjamin D. Levine, FACSM. *Presbyterian Hospital, The University of TX SW Medical Center, Dallas, TX.*
(No relevant relationships reported)

832 Discussant: Matthew Sedgley, FACSM. *U of Maryland Sports Medicine, frederick, MD.*
(No relevant relationships reported)

833 May 27 3:15 PM - 3:35 PM
Cardiovascular-Track And Field
 Mitchell J. Odom. *University of Michigan, Ann Arbor, MI.*
 (Sponsor: Robert Kinningham, FACSM)
(No relevant relationships reported)

HISTORY: A 21-year old senior male track and field athlete who competes in mid-distance running events in a Division I university was evaluated for a family history of hypertrophic cardiomyopathy. During his pre-participation physical exam, he denied history of dizziness, syncope, or chest pain. There was no family history of an abnormally thickened heart or early sudden cardiac death. However, his father was recently diagnosed with hypertrophic cardiomyopathy by his primary care provider. There is no other known history of hypertrophic cardiomyopathy in the family. **PHYSICAL EXAMINATION:** There were no abnormalities during his cardiac exam. There were no murmurs on standard exam or with provocative maneuvers. **DIFFERENTIAL DIAGNOSIS:** 1. Family history of hypertrophic cardiomyopathy. 2. Physiologic hypertrophy response to exercise. **TEST AND RESULTS:** 1. Standard electrocardiogram: Sinus bradycardia with a heart rate of 55, PR interval 152, QRS duration 94, QT/QTc interval 442/422, evidence of left ventricular hypertrophy, and non-specific ST-T wave changes in leads V2 and V3. 2. Stress electrocardiogram: Asymptomatic during exercise. Interpretation: decreased sensitivity of the test due to baseline left ventricular hypertrophy, non-diagnostic study. 3. Resting echocardiogram: No valvular abnormalities, normal size of right and left atria, normal size of right and left ventricles. Concentric left ventricular hypertrophy present and marked right ventricular hypertrophy present. Impression: Consider hypertrophic cardiomyopathy. 4. Stress echocardiogram: normal hyperdynamic response to exercise. Return to baseline following rest. 5. Cardiac MRI: Left ventricle size normal, maximal left ventricular wall size 11mm, normal left ventricle indexed mass, mildly dilated right ventricle. **FINAL DIAGNOSIS:** Normal physiologic response to exercise. False positive resting echocardiogram. **TREATMENT AND OUTCOMES:** 1. After discussion with a sports cardiologist, a cardiac MRI was ordered as his resting echocardiogram was concerning for hypertrophic cardiomyopathy. 2. Cardiac MRI showed no evidence of hypertrophic cardiomyopathy. 3. No restrictions were placed on activity or participation

834 May 27 3:35 PM - 3:55 PM
Incidental Cardiac Arrhythmia Identification With Consumer Grade Heart Rate Monitors: A Case Study
 Neal C. Phifer, Dale D. Brown, FACSM, Kelly R. Laurson, Skip M. Williams, Emily Jones, Karen K. Dennis, Megan Smith, Ryan Swenson. *Illinois State University, Normal, IL.* (Sponsor: Dale Brown, FACSM)
 Email: ncphife@ilstu.edu
(No relevant relationships reported)

HISTORY: A 19-year-old sophomore NCAA Division I female volleyball player was identified, via a consumer-grade heart rate (HR) telemetry system, as having what would be considered a high heart rate (123% of age predicted max HR or 233 bpm) during practice. **PHYSICAL EXAMINATION:** Athlete was observed without interaction for signs of distress, excessive heavy breathing, pallor changes, or any sort of balance issues that would indicate dizziness or syncope. After approximately 5 minutes, HR returned to a normal level that would be commensurate with the exercises/drills being performed. Once a more in-depth analysis of the collected data was performed it was determined that consultation with team physician and cardiologist was needed. Retrospective analysis of data recorded prior to this episode was undertaken and identified approximately 40% of recorded session contained a similar episode. Further clarification of both HR, and R-R interval data aided in identification of episodes. **DIFFERENTIAL DIAGNOSIS:** 1. Supraventricular tachycardia (SVT) 2. Wolf-Parkinson-White Syndrome 3. Atrioventricular Nodal Reentrant Tachycardia (AVNRT) **TEST AND RESULTS:** Electrocardiogram: --No noticeable abnormalities Holter Monitor: --identified an exercise induced SVT episode with no other abnormalities when episode was not present. --HR data was used to assist in identifying duration, initiation and termination of the episode. **FINAL/WORKING DIAGNOSIS:** Exercise induced SVT **TREATMENT AND OUTCOMES:** Athlete continued participation with continuous real time heart rate monitoring for episodic activity. When episodes of tachycardia occurred, the athlete was removed from practice/play until a return to normal HR was achieved. After conclusion of academic year an ablation was attempted to correct the problem. The remaining athletes using the HR telemetry system have performance data analyzed on a daily basis for possible identification of arrhythmic signatures. Currently development and implementation of a policy to address identified athletes is underway and will streamline addressing future instances.

835 May 27 3:55 PM - 4:15 PM
Cardiovascular-Football
 Sabrina P. Sawlani, Joshua T. Goldman, Kevin Shannon. *University of California - Los Angeles, Los Angeles, CA.* (Sponsor: Aurelia Nattiv, FACSM)
(No relevant relationships reported)

HISTORY
 A 19-year-old football offensive lineman with history of SVT (treated in infancy with propranolol and adenosine) presented during his annual pre-participation exam with palpitations for 3 months. Episodes occurred during exercise, lasting 30 seconds to 5 minutes. He admitted associated difficulty breathing and chest tightness. He denied dizziness or syncope. **PHYSICAL EXAMINATION**
 BP 133/79, HR 96, SpO2 98%/RA, BMI 35. Exam in training room: Regular heart rate and rhythm, no murmurs sitting/lying/standing, lungs clear to auscultation bilaterally, 2+ pulses throughout. **DIFFERENTIAL DIAGNOSIS**
 1. Supraventricular tachycardia
 2. Wolff-Parkinson-White syndrome
 3. Cardiomyopathy
 4. Hyperthyroidism
 5. Anemia
 6. Anxiety or panic disorder **TESTS AND RESULTS**
 CBC, CMP, TSH, A1c normal, except: AST 53, ALT 68, Ferritin 505
 CXR: No acute cardiopulmonary abnormalities
 EKG: NSR, pre-excitation in V3
 ECHO: Normal
 Treadmill stress test: Excellent exercise tolerance (92% of HRmax), limited by shortness of breath and leg fatigue. Exercise-induced chest pressure present. Pre-excitation difficult to see at peak exercise, no sudden change to suggest abrupt loss of pre-excitation. **FINAL/WORKING DIAGNOSIS**
 Wolff-Parkinson-White syndrome **TREATMENT/OUTCOMES**
 1. Urgent referral to Cardiology, EKG and ECHO (see results), outpatient cardiac ambulatory monitor placed, and treadmill stress test completed.

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2. Concern for high-risk pathway as pre-excitation persisted at higher heart rates on stress test. Cardiology recommended electrophysiology study and ablation.
3. Underwent uncomplicated catheter ablation of left posterior accessory pathway.
4. 1 week post-ablation, some degree of pre-excitation noted on follow-up EKG (however, similar to post-elimination and initial EKG).
5. 2 weeks post-ablation, ambulatory monitor with no events.
6. 6 weeks post-ablation, remained asymptomatic and received cardiac clearance to return to sport.

836 May 27 4:15 PM - 4:35 PM

Chest Pain - Football

Courtney Nicole Hintz. *UCLA Health, Los Angeles, CA.*
(Sponsor: Aurelia Nattiv, FACSM)
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(No relevant relationships reported)

HISTORY: A 23-year old male division I football linebacker developed acute-onset exertional chest pain 30 minutes into practice. The pain was substernal, radiated to his back and was associated with shortness of breath. He was immediately transferred to the ED and after two hours had resolution of his pain with intravenous ketorolac. The patient admitted to suffering from a viral upper respiratory infection with mild unreported chest pain for two weeks prior to the episode. He has a past medical history of well-controlled asthma and sickle cell trait. He denied previous episodes of chest pain or syncope and also denied family history of sudden cardiac death.

PHYSICAL EXAMINATION: Initial vital signs were BP 141/85, HR 74, O₂ saturation 96%, T 97.8°F. Athlete was in visible distress in right lateral decubitus position, clutching chest. Cardiac examination revealed regular rate and rhythm, no murmurs or rubs. Chest pain was not reproducible on palpation of anterior chest. Pain was positional and worse with leaning forward. Lungs were clear to auscultation bilaterally with no wheezing or rhonchi, and good air movement.

DIFFERENTIAL DIAGNOSIS: 1. Myocarditis/Pericarditis 2. Acute coronary syndrome 3. Anomalous coronary artery with myocardial infarction 4. Pulmonary embolism 5. Aortic dissection

TEST AND RESULTS: Emergency Department: Labs: Troponin 2.9, CBC: 9.3 > 15.2/45.6 < 234, BMP: 141/4.3/104/23/1.4 < 102. Imaging: CXR with no cardiopulmonary disease. Bedside ultrasound with no pericardial effusion, no evidence of acute right heart strain. EKG: Sinus rhythm, rate 69, nonspecific T-wave inversions and diffuse ST-segment elevation. Cardiac Unit: Labs: Troponin trend: 2.9->6.4->11.9->13.3->9.7, D dimer 650, CRP 0.4, ESR 10. Imaging: Normal CT pulmonary angiogram. TTE with normal LV and RV size and systolic function, EF 60-65%, no valvular abnormalities. Cardiac MRI: Mild hypokinesis in the basal septum with associated patchy mesocardial delayed enhancement and transmural delayed enhancement in the basal anterior wall and mid septum with mild hypokinesis.

FINAL WORKING DIAGNOSIS: Myocarditis **TREATMENT AND OUTCOMES:** 1. Colchicine and high dose ibuprofen taper over 3 weeks 2. Avoidance of physical activity for 3-6 months per AHA guidelines 3. Resting and stress TTE and EKG, 24-hour Holter monitor prior to RTP.

B-52 Clinical Case Slide - Foot and Ankle

Wednesday, May 27, 2020, 3:15 PM - 4:35 PM
Room: CC-2016

837 **Chair:** Courtney Gleason. *Emory University, Atlanta, GA.*
(No relevant relationships reported)

838 **Discussant:** Jeffrey A. Ross, FACSM. *Baylor College of Medicine, Houston, TX.*
(No relevant relationships reported)

839 **Discussant:** Stephen M. Simons, FACSM. *Saint Joseph Regional Medical Center, South Bend, IN.*
(No relevant relationships reported)

840 May 27 3:15 PM - 3:35 PM

Left Foot Injury In A Female Gymnast

George Ceremuga¹, Elena Jelsing². ¹*Mayo Clinic, Rochester, MN.* ²*Mayo Clinic Square, Minneapolis, MN.* (Sponsor: Jonathan Finnoff, FACSM)
Email: ceremuga.george@mayo.edu
(No relevant relationships reported)

HISTORY: A 17-year-old female high level gymnast presented for evaluation of left heel pain and ecchymosis. Two days prior to her presentation, she was sprinting in preparation for a roundoff prior to vault take-off and felt her heel shift when she went to push-off. She fell and was immediately unable to bear weight secondary to heel pain. Pain was exacerbated by any weight-bearing activity and improved with rest. She had been wearing a walking boot and using crutches for ambulation. **PHYSICAL EXAMINATION:** Healthy-appearing female with a muscular build in no apparent distress. Antalgic gait favoring left foot, avoiding pressure on heel. Ecchymosis along both the medial and lateral aspects of the calcaneus. Tenderness to palpation and associated swelling at the plantar aspect of the calcaneus and along the subtalar joint. Ankle range of motion was full and pain-free. Pain with resisted eversion. Talar tilt and calcaneal squeeze tests were positive. No pain with plantar fascia stretching or palpation along the mid to distal plantar fascia. Achilles tendon was intact. Anterior drawer was negative. Strength was full and light touch sensation was intact. **DIFFERENTIAL DIAGNOSIS:** 1. Calcaneal stress fracture 2. Subtalar joint subluxation 3. Plantar fascia tear **TEST AND RESULTS:** Left ankle and foot radiographs were negative for acute fracture or dislocation. Left ankle MRI revealed a focal tear involving the lateral margin of the lateral cord of the plantar aponeurosis. **FINAL WORKING DIAGNOSIS:** Lateral cord plantar fascia rupture **TREATMENT AND OUTCOMES:** 1. Walking boot for 6 weeks with gradual wean out of boot during the 6th week and ankle range of motion exercises when out of the boot. 2. Once out of boot, supportive shoes with ankle brace and dorsiflexion night splint at night. 3. Physical therapy focusing on Achilles stretching, ankle range of motion and strengthening until pain and tenderness resolved. Slowly advanced to more sports-specific tasks once pain-free. 4. At 10 weeks post injury, she was pain free while performing plyometric and balance/proprioceptive exercises and had a normal exam with full pain-free range of motion. 5. Functional return to sport given her normal exam and pain-free activity with physical therapy.

841 May 27 3:35 PM - 3:55 PM

Heel Pain - Skier

Hung M. Le, Mary Dubon. *Boston Children's Hospital, Boston, MA.* (Sponsor: Pierre d'Hemecourt, FACSM)
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(No relevant relationships reported)

HISTORY: 17 year-old male with fascioscapulohumeral muscular dystrophy who developed acute left heel pain while skiing. He was alpine skiing when he struck his heel on a mogul and felt immediate heel pain. He was able to reach the bottom of the ski slope but was unable to continue skiing due to severe heel pain. He denied any popping sensation. He had no bruising, numbness, tingling, weakness or mechanical symptoms. **PHYSICAL EXAMINATION:** There was no swelling or obvious deformity on inspection of his left heel. He was tender on palpation over his left heel, distal Achilles tendon, and medial malleolus. He had limited range of motion of his foot due to pain. Negative Thompson's test although left had 15 degrees compared to 30 degrees of plantar flexion on the right.

DIFFERENTIAL DIAGNOSIS:

1. Bone spur
2. Partial tear of Achilles tendon
3. Bursitis
4. Hindfoot fracture

TEST AND RESULTS:

X-ray AP and lateral views of left ankle were normal.

MRI left ankle revealed a nondisplaced fracture of the calcaneus. There was no signal abnormality involving the Achilles tendon and it appeared intact.

FINAL/WORKING DIAGNOSIS:

Nondisplaced calcaneus fracture

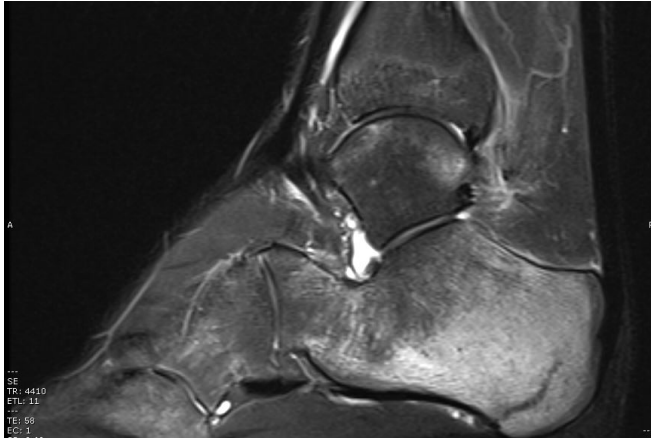
TREATMENT AND OUTCOMES:

Placed in a pneumatic boot with weight bearing as tolerated.

Out of pneumatic boot at 8 weeks.

Began physical therapy at 7 weeks.

Planning to return to skiing this winter as injury occurred in the spring.



MRI Sagittal T2 FS

842 May 27 3:55 PM - 4:15 PM

Bimalleolar Fracture In Athlete With Negative Ottawa Ankle Rules

Bilal Ittiq, Kaiser Permanente Fontana, Fontana, CA. (Sponsor: Dr. Robert E. Sallis, FACS, FACS)

(No relevant relationships reported)

HISTORY: A 16-year-old senior high school football wide receiver sustained an ankle injury while getting tackled after catching a pass. During the last few minutes of the game, he sustained an inversion ankle injury while falling to the ground during a tackle. He reported pain at the lateral malleolus during the on-field examination and was able to bear weight on the leg while walking off of the field, even though he was limping. He denied any previous ankle injuries, numbness, tingling, or radiation of pain.

PHYSICAL EXAMINATION: Examination on the field revealed full range of motion, no gross deformities, and tenderness along the anterior lateral malleolus. Further evaluation on the sideline revealed pain at the lateral ankle with inversion and eversion against resistance. The athlete was tender to palpation along the anterior lateral malleolus but he denied pain with palpation of the posterior distal 6 cm of the tibia and fibula, navicular, and base of the 5th metatarsal.

DIFFERENTIAL DIAGNOSIS: 1. Ligamentous sprain (most likely ATFL). 2. Peroneal tendon injury. 3. Fracture of the lateral malleolus. 4. Osteochondral defect.

TEST AND RESULTS: Ankle anterior-posterior and lateral radiographs: bimalleolar fracture and soft tissue edema

FINAL WORKING DIAGNOSIS: Bimalleolar fracture

TREATMENT AND OUTCOMES: 1. Immobilization in CAM boot. 2. Transitioned to lace-up ankle brace once pain resolved. 3. Range of motion, proprioceptive, and balance exercises initiated. 4. Returned to play once he achieved full, pain-free range of motion.

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A Rare Case Of Ankle Pain In An Adolescent Male Athlete

Ike Hasley, Edward Laskowski, Mayo Clinic, Rochester, MN.

(No relevant relationships reported)

History 12-year-old healthy male presents for evaluation of progressive left lateral ankle pain for 3 weeks. Denies recent injury, trauma, change in activity, prior history

of similar pain, radicular pain, weakness/sensory symptoms. Pain present at rest and at night. Increases with walking and twisting activities. Mild improvement with ice, Tylenol, ibuprofen, compression wrap.

Physical examination Gait: Non-antalgic gait with normal cadence and stride. Strength: Bilateral lower extremity strength intact. Inspection/palpation: Significant focal edema noted at the left distal fibula which is tender to palpation correlating with area of most significant pain. Range of motion: Within functional limits. Sensation: Normal. Provocative maneuvers: Mild tenderness in the area of the left anterior talofibular ligament. Bilateral ankle drawer test, squeeze test, external rotation stress tests are negative/unremarkable.

Differential Diagnosis Osteoid osteoma, Intracortical hemangioma, Nonossifying fibroma, Distal fibula physeal injury, Chondromyxoid fibroma, Ewing sarcoma, Langerhans cell histiocytoma, Osteosarcoma, Stress fracture

Tests and results: Initial plain films Focal lucency in distal left fibular metaphysis abutting the physis. Periosteal reaction and overlying soft tissue swelling.

MRI Oval well-circumscribed area in distal left fibular metaphysis crossing the physis with surrounding bone marrow edema and periosteal reaction. No evidence of abscess.

Final working diagnosis Suspected Brodie's abscess

Treatment and Outcomes Orthopedics service was consulted and patient underwent debridement of left ankle and curettage of the distal fibula. Admitted overnight for administration of IV vancomycin and cefazolin. Infectious disease service was consulted. He was discharged with one month of oral antibiotics (cefadroxil) following operation. Cultures from tissue taken remained negative. However, the patient did have a positive nares MSSA swab. He was able to return to activity and he recovered well, without significant events or issues.

B-53 Clinical Case Slide - Oncology I

Wednesday, May 27, 2020, 3:15 PM - 4:35 PM

Room: CC-2022

844 **Chair:** Thomas Trojian, FACS, Drexel University, Philadelphia, PA.

(No relevant relationships reported)

845 **Discussant:** Shawn F. Kane, FACS, UNC - Chapel Hill, Carrboro, NC.

(No relevant relationships reported)

846 **Discussant:** Scott A. Magnes, FACS, Fort Belvoir Community Hospital, Fort Belvoir, VA.

(No relevant relationships reported)

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A 26 Year Old Pregnant Woman With Growing Wrist Pain

Keyur Desai, University of Chicago (NorthShore), Glenview, IL. (Sponsor: Carrie A. Jaworski, FACS) Email: KeyurD@gmail.com

(No relevant relationships reported)

HISTORY: A 26 year old G1P1001 right-hand dominant woman presents 4 weeks after delivery for insidious onset right ulnar-sided wrist pain. Pain was initially present 6 months prior to visit during pregnancy. Her symptoms were initially intermittent but eventually progressed to constant pain. Pain is localized to the distal ulna without radiation. Patient endorses swelling. Patient has no previous history of wrist and hand pain or injury. Patient denies any mechanism of injury or trauma. Patient denies numbness and tingling.

PHYSICAL EXAMINATION: Vital signs: 133/77, HR79, T 97.5degF, 1.68m, 75.3kg, BMI 26.62

Inspection: Right wrist swollen medially

Palpation: Tender over volar aspect of distal ulna

Range of motion: Full AROM of wrist flexion, extension, supination, pronation, ulnar deviation, radial deviation. Pain with resisted flexion, end-range supination and pronation, and with ulnar deviation.

Strength testing: Strength 5/5 of wrist flexors, extensors, supination, pronation.

Special testing: Sensation preserved over C5-T1 dermatomes. Negative Tinel's. Negative Phalen's.

DIFFERENTIAL DIAGNOSIS:

1. ECU Tendonitis
2. TFCC Tear

3. DRUJ Instability
4. Ulnocarpal arthritis or abutment syndrome
5. Giant cell tumor
6. Chondrosarcoma
7. Bone cyst

TEST AND RESULTS: Right wrist X-ray:

Expansile lucent septated bony lesion in the distal ulna. The findings may reflect an aneurysmal bone cyst.

Right wrist MRI:

Expansile, enhancing, solid lesion within the distal ulna extending to the subarticular bone surface, with appearance most suggestive of giant cell tumor. Less likely considerations include chondroid lesions such as chondromyxoid fibroma or a clear cell/low-grade chondrosarcoma. Consider bone biopsy or surveillance follow-up imaging. **FINAL WORKING DIAGNOSIS:** Distal right ulna giant cell tumor. **TREATMENT AND OUTCOMES:** 1. Patient was referred to orthopedic oncology. 2. Patient underwent biopsy with curettage and allograft of distal right ulna. 3. Frozen specimens during procedure confirmed giant cell tumor. 4. Patient has followed up with orthopedic oncology with good improvement in pain and return of function.

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Toe Pain - Softball

Miguel Lopez, Angel Lazu, Peter Seidenberg, FACSM. *Penn State University, State College, PA.* (Sponsor: Peter Seidenberg, FACSM)

(No relevant relationships reported)

HISTORY: An 18-year-old collegiate softball player started noticing right great toe pain in March of her freshman season. Pain was unrelenting throughout the day but temporarily responded to anti-inflammatories. She denied fevers, chills, night sweats, or unexpected weight loss. She did not report her pain to the team physician. However, after seeing an outside physician for continued pain, she was placed in a walking boot and provided a bone stimulator. After an additional three weeks of pain despite these therapies, she presented to the training room for re-evaluation of her toe. **PHYSICAL EXAMINATION:** Examination revealed exquisite tenderness to palpation of the dorsal-fibular aspect of the proximal portion of the distal phalanx of the right first toe, with mild swelling but no plantar tenderness. There was full passive and active range of motion of the MTP and IP joints. Skin of the right foot was intact, without erythema or induration. Tendon function was intact. The foot was neurovascularly intact. **DIFFERENTIAL DIAGNOSIS:** 1. Stress Reaction of right first toe distal phalanx 2. Subacute/Chronic Osteomyelitis 3. Bony Tumor **TEST AND RESULTS:** Right toe AP, lateral, and oblique radiographs- bony alignment is unremarkable, no acute fracture; joint spaces well preserved. MRI of right foot without contrast - diffuse marrow edema throughout the first distal phalanx; no corresponding focal signal hyperintensity in the distal phalanx. Nuclear medicine bone marrow imaging - mild increased radiotracer uptake in the region of the distal first phalanx suggesting increased regional blood flow. The above studies were reviewed by the team physicians and there was a concern for bony mass of the proximal portion of the dorsal fibular distal phalanx. MRI with contrast confirmed this suspicion. CT right foot without contrast with 3D reconstruction - ill-defined sclerosis in the medial aspect of the base of the first distal phalanx measuring 7 mm x 4 mm x 5 mm with faint lucency proximal to the sclerosis. **FINAL WORKING DIAGNOSIS:** Osteoid Osteoma **TREATMENT AND OUTCOMES:** 1. Continued anti-inflammatories with COX2 inhibitors for symptomatic treatment. 2. Surgical curettage and excisional biopsy of the 7 mm x 4 mm x 5 mm nidus; deferment of radiofrequency ablation due to proximity to the joint. 3. Anticipated return to play in 4-6 weeks.

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New Mole In A College Football Athlete

Kathleen Roberts, Robert Hosey, FACSM, Kyle Smoot. *University of Kentucky, Lexington, KY.* (Sponsor: Robert Hosey, FACSM)

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(No relevant relationships reported)

Skin Cancer – Football

History: A 19-year-old male college sophomore football defensive lineman noted a pigmented lesion on the sole of his right foot with the appearance of a blood blister at the end of his freshman year. Over the next weeks to months the lesion grew in size and also became painful with activity. Because the pain was limiting him with football activity he presented to be seen by a dermatologist.

Physical exam: Right foot without soft tissue swelling, area on the plantar surface of the first metatarsal approximately 1.5cm in size with dark coloration, black in appearance, negative signs of infection. Tender to palpation over this area. Range of motion intact at the first metatarsal in flexion and extension without pain. Plantar and dorsiflexion, inversion and eversion intact at the ankle. Pain with ambulation when weight bearing on the area. Sensation intact to light touch. Dorsalis pedis pulse 2+.

Differential Diagnosis:

1. Dysplastic Nevus
2. Melanoma
3. Benign Nevus

Test and Results:

Shave biopsy of the right plantar forefoot overlying the first metatarsal:

- Malignant Melanoma in situ, the deep biopsy margin being free in the tissue planes examined. Lesion involves the peripheral biopsy margin.

Lesion Excision

- Malignant melanoma, 3.3mm

Final/Working Diagnosis:

Acral Lentiginous Melanoma

Treatment and Outcomes:

1. Patient underwent resection of the right foot melanoma in situ with a total defect of 2x2cm, with subsequent adjacent tissue transfer 5x3cm.
2. Sentinel node sampling performed which identified microscopic foci of melanoma in both sentinel nodes resulting in Stage IIIB (T3a, N2a), genetic testing performed showing BRAF negative.
3. PET scan performed showing no evidence of residual disease or metastatic focus.
4. Started on Nivolumab 480mg IV monthly for 13 doses.
5. Patient able to return to football competition in the middle of November, competing in the last few games of his sophomore season.

850 May 27 4:15 PM - 4:35 PM

Atraumatic Knee Swelling - Runner

Bernadette Pendergraph, Bret Namihas, Jason Alvarado. *Harbor-UCLA, Harbor City, CA.*

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(No relevant relationships reported)

HISTORY: 38-year-old male runner with 4 months of left knee pain and swelling that he noticed worsened with running. He remembers no particular injury, increase in mileage, change in footwear, or systemic symptoms such as night sweats, weight loss, or other joint swelling. He was seen in urgent care with his exam showing an effusion and painful range of motion. He was diagnosed with a knee sprain, MRI ordered, and referred to sports medicine. In our clinic, he complained about anterolateral knee pain, persistent knee effusion, and inability to train because of pain and swelling. He denied locking or giving way.

PHYSICAL EXAMINATION: Left knee with 1-2+ non-warm effusion, range of motion 0-130 degrees, lateral patellar facet tenderness, medial joint line tenderness, Lachman negative, valgus/varus testing stable, McMurray negative for click.

DIFFERENTIAL DIAGNOSIS: 1. Medial meniscal tear 2. Patellar chondromalacia 3. Rheumatologic disorder 4. Pigmented nodular synovitis 5. Synovial chondromatosis

TEST AND RESULTS: X-ray: small joint effusion MRI without contrast:

large joint effusion, small medial meniscal tear, lateral patellar facet chondromalacia Arthrocentesis: 303,500 RBCs, 839 WBCs, no crystals; ESR 10, CRP 0.08, ANA negative, RF negative, Normal CBC; MRI with contrast: multiple round lesions on the medial posterior mid joint next to the proximal tibiofibular joint with peripheral enhancement consistent with pigmented villonodular synovitis vs infection

FINAL WORKING DIAGNOSIS: 1. Pigmented villonodular synovitis 2. Medial meniscal tear 3. Patellar chondromalacia

TREATMENT AND OUTCOMES: 1. Athlete was initially treated with physical therapy for the atraumatic meniscal tear. 2. Athlete had persistent effusion, with an aspiration that showed blood. This provoked review of prior MRI with concern of nodularity of synovium. Therefore an MRI with contrast was performed consistent with likely pigmented nodular synovitis. 3. Athlete evaluated by orthopedics for arthroscopy and synovial biopsy. Intraoperative findings included diffuse involvement of joint including anterior compartment, medial and lateral gutters, and the notch. Pathology consistent with pigmented villonodular synovitis. 4. Post op care complicated by poor progression of range of motion, current 10 to 70 degrees.

B-54 Rapid Fire Platform - Oxygen Uptake Kinetics

Wednesday, May 27, 2020, 3:15 PM - 4:15 PM
Room: CC-Exhibit Hall

851 Chair: Silvia Pogliaghi, FACSM. *Università di Verona, Verona, Italy.*
(No relevant relationships reported)

852 May 27 3:15 PM - 3:25 PM
Residual Fatigue Does Not Affect Critical Power And W' Using A Single-visit Protocol

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Traditionally, determining critical power (CP) and its related work above CP (W') requires exhaustive constant-power trials interspersed by at least 24 h rest. During the last decade several approaches were undertaken to make the protocol less time consuming and to use self-paced ecological time-trials (TT). However, it is debatable whether residual fatigue induced by a single-visit protocol might affect CP and/or W' . Parameters of oxygen uptake ($\dot{V}O_2$) kinetics and muscle deoxygenation can be suggested as suitable to assess the effects of residual fatigue. **PURPOSE:** Assessing fatigue-related parameters of $\dot{V}O_2$ kinetics and muscle deoxygenation between a single-visit and a multi-visit protocol. **METHODS:** Nine well-trained male triathletes (mean \pm SD; age: 27.7 \pm 4.3 yrs; body mass: 75.6 \pm 5.6 kg; $\dot{V}O_{2peak}$: 60.0 \pm 6.5 mL/min/kg) participated. Athletes had to perform a single-visit (2, 5 and 10 min TT, interspersed by 30 min passive rest) as well as a multi-visit determination of CP and W' (2, 5 and 10 min TT, interspersed by at least 24 h rest). During all tests, heart rate (HR) was recorded continuously, respiratory gases were measured breath-by-breath and deoxygenation was recorded at 10 Hz using near infrared spectroscopy (NIRS). The following parameters were assessed: maximal HR, $\dot{V}O_2$ during the first 2 min ($\dot{V}O_{2onset}$), mean response time (MRT), end-exercise $\dot{V}O_2$ ($\dot{V}O_{2peak}$), $\dot{V}O_2$ amplitude ($\text{ampl}\dot{V}O_2$), O_2 deficit, NIRS τ , amplitude (ampl_{NIRS}), and time-delay (TD). To compare the two protocols a paired sample t-test was used to assess the differences in CP and W' and a two-way ANOVA to assess the differences between trials and/or groups as well as and trials \times groups interactions.

RESULTS: No significant differences were found for CP or W' between protocols ($p > 0.05$). Significant main effects between trials were found for HR, $\dot{V}O_{2onset}$, $\text{ampl}\dot{V}O_2$, τ and ampl_{NIRS} ($p < 0.001$), but not for MRT, $\dot{V}O_{2peak}$, O_2 deficit and TD ($p > 0.05$). A post-hoc analysis of main effects did not reveal significant differences between corresponding trials ($p > 0.05$).

CONCLUSIONS: Due to non-significant differences in fatigue-related parameters results indicate that the determination of CP and W' using a single-visit protocol is not affected by residual fatigue. Consequently, the single-visit TT approach is a valid method to accurately determine CP and W' .

853 May 27 3:25 PM - 3:35 PM
Influence Of Body Position On Pulmonary Oxygen Uptake And Muscle Deoxygenation Kinetics During Cycle Exercise

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Whether pulmonary oxygen uptake ($\dot{V}O_2$) kinetics are limited by O_2 delivery remains contentious. Previous studies have demonstrated that the time constant of pulmonary $\dot{V}O_2$ kinetics ($\tau_{\dot{V}O_2}$) is greater during supine compared to upright cycle exercise, presumably reflecting the superimposition of an O_2 availability limitation. However, interpretation of these studies is compromised by their use of superficial single-site measurements using continuous-wave near-infrared spectroscopy (NIRS), which is unable to determine absolute [heme]. **PURPOSE:** To determine the impact of body position (i.e. upright [U] vs. supine [S]) on the kinetics of pulmonary $\dot{V}O_2$, as well as muscle deoxygenation (deoxy[heme]) kinetics and total[heme] using time-resolved

(TR-)NIRS. **METHODS:** 7 healthy men completed an incremental ramp test to determine $\dot{V}O_{2max}$ and the gas exchange threshold in the supine position. 4 visits followed whereby pulmonary $\dot{V}O_2$ and deoxy[heme] kinetics and total[heme] were determined via TR-NIRS at three muscle sites (deep [VLD] and superficial [VLS] vastus lateralis and superficial rectus femoris [RFs]) in two conditions: 1) during S heavy intensity constant work rate exercise at 40% Δ (between ventilatory threshold and $\dot{V}O_{2max}$); and 2) during U exercise at the same absolute work rate. **RESULTS:** $\tau_{\dot{V}O_2}$ was increased during S compared to U (S: 42 \pm 12 vs. U: 32 \pm 9 s, $P = 0.03$). The fundamental phase deoxy[heme] was greater (i.e. slower) in S compared to U for each muscle site (VLD S: 19 \pm 10 vs. U: 8 \pm 5 s; VLS S: 16 \pm 7 vs. U: 10 \pm 3 s; RFs S: 20 \pm 7 vs. U: 11 \pm 3 s, $P = 0.002$) and its amplitude was greater in S compared to U for RFs only (S: 27.4 \pm 12.1 vs. U: 9.1 \pm 2.5 μ M, $P = 0.008$). Total[heme] did not differ between U and S for any muscle site (all $P > 0.05$). **CONCLUSION:** The slowing of pulmonary $\dot{V}O_2$ kinetics for S versus U occurs concomitant with a depressed rate of muscle(s) deoxygenation. This finding suggests that supine exercise results in a relatively greater fall in muscle $\dot{V}O_2$ when compared to O_2 delivery kinetics at least for VLD and VLS. The increased amplitude of deoxy[heme] in S for RFs suggests an increase in O_2 extraction to compensate for impaired muscle perfusion in S compared to U.

854 May 27 3:35 PM - 3:45 PM
Skeletal Muscle Endurance And Oxygen Uptake Kinetics During Cycling In Patients With High Affinity Hemoglobin

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(No relevant relationships reported)

Skeletal muscle oxygen (O_2) consumption is linked to the metabolic demand of the exercising skeletal muscle. In hypoxic conditions (e.g. high altitude) O_2 consumption may be the limiting factor of exercise tolerance. Patients with increased O_2 content, secondary to an increased oxygen affinity (HAH), provide an experiment of nature to investigate the effects of increased flux through the O_2 transport pathway on exercise tolerance. **PURPOSE:** To determine the effect of HAH on O_2 uptake kinetics and exercise tolerance during high-intensity exercise under normoxia (NORM) and hypoxia (HYP) conditions. **METHODS:** Five healthy controls (CTL); 4 men, 41 \pm 8 years, $P_{50} = 27 \pm 1$ mmHg; Hemoglobin concentration ([Hb]) = 14.2 \pm 1.3 g \cdot dL⁻¹; hematocrit (Hct) = 43 \pm 4% and five patients with high-affinity hemoglobin (HAH); 3 men, 37 \pm 12 years, $P_{50} = 15 \pm 2$ mmHg; [Hb]: 19.8 \pm 2.3 g \cdot dL⁻¹, Hct = 59 \pm 7% cycled during unloaded pedaling then at a power output that elicited 85% $\dot{V}O_{2max}$ until volitional exhaustion during two different environmental conditions: 1) NORM, ($F_{iO_2} = 0.21$), and 2) HYP, ($F_{iO_2} = 0.15$). O_2 uptake kinetics were modeled as a double-exponential rise to maximum from continuous measurements of inspired/expired gases. Two-way ANOVA with group (HAH, CTL) and inspire (NORM, HYP) as between-subjects factors were used to compare dependent variables. **RESULTS:** HAH patients had marked polycythemia (higher [Hb] and Hct, $P < 0.05$ for both). There was no effect of inspire on any of the parameters of O_2 kinetics, all $P > 0.175$). There was no main effect of group or inspire on $\dot{V}O_2$ during unloaded pedaling (A_p , $P > 0.24$), $\dot{V}O_2$ of the primary component (A_1 , $P > 0.13$), or the $\dot{V}O_2$ slow component ($P > 0.10$). HAH exhibited a trend towards slower O_2 kinetics (HAH = 64.3 \pm 17.7 s vs. CTL = 49.2 \pm 17.0 s, $P = 0.08$) and significantly lower primary component amplitude (HAH = 1.14 \pm 0.66 L \cdot min⁻¹ vs. CTL = 1.92 \pm 0.67 L \cdot min⁻¹, $P = 0.02$). There was a trend towards reduced time-to-exhaustion in HYP ($P = 0.09$), but no main effect of group ($P = 0.21$). **CONCLUSION:** Patients with HAH had slower and blunted $\dot{V}O_2$ kinetics, which may be due to 1) blunted O_2 off-loading to the contracting skeletal muscle or 2) adaptations of skeletal muscle (e.g. myosin heavy chain expression) to HAH.

855 May 27 3:45 PM - 3:55 PM

Influence Of Priming Exercise On Muscle Deoxygenation Kinetics During Upright And Supine Cycle Exercise

Shunsaku Koga¹, Dai Okushima², Simon Marwood³, Tze-Tuan Lei⁴, Narihiko Kondo⁴, David C. Poole, FACSM⁵, Thomas J. Barstow, FACSM², Goulding P. Richie¹. ¹Kobe Design University, Kobe, Japan. ²Osaka International University, Osaka, Japan. ³Liverpool Hope University, Liverpool, United Kingdom. ⁴Kobe University, Kobe, Japan. ⁵Kansas State University, Kansas, KS.
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A bout of prior heavy "priming" exercise typically reduces the time constant of fundamental phase oxygen uptake (VO_2) kinetics (τ_{VO_2}) in the supine position, an effect that is generally absent during upright exercise. This priming-induced speeding of pulmonary VO_2 kinetics has been attributed to increased muscle oxygenation at the onset of the second bout. However, the extent to which priming-induced improvements in muscle oxy/deoxygenation status differ across distinct muscle regions, as well as between deep vs. superficial muscle and with respect to body position, remains unknown. **PURPOSE:** To examine the impact of priming exercise on pulmonary VO_2 and muscle deoxygenation kinetics at three muscle sites (superficial rectus femoris [RFs], deep [VLd] and superficial [VLs] vastus lateralis) using time-resolved near-infrared spectroscopy during upright (U) and supine (S) exercise. **METHODS:** 7 healthy men completed an incremental ramp test to determine VO_2 max and the gas exchange threshold in S. 4 visits followed whereby participants performed two 6-min bouts of heavy exercise separated by 6-min unloaded pedalling in two conditions: 1) during constant power exercise at 40% Δ in S; and 2) during exercise at the same absolute work rate in U. Pulmonary VO_2 and muscle deoxy[heme] kinetics were determined during each test. **RESULTS:** τ_{VO_2} was reduced in bout 2 in S (bout 1: 42 \pm 12 vs. bout 2: 31 \pm 7 s, $P = 0.016$) but not in U (bout 1: 32 \pm 9 vs. bout 2: 28 \pm 5 s, $P = 0.32$). The fundamental phase tdeoxy[heme] was greater in bout 2 for RFs in both postures (S, bout 1: 20 \pm 7 vs. bout 2: 31 \pm 18 s; U, 1: 11 \pm 3 vs. bout 2: 23 \pm 9 s, $P = 0.021$), whereas it was increased in bout 2 for VLs during U only (bout 1: 10 \pm 3 vs. bout 2: 15 \pm 4 s, $P = 0.028$). The fundamental phase muscle deoxy[heme] amplitude was greater in bout 2 for RFs ($P = 0.001$) and VLs ($P = 0.024$) in both U and S. Both the fundamental phase tdeoxy[heme] and amplitude did not differ between bouts 1 and 2 for VLd in either position (both $P > 0.05$). **CONCLUSION:** Prior heavy exercise reduced τ_{VO_2} in S but not U. This was accompanied by a greater amplitude and slower rate of muscle deoxygenation in superficial but not deep muscle. The contrasting responses of deep and superficial muscle to priming exercise in both U and S suggests that these muscles rely on fundamentally different O_2 transport strategies.

856 May 27 3:55 PM - 4:05 PM

Contrasting Patterns Of Respiratory And Locomotor Muscle Deoxygenation And Total Hemoglobin During Incremental Ramp Cycling

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Respiratory muscle demands during severe intensity exercise may constrain the blood flow increase to locomotory muscles, thereby limiting exercise tolerance. Muscle mitochondrial O_2 delivery depends on both perfusive and diffusive O_2 transport, the former reflecting the O_2 delivery-utilization balance and the latter exercise-induced changes in muscle total hemoglobin (THb). Resolution of changes in deoxygenation and THb simultaneously within these two muscle groups will provide novel insights into vascular and metabolic control. **PURPOSE:** We investigated absolute deoxygenated [Hb+Mb] (HHb, index of fractional O_2 extraction) and THb responses in respiratory and locomotor muscle using time-resolved near-infrared spectroscopy (TR-NIRS). **METHODS:** Ten males performed ramp incremental cycling (20 W \cdot min⁻¹) to exhaustion while measuring pulmonary VO_2 , HHb and THb (9-10th intercostal space for intercostal muscle and diaphragm, IC-DP, and vastus lateralis, VL). HHb and THb were corrected for adipose tissue thickness (ATT) at each optode site, using the THb-ATT regression. **RESULTS:** HHb increased systematically with power output (PO) in VL and plateaued above ~80% PO_{max} (Figure 1A). In contrast, HHb in IC-DP was unchanged from rest. THb in VL increased modestly and plateaued above ~50% PO_{max} ,

whereas THb in IC-DP declined gently from rest such that THb was greater in VL than IC-DP from 30 to 100 % PO_{max} (Figure 1B). **CONCLUSIONS:** These disparate HHb and THb profiles imply a muscle-specific regulation of perfusive and diffusive O_2 fluxes for respiratory versus locomotory muscle(s). Supported by JSPS-17J09854, 18K17875
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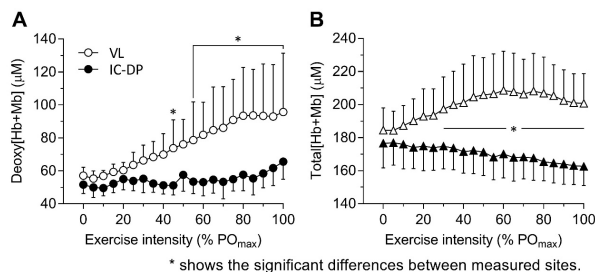


Figure 1. Mean temporal profile of muscle deoxy- (HHb, A) and total [Hb+Mb] (THb, B) concentration for the intercostal and diaphragm (IC-DP), and vastus lateralis (VL) muscles across normalized power output. * shows the significant differences between measured sites.

857 May 27 4:05 PM - 4:15 PM

Beneficial Effects Of Exposure To Mild Hyperbaric Oxygen On Microcirculation In Peripheral Tissues

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The intent of exposure to mild hyperbaric oxygen (mHBO) is to increase the oxygenation of a person's blood by forcing additional oxygen to dissolve into the blood plasma. There is a lack of substantial evidence regarding responses of exposure to mHBO on microcirculation in peripheral tissues, and this research will provide insight into it. **Purpose:** To determine the beneficial effects of exposure to mHBO on microcirculation in peripheral tissues. **Methods:** In this experimental study 15 healthy individuals were exposed to both normobaric (1.00 ATA with 20.9% oxygen) and mHBO (1.4 ATA, Oxygen Concentration 30.8% - 39.5%) in a mild hyperbaric oxygen chamber for 70 minutes in each condition. Peripheral capillary oxygen saturation (SpO_2) and blood flow in capillaries of muscles and skin were measured every 15 minutes during both exposures in the supine position. Repeated measures ANOVA and paired t-test were used for statistical comparisons. An analysis with a p-value < 0.05 was considered significant. **Results:** The mean age of participants was 24.6 \pm 4.9 years and mean BMI was 20.5 \pm 2.7. Average blood flow in capillaries was increased from 94 $\mu\text{m/s}$ to 105 $\mu\text{m/s}$ after exposure to normobaric condition whereas average blood flow was increased from 92 $\mu\text{m/s}$ to 126 $\mu\text{m/s}$ after exposure to mHBO. We found a significant effect of conditions ($p < .008$), time ($p < .001$) as well as interactional effect ($p < .001$). SpO_2 was increased from 97.6% to 99.5% after exposure to mHBO and it was unchanged after exposure to the normobaric condition. We found a significant effect of conditions ($p < .001$), time ($p < .001$) as well as interactional effect ($p < .001$). **Conclusion:** The results of this study confirm that exposure to mHBO increases oxygen saturation and blood flow in the capillaries of peripheral tissues.

B-63 Free Communication/Poster - Resistance Training

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

875 Board #1 May 27 1:30 PM - 3:00 PM

Strengthening Knee Extensor Muscles In Healthy Individuals: Single-joint Or Multi-joint Exercises?

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Introduction

Increases in muscle strength from resistance training are maximized when the spatiotemporal recruitment of the muscle is full and the peripheral perturbation is high.

During maximal single-joint knee extension and multi-joint leg extension movements, activation of the *vastii* knee extensor muscles is similar, however, little is known of the magnitude and etiology of fatigue development when these movements are repeated.

Purpose

To compare the magnitude and etiology of fatigue in the *vastii* knee extensor muscles following repeated maximal contractions performed through single-joint (knee extension) or multi-joint (leg extension) exercises.

Method

On separate days, 16 participants completed 60 maximal unilateral: i) knee extensions on a dynamometer (K_{EXT}) or ii) leg extensions on a cycle ergometer (L_{EXT}). Knee range of motion ($\sim 120^\circ - 30^\circ$ flexion) and angular velocity ($\sim 80^\circ \cdot s^{-1}$) were matched. Maximal torque, *vastii* muscle EMG and M-wave amplitude (M_{max}) were calculated during the first and last three contractions of both exercises. Knee extensor isometric maximal voluntary force (IMVF), voluntary activation (VA) and resting twitch force ($RT_{10:100\text{ Hz}}$) were measured pre-exercise and 40-s post-exercise.

Results:

Similar torque (K_{EXT} : 152 ± 33 N·m vs. L_{EXT} : 165 ± 30 N·m, $P > 0.05$), EMG (K_{EXT} : $95 \pm 6\%$ vs. L_{EXT} : $96 \pm 8\%$, $P > 0.05$) and M_{max} (K_{EXT} : $95 \pm 5\%$ vs. L_{EXT} : $97 \pm 5\%$, $P > 0.05$) were measured at the start of the exercises. Larger reductions in torque (K_{EXT} : $-60 \pm 10\%$ vs. L_{EXT} : $-38 \pm 14\%$) and EMG (K_{EXT} : $-21 \pm 16\%$ vs. L_{EXT} : $-13 \pm 16\%$) were seen for K_{EXT} during the final part of the exercise ($P \leq 0.05$), whereas no differences were reported in M_{max} ($P > 0.05$). Larger reductions in VA were seen after K_{EXT} whereas greater reductions in $RT_{10:100\text{ Hz}}$ were seen after L_{EXT} (both $P \leq 0.05$). Ultimately, similar reductions in IMVF were seen following K_{EXT} ($-32 \pm 10\%$) and L_{EXT} ($-35 \pm 13\%$) ($P > 0.05$).

Conclusion:

A lower-limb resistance training program which adopts multi-joint exercises may induce superior strength gains in *vastii* knee extensor muscles compared to single-joint exercises, as it is possible to induce larger levels of peripheral fatigue with a smaller reduction in voluntary activation.

876 Board #2 May 27 1:30 PM - 3:00 PM Neural And Muscular Responses To Maximal Strength Training

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PURPOSE: Maximal strength training (MST), performed with heavy loads ($\sim 90\%$ of one repetition maximum; 1RM) and few repetitions (4-5), yields large improvements in efferent neural drive and skeletal muscle force generating capacity. However, it is elusive how MST-induced neural adaptations may translate to muscular factors regulating excitation-contraction coupling. **METHODS:** Sixteen healthy young males (24 ± 4 years) were randomized to MST 3 times per week for 8 weeks ($n=8$), or a control group (CG; $n=8$). Measurements were taken of 1RM and rate of force development (RFD), and evoked potentials recordings (V-wave and H-reflex normalized to M-wave (M) in musculus soleus) applied to assess efferent neural drive to maximally contracting skeletal muscle. Biopsies were obtained from m. vastus lateralis and analyzed by western blot and mRNA isolation to investigate the protein expression of Sarcoplasmic Reticulum Ca^{2+} ATPase (SERCA) and mRNA expression of SERCA1 and SERCA2, myostatin, MuRF1 and Ryanodine receptor (RyR1). **RESULTS:** 1RM ($17 \pm 9\%$; $p < 0.05$) and early (0-100ms), late (100-200ms) and maximal RFD increased ($31-53\%$; $p < 0.01$) in the MST group, accompanied by increased maximal V-M wave ratio ($9 \pm 14\%$; $p < 0.05$), with no change in H-reflex to M-wave ratio. No changes were observed in the CG. No pre- to post-training differences were found in mRNA or protein expressions in either group ($p > 0.05$). **CONCLUSION:** MST increased efferent neural drive to maximally contracting skeletal muscle, and resulted in improved force generating capacity. The neural adaptations were not reflected in key muscular factors involved in excitation-contraction coupling, indicating that responses to high intensity strength training may predominantly be governed by neural adaptations.

877 Board #3 May 27 1:30 PM - 3:00 PM Ten Weeks Of Resistance Training Increased Total Hemoglobin Mass Without Increasing Maximal Oxygen Uptake

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(No relevant relationships reported)

PURPOSE: Resistance training increases muscles mass whereas maximal oxygen uptake remains normally unchanged. The purpose of the present study was to investigate the effect of 10 weeks resistance training on total hemoglobin mass, lean mass and maximal oxygen uptake in young healthy males.

METHODS: Thirteen young male subjects (age: 22.2 ± 2.6 years; height: 177.7 ± 3.7 cm) completed 10 weeks of resistance training. The resistance training consisted of 5 weekly sessions of full body resistance training. The training program consisted of 13 exercises; for all exercises 3 sets with 12 repetitions were conducted. Each training session lasted 70-90 min. Body composition was measured with Dual-energy X-ray absorptiometry (DXA), total hemoglobin mass with CO rebreathing method, and maximal oxygen uptake was tested on treadmill.

RESULTS: Body mass did not increase significantly during the training intervention (before: 74.5 ± 7.9 ; after: 77.6 ± 6.2 kg; $p=0.30$), but fat free mass increased 8.8% ($p < 0.05$). Total hemoglobin mass (tHb) increased from 865.1 ± 70.6 to 981.2 ± 89.8 g ($p < 0.05$) during the training intervention and hematocrit was unchanged. Hemoglobin mass per kg body weight did not increase significantly (before: 11.0 ± 1.7 ; after: 13.4 ± 1.9 g/kg; $p=0.25$). Maximal oxygen was 3.32 ± 0.47 L/min before and 3.38 ± 0.52 L/min after the resistance training. Maximal oxygen uptake related to body weight did neither change during the training intervention (before: 44.4 ± 4.0 ; after 43.7 ± 5.9 ml \cdot kg $^{-1} \cdot$ min $^{-1}$).

CONCLUSIONS: Whole body resistance training for ten weeks increased fat free mass and tHb, but VO_{2max} did not increase. These data show that increased total hemoglobin mass is not sufficient to increase maximal oxygen uptake in young healthy males.

878 Board #4 May 27 1:30 PM - 3:00 PM Variation Of Resistance Exercise Intensity Versus Resistance Exercise Selection: The Effects On Strength And Power

Jonathan Hummel, East Stroudsburg University, East Stroudsburg, PA. (Sponsor: Shala Davis, FACSM)

(No relevant relationships reported)

Variation of resistance exercise intensity versus resistance exercise selection: the effects on strength and power

Jonathan W. Hummel, Gavin L. Moir, Matthew R. Miltenberger, Shawn N. Munford. East Stroudsburg University, East Stroudsburg, PA.

Purpose: To compare the effects of exercise selection variations versus exercise intensity variations on absolute strength and power measures across a 4-week training block for in-season collegiate athletes. **Methods:** 14 Division II collegiate track and field athletes ($n=5$ females; $n=9$ males; age: 20.7 ± 1.4 yrs; primarily anaerobic based track and field events) participated in one of two 4 week periodized exercise programs: 1) manipulation of resistance training intensity (INT group), 2) manipulation of resistance training exercise selection (EXE group). Exercise selection was held constant in the INT group while the intensity was varied (85%-90%). The EXE group held intensity at a constant but varied the selection of exercises (e.g. pin squat, box squat). The mean intensity and working repetitions across the 4-week block of training were equated across the groups. Absolute strength was assessed with a 1-repetition maximum (1RM) back squat and power was assessed in a vertical jump. **Results:** Both INT (mean improvement: 3.52 kg, $p < 0.05$) and EXE (mean improvement: 3.08 kg, $p < 0.05$) increased 1RM across the training period, but there were no significant differences between the groups ($p > 0.05$). Both groups produced an increase in jump height (INT mean improvement: 0.04 m, $p < 0.05$; EXE mean improvement: 0.04 m, $p < 0.05$) with no significant differences between the groups ($p > 0.05$). **Conclusion:** Variation in training applied through the manipulation of exercise intensity was as effective as that applied through the manipulation of exercise selection for improving strength and power in collegiate track and field athletes during a 4-week block. Both variables are equally important when considering implementation into programming for athletic populations.

879 Board #5 May 27 1:30 PM - 3:00 PM Diurnal Sensitivity Of Muscle Force And Acceleration Parameters Of The Upper Limb

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(No relevant relationships reported)

Novel technology permits more precise investigation of motor function. Limited data exist on diurnal variation in force and acceleration parameters of the upper limb. **PURPOSE:** To detect the optimal time of day for maximum power output and development rate in unilateral row and press motions. **METHODS:** We tested 112 physically active male and female subjects on Proteus (Proteus Motion, USA). In total, they performed 2,750 unilateral, isotonic sets, evenly divided between rows and presses. Loads were applied through three-dimensional magnetic resistance at 10lb (862 sets), 15lb (646 sets), 20lb (612 sets), and 25lb (630 sets). Testing was performed at various times over a 14-hour span (6:00am to 8:00pm). For each individual set, Proteus calculated average peak power of all repetitions (PP_{max}), highest power achieved during any single repetition (PP_{max}), average peak force development rate across all repetitions ($PFDR_{max}$), and the highest rate achieved during a single repetition ($PFDR_{max}$). Mixed model ANOVA with repeated measures tested the differences in these parameters between push and pull motions, loads applied, and

times of day. Linear regression models isolated the effect of time on performance holding other influential factors constant. RESULTS: Across all movements, loads, and times, PP_{mean} was 235.2 ± 114.1 w; PP_{max} was 254.1 ± 120.0 w; $PFDR_{mean}$ was $1,036.1 \pm 631.6$ w/s; and $PFDR_{max}$ was $1,243.4 \pm 789.6$ w/s. Differences in both PP_{mean} and PP_{max} were detected by time of day ($p < 0.001$) and load ($p < 0.001$). The highest values were achieved between 2:00pm and 4:00pm. Similar relationships were found with time of day in $PFDR_{mean}$ ($p < 0.001$) and $PFDR_{max}$ ($p < 0.001$). Holding constant the subject performing the set, arm dominance, exercise being performed, and the load applied, linear regression analyses found that if performance occurred between 2:00pm and 4:00pm, there was a 139.6 w/s increase in $PFDR_{mean}$ (95% CI: 75.5-203.6), 164.7 w/s increase in $PFDR_{max}$ (95% CI: 79.7-249.8), 29.6 w increase in PP_{mean} (95% CI: 20.7 \pm 38.5), and 33.6 w increase in PP_{max} (95% CI: 24.4 \pm 42.8). CONCLUSIONS: Success in many athletic contexts depends on expressions of power and the rate of its development. Our findings demonstrate diurnal rhythms in power parameters of the upper limb, with optimal performance occurring in the afternoon.

880 Board #6 May 27 1:30 PM - 3:00 PM
Assessing True Variability And Mean Changes To Two Distinct Resistance Training Protocols

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(No relevant relationships reported)

Millions of dollars are spent analyzing inter-individual differences in response to resistance exercise, but the lack of a non-exercise control group makes it possible that these studies may simply be examining random error. Furthermore, it has been hypothesized that the magnitude of variability may differ depending upon the exercise protocol employed, but this yet to be appropriately tested.

PURPOSE: To determine differences in two distinct resistance training protocols and whether true variability could be detected after accounting for random error.

METHODS: Individuals (n=151) were randomly assigned to one of three groups: (1) a traditional exercise group performing four sets of elbow flexion exercise to failure; (2) a one-repetition maximum (1RM) performing a 1RM elbow flexion test; and (3) a time-matched non-exercise control group. Both exercise groups performed 18 sessions over six weeks. A Bayesian ANCOVA was used to test for mean changes across groups while adjusting for pre-values. To assess whether the variability in response to each exercise intervention differed from that of the control group, Bayesian Levene's tests were computed. Bayes Factors (BF_{10}) were used to quantify evidence for or against the null hypothesis.

RESULTS: Both 1RM (2.3kg; $BF_{10} = 4.791e+6$) and traditional training groups (2.4kg; $BF_{10} = 11,915$) increased 1RM strength similarly ($BF_{10} = 0.21$), but only the 1RM group increased untrained arm 1RM strength (1.5kg; $BF_{10} = 271$). Only the traditional exercise group increased ultrasound measured muscle thickness (~0.23 cm across all sites; all $BF_{10} \geq 224$). Across both training groups, the only differential responses were found in the change in 1RM strength of the trained arm in the traditional training group ($BF_{10} = 5.381$). This resulted in a true variability of 1.8 kg after the removal of random error.

CONCLUSION: These findings demonstrate the importance of taking into consideration the magnitude of random error when determining response heterogeneity, as many studies may be classifying individuals based on random error. Additionally, our mean results demonstrate that strength is largely driven by task specificity, and the cross-over effect of strength may be load dependent.

881 Board #7 May 27 1:30 PM - 3:00 PM
Progressive Movement Training: An Analysis Of Its Effects On Muscular Strength And Power Development

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(No relevant relationships reported)

Muscular strength and power are important attributes in many sports, so research on resistance training (RT) methods that may improve these attributes are of great interest. One such RT method is Progressive Movement Training (PMT) which incorporates a partial range of movement (ROM) with a supramaximal load. **PURPOSE:** This study compared the effects of PMT and traditional full ROM RT on the 1-RM back squat (BSQ), vertical jump (VJ) height, and power output (PO). **METHODS:** High school male participants were randomly assigned to either a PMT RT group (n=21, age: 17.4 \pm 0.7 yrs, height: 174.9 \pm 5.8 cms, mass: 84.7 \pm 26.5 kgs) or a full ROM RT group (n=15, age: 17.3 \pm 0.7 yrs, height: 175.9 \pm 8.8 cms, mass: 82.1 \pm 14.9 kgs). The experimental groups then engaged in a 7-week intervention period using either the

PMT or full ROM BSQ modality in order to target lower body strength and power. The participant's body weight, 1-RM BSQ and VJ were measured prior to and upon completion of the intervention period. PO was calculated using the Lewis formula. No additional lower body auxiliary movements were performed in the study. Dependent t-tests (two-tailed) were used to compare the dependent variables (DVs) from pre to post RT intervention within experimental groups. Independent t-tests (two-tailed) were used to compare the gain scores for each of the DVs between experimental groups. **RESULTS:** The PMT group improved significantly from pre to post intervention period for all DVs: 1-RM BSQ (pre: 96.0 \pm 37.8, post: 110.6 \pm 37.0 kg), VJ (pre: 55.8 \pm 8.0, post: 59.4 \pm 9.5 cm) and PO (pre: 1365.8 \pm 410.7, post: 1417.2 \pm 394.7 W) ($p < 0.01$). The full ROM group improved significantly from pre to post intervention period for the 1-RM BSQ only (pre: 91.3 \pm 23.3, post: 102.3 \pm 19.4 kg) ($p < 0.01$), VJ (pre: 59.3 \pm 9.8, post: 60.7 \pm 10.6 cm) ($p > 0.05$) and PO (pre: 1359.3 \pm 203.9, post: 1397.1 \pm 221.8 W) ($p > 0.05$). When comparing gain scores between each group there were no significant differences between the PMT and full ROM groups for any of the DVs ($p > 0.05$). **CONCLUSION:** Within the parameters of this study, PMT is as effective and may be more effective than full ROM RT for increasing lower body strength and power.

882 Board #8 May 27 1:30 PM - 3:00 PM
Strength Adaptions And Body Composition Changes Following High Vs. Low Volume Resistance Training And Detraining

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Resistance training (RT) is used for improving strength and body composition. However, it is still under debate whether higher RT volume (HV) is necessary in novices, or if lower volume (LV) is equally effective. In addition, effects of detraining (DTR) following HV and LV RT are not well understood.

PURPOSE:

To determine the effects of a 12-week HV program (3 sets, 10 repetitions) compared to LV RT (1 set, 10 repetitions) to concentric muscle failure on strength and body composition, followed by four weeks of DTR in male and female subjects.

METHODS:

Forty-two untrained subjects were randomly assigned to either LV (female n=10; male n=10; age 32.9 \pm 11.8y, height 174.2 \pm 8.4cm; weight 70.3 \pm 13.5kg) or HV RT (female n=11; male n=11; age 33.0 \pm 9.6y, height 174.2 \pm 11.2cm; weight 72.4 \pm 18.1 kg). RT consisted of two RT sessions per week (squat, bench press, arm and leg flexion and extension). Measurements were taken prior to and post RT, and after DTR. Body composition was assessed using BIA. Strength measurement (10-RM) was done using the aforementioned exercises. Six subjects were eliminated from the study due to various reasons, resulting in 36 subjects included for further analysis (HV female n=10, male n=8; LV female n=9, male n=9). Compliance was 100%. Comparisons were made using two-way ANOVA with repeated measures.

RESULTS:

Both groups increased strength through RT with no difference between groups (squat HV 61.1% vs. LV 59.0%, $p < 0.001$; bench press HV 28.9% vs. LV 31.3%, $p < 0.001$; leg extension HV 54.6% vs. LV 50.2%, $p < 0.001$; leg flexion HV 30.9% vs. LV 30.3%, $p < 0.001$; arm extension HV 51.0% vs. LV 44.8%, $p < 0.001$; arm flexion HV 36.9% vs. LV 31.7%, $p < 0.001$). Body mass ($p = 0.182$), fat mass ($p = 0.238$), and fat-free mass ($p = 1.000$) was unaltered by RT. After DTR strength in arm flexion ($p = 0.007$), arm extension ($p = 0.001$), bench press ($p < 0.001$), and squat ($p = 0.039$) decreased to the same extend in both groups. Leg flexion and extension strength was unaltered following DTR, while fat-free mass increased ($p = 0.004$).

CONCLUSION:

HV and LV RT was equally effective in untrained subjects to increase strength. Novices could therefore save time with LV, with similar results. Yet, RT alone was not sufficient to change body composition. Following DTR strength gains were still elevated but in some measurements slightly lower than post RT.

883 Board #9 May 27 1:30 PM - 3:00 PM
Effect Of Gender And Body Type On Strength Gain From Different Modes Of Resistance Training

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(No relevant relationships reported)

The discussion of the influence of body type on potential to gain strength from resistance training (RT) is a relatively new field of investigation. What has not been

explored is the degree to which body type might impact the potential for strength gains between men and women. **PURPOSE:** To determine the influence of sex and body type on changes in upper-body strength resulting from free-weight RT in college men and women. **METHODS:** College men and women were measured for fat mass (FM) and fat-free mass (FFM) determined from gender-specific skinfold equations. Body type was determined by regressing FFM/Ht² on FM/Ht² for each sex and partitioned into thirds as slender (SL), average (AV), and solid (SO). Men and women were matched for body type: SL (men = 40, women = 50), AV (men = 62, women = 44), and SO (men = 60, women = 43). RM bench press was measured before and after 12 weeks of linear periodization free weight RT performed 3 times/week in 3 sets of 6 overall body exercises. **RESULTS:** Sex x body type ANOVA on absolute strength revealed significantly greater ($p < 0.001$) gains by men (6.8 ± 8.4 kg) than women (4.2 ± 3.0 kg) but no significant difference ($p = 0.15$) across body types (SL = 6.5 ± 8.9 , AV = 5.3 ± 5.9 , SO = 5.2 ± 5.4 kg). The sex x body type interaction was not significant ($p = 0.60$). Absolute strength gains were poorly correlated with initial strength ($r = 0.01$, $r = -0.10$, respectively) and body type ($r = 0.00$, $r = -0.11$, respectively) in men and women. Sex x body type ANOVA on relative strength gain indicated a significantly greater ($p = 0.04$) gain by women ($14.0 \pm 14.2\%$) than men ($10.6 \pm 12.6\%$) but no significant difference among body types (SL = $13.8 \pm 15.3\%$, AV = $11.9 \pm 14.2\%$, SO = $11.0 \pm 11.1\%$). The sex x body type interaction was not significant ($p = 0.38$). Relative strength gains were significantly correlated with initial strength in both men ($r = -0.27$) and women ($r = -0.34$) as well with body type ($r = 0.06$ and $r = -0.07$ respectively). **CONCLUSIONS:** When following the same RT program, men make a greater absolute gain but women make a greater relative gain in upper-body strength. Body type does not seem to influence the degree of absolute or relative strength gain in RT in either sex. Initial strength level has little influence on the amount of strength to be gained during short-term training.

884 Board #10 May 27 1:30 PM - 3:00 PM
Acute Response Of Blood Glucose After Two Resistance Training Protocols With Different Execution Velocities

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 (No relevant relationships reported)

PURPOSE: Studies have demonstrated that a single session of resistance training (RT) can reduce glycemia in subjects with or without diabetes. The aim of this study was to compare the acute response of blood glucose after 2 resistance training protocols with different execution velocities in amateur weightlifting athletes. **METHODS:** A randomized clinical trial was conducted in 24 amateur weightlifting athletes (23.5 ± 6.2 years). The participants were randomized into 2 groups: high velocity (MV, $n = 12$) or low velocity (LV, $n = 12$). The RT training protocol was based on a session with these characteristics: 3 sets of 12 repetitions at 60% of a maximum repetition in each of the exercises (bench press, squat and military press). The only difference between the training session was that the MV group performed all the repetitions at 100% of their maximum velocity and the LV group performed at 50%. This variable was controlled with the T-force system. An oral glucose tolerance test (OGTT) was conducted with metabolic measurements immediately after each RE protocol and every 30 min until 120 min of recovery. For the statistical analysis, the area under the blood glucose curve (AUC) was calculated at each time point. Cohen's d for effect size were also calculated to determine the magnitude of the group differences. The criteria to interpret the magnitude of the ES was as follows: trivial (< 0.2), small ($0.2-0.59$), moderate ($0.60-1.19$), large ($1.2-2.0$), or very large (> 2.0) **RESULTS:** The responses of blood glucose following each protocol and OGTT was similar in all groups, reaching the glycemic peak at 30 min of recovery. However, the MV group exhibited significantly lower values in the AUC when compared with LV group over two hours monitoring period ($P = 0.021$, $ES = 1.198$). **CONCLUSIONS:** The present study showed that RT at different velocities can generate different metabolic responses. In conclusion, the results of this study indicated that RT at a high velocity could be the optimum for postprandial glucose control.

885 Board #11 May 27 1:30 PM - 3:00 PM
Effect Of Body Type On Upper-body Strength Gain From Resistance Training In Men And Women

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Discussion of the influence of body type on the potential to gain strength from resistance training (RT) is a relatively new field of investigation. What has not been

explored is the degree to which body type might impact the potential difference between men and women to make strength gains from RT. **PURPOSE:** To determine the influence of sex and body type on changes in upper-body strength resulting from free-weight RT in college men and women. **METHODS:** College men and women ($n = 903$) were measured for fat mass (FM) and fat-free mass (FFM) as determined from gender-specific skinfold equations. Body type was determined by regressing FFM/Ht² on FM/Ht² and partitioning into thirds for each sex as slender (SL), average (AV), and solid (SO). Sexes were matched within the 3 body types for SL (men = 47, women = 23), AV (men = 43, women = 18), and SO (men = 44, women = 16). Each participant was measured for 1RM bench press before and after 12 weeks of linear periodization RT in 3 sets of 6 exercises. **RESULTS:** Sex x body type ANOVA on absolute strength gain revealed no significant difference between sexes ($M = 6.3 \pm 5.7$ kg; $W = 4.5 \pm 5.0$ kg) or across body types (SL = 4.9 ± 5.8 , AV = 6.0 ± 5.7 , SO = 6.5 ± 4.9 kg). The sex x body type interaction was not significant. SO (36.6 ± 8.3 kg), SL (35.8 ± 8.0 kg), and AV (35.1 ± 8.4 kg) differed by $< 2\%$ in initial 1RM. Absolute strength gains had low correlations with initial strength in both men ($r = -0.16$) and women ($r = 0.12$) as well with body type ($r < 0.12$). **CONCLUSIONS:** Untrained men and women of comparable body types appear to make similar gains in upper-body strength when following the same periodized free-weight RT program. The level of initial strength seems to have little bearing on the amount of strength that can be gained during training.

886 Board #12 May 27 1:30 PM - 3:00 PM
Muscle Damage And Inflammatory Response From Resistance Exercise With Higher Vs Lighter Loads

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 (No relevant relationships reported)

Resistance exercise is considered the most efficient strategy for strength, power, and muscle endurance enhancement. **PURPOSE:** The aim was to analyze the effects of different resistance exercise (RE) loads on inflammatory response and muscle tissue damage. **METHODS:** Ten trained men with at least one year of resistance training were selected (26.40 ± 4.73 years, 80.71 ± 8.95 kg, 176.03 ± 6.11 cm, $9.86 \pm 3.25\%$ body fat, bench press relative strength: 1.27 ± 0.27 kg/kg-1 of body mass), and alternately ordered to perform two separate visits. The first consisted of five submaximal sets of 10 repetitions at 80% of 10-RM, and the second consisted of five submaximal sets of 20 repetitions at 40% of 10-RM, for the horizontal bench press and leg press exercises with one-minute of rest, guaranteeing the volume equalization for both conditions. Circulating concentrations of creatine kinase (CK), lactate dehydrogenase (LDH), and leucocyte count were measured at pre-exercise (PRE) and post 3h, 6h, 12h, and 24h. **RESULTS:** The ANOVA presented increases in CK compared to the PRE moment, from 6h ($p < 0.0001$), to 24h after the higher 80% of the 10-RM load. The area under the curve differed significantly ($p = 0.009$) between 80% of 10-RM (4572.42 ± 1169.54 u/L) and 40% of 10-RM (3268.68 ± 1042.02 u/L). For the LDH concentration, a significant interaction effect (load x moment of the checks) was observed ($p = 0.019$). Specifically, for the main effect of verification moments ($p < 0.0001$), the data revealed that both loading protocols resulted in significant increases in LDH compared to PRE at 12 hours after exercise. The magnitude of the findings verified by the effect size showed large elevations of LDH from 6h to 12h for the higher load condition. For the 40% of 10-RM load, large elevations were observed in 3h, 6h, 12h, and 24h. For leucocyte count, the main effect of verification moments elevations ($p < 0.0001$), occurred from the time of 3h to 12h after exercise for both conditions. **CONCLUSION:** We found differences in tissue damage such an increase in the CK lesion marker with 80% 10-RM loading, which did not happen with 40% 10-RM loading, however with no differences on the inflammatory response concerning the total leucocyte count, neutrophils, lymphocytes and monocytes between different loads conditions. Supported by CAPES Brazil: 2.034.476.

887 Board #13 May 27 1:30 PM - 3:00 PM
Ischemic Preconditioning Of Thigh Muscles: Number Of Proper Repetitions And Effectiveness

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Ischemic preconditioning (IPC) was introduced after it was demonstrated that repetitions of short-term ischemia and reperfusion of coronary arteries can reduce the myocardial damage following prolonged ischemia (direct IPC). It was later shown that the IPC of coronary arteries also protects remote cardiac tissue not directly exposed to IPC (remote IPC). Several studies suggested that the IPC of a limb may protect

remote organs against an ischemic incident. Because of the intermittent nature of blood flow during intense muscle actions, it was proposed that IPC prior to exercise could increase muscular performance. Although most of the prior exercise studies used an IPC protocol involving four cycles of 5-min circulatory occlusion followed by a 5-min reperfusion period, the optimal number of repetitions of IPC has been unknown. **PURPOSE:** We examined the effects of direct IPC on thigh strength and sought to determine the optimal repetitions of IPC for successful results. **METHODS:** In a randomized cross-over study, 12 healthy young males (19.8 ± 2.1 yrs, body mass index: 22.1 ± 2.7 kg/m²) performed maximal knee extension (Biodex System 3; New York, USA) of the right leg preceded by direct IPC at four different repetitions (1, 2, 3, and 4 sets) and a control intervention. One IPC consisted of 5-min circulatory occlusion by 1.3-times systolic blood pressure and 5-min reperfusion. **RESULTS:** There was no significant difference in the maximal voluntary torque of knee extension between the control and any number of repetitions of the IPC, as shown below.

MVT	Control	1 set	2 sets	3 sets	4 sets
60°/sec, Nm	287.3 ± 46.3	275.3 ± 46.3	276.4 ± 47.1	270.2 ± 52.0	262.6 ± 44.5
180°/sec, Nm	191.9 ± 25.2	198.0 ± 23.6	190.5 ± 20.4	199.3 ± 31.6	188.3 ± 22.7
300°/sec, Nm	144.7 ± 21.4	150.0 ± 17.4	144.7 ± 18.3	146.2 ± 16.7	141.7 ± 16.4

MVT, maximal voluntary torque; Nm, newton meter. Data are mean ± SD (n=12). **CONCLUSIONS:** These data indicate that direct IPC for the thigh muscles could not improve maximal strength regardless of the number of repetitions. The application of pre-exercise IPC for improving performance should be further carefully examined concerning the optimal protocol and its indications, such as exercise types and target muscles.

888 Board #14 May 27 1:30 PM - 3:00 PM
Effect Of Respiratory Training On Vas Pain Rating And Via Thickness In Patients Withrating And Via Thickness In Patients With Chronic Non-specific Lumber Pain

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 (No relevant relationships reported)

PURPOSE: Non-specific low back pain(NLBP) is defined as a lumber pain that does not belong to an identifiable specific pathology. The probability of experiencing lumber pain in one's lifetime is as high as 84 %. According to the most accurate estimate, the prevalence of NLBP is 23 %, and 11 % of them have disabilities as a result. Compared with conventional physical therapy methods, core strength training can effectively relieve patients 'pain. Due to the overlap of the core muscle group and respiratory muscle in the anatomical structure, there is also a certain relationship in its function. But it is easy to ignore the training of respiratory muscle during the core force training. Therefore, this study compared the effect between respiratory training combined with core strength training and single core strength training in patients with NLBP, in order to confirm the effect of respiratory training on NLBP.

METHODS: 26 patients with NLBP were equitably distributed into observation group and control group according to random number table method. All the patients were taken in 3*40min exercise intervention for 8 weeks. The observation group adopted breath training combined with core strength training, while the control group only conducted core strength training. The VAS score measured with pain visual analog scale (VAS) and the thickness of transverse abdominis of patients were determined with Bone Ultrasound Instrument before and after the intervention.

RESULTS: The difference of VAS scores (4.40 ± 1.30 vs. 4.45 ± 1.29 , $P=0.92$) and thickness of transverse abdominis (0.35 ± 0.03 vs. 0.37 ± 0.03 , $P=0.12$) between groups were not obvious before intervention. But VAS score in observation group was significantly lower than that in the control group (3.20 ± 1.15 vs. 4.18 ± 1.17 , $P<0.05$), and the thickness in myalgia side of transverse abdominis was significantly higher than that in the control group (0.42 ± 0.03 vs. 0.39 ± 0.01 , $P=0.00$) after intervention.

CONCLUSIONS: The effect of respiratory training combined with core strength training on patients with NLBP is significantly better than that of the single core strength training, suggesting that respiratory training plays an important role in the treatment of NLBP.

889 Board #15 May 27 1:30 PM - 3:00 PM
Cross-validation Of A Prediction Equation For Energy Expenditure Of An Acute Resistance Exercise Bout.

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 (No relevant relationships reported)

Previously, our laboratory introduced a regression equation for predicting net kcal consumption of a resistance exercise (RE) bout: Total net kcal = $0.874(\text{height, cm}) - 0.596(\text{age, years}) - 1.016(\text{fat mass, kg}) + 1.638(\text{lean mass, kg}) + 2.461(\text{total volume} \times 10^{-3}) - 110.742$ ($R^2 = 0.773$, $SEE = 28.5$ kcal).

PURPOSE: The purpose of this study was to validate this regression equation using the same variables as predictors.

METHODS: Forty-seven healthy, active subjects (23 men, 24 women, 20-58 yrs, 173.5 ± 10.5 cm, 85.5 ± 19.0 kg, $VO_{2max} 36.0 \pm 8.4$ ml/kg/min) were randomly divided into validation and cross-validation groups ($n_v = 24$, $n_{cv} = 23$). The validation group's data was used to develop an equation to predict net kcal consumption, which was applied to the cross-validation group's data to estimate net kcal consumption. Similarly, a prediction equation was derived from the cross-validation group's raw data and applied to that of the validation group. The strength of the relationship between each group's measured and estimated net kcal consumption was assessed via correlational analysis.

RESULTS: Multiple linear regression yielded the following estimates of net kcal consumption: validation net kcal = $1.125(\text{height, cm}) - 0.662(\text{age, years}) - 0.800(\text{fat mass, kg}) + 1.344(\text{lean mass, kg}) + 2.278(\text{total volume} \times 10^{-3}) - 144.846$ ($R^2 = 0.751$, $p < 0.0001$, $SEE = 29.7$ kcal); cross-validation net kcal = $0.515(\text{height, cm}) - 0.520(\text{age, years}) - 1.220(\text{fat mass, kg}) + 1.995(\text{lean mass, kg}) + 2.620(\text{total volume} \times 10^{-3}) - 59.988$ ($R^2 = 0.823$, $p < 0.0001$, $SEE = 29.2$ kcal). These equations had a cross-validation coefficient of 0.902 and a double cross-validation coefficient of 0.863.

CONCLUSION: The strong relationship between the measured and estimated net kcal consumption of both the cross-validation and validation group lead us to conclude that the regression equation derived by this laboratory is valid for estimating net energy expenditure for a total RE bout.

890 Board #16 May 27 1:30 PM - 3:00 PM
Effects Of High-Load And High-Volume Resistance Training On Maximal Strength, Peak Torque, And Mean Torque

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 (No relevant relationships reported)

Purpose: This study was conducted to compare the effects of high-load, moderate-volume and high-volume, moderate-load resistance training on estimated one repetition maximum (Est. 1RM) on unilateral leg press and leg extension as well as isokinetic knee extension peak and mean torque.

Methods: Well-trained college-aged males ($n=15$; training age = 7 ± 3 years, mean squat relative to body weight = 1.9 ± 0.4), completed a 6-week (3 days per week) unilateral training program. Training involved exercising one leg with high loads at moderate volumes (HL: 82.5-95% Est. 1RM, 3 sets of 5 repetitions), and the other leg with moderate loads at high volumes (HV: 60% Est. 1RM, 5 - 10 sets of 10 reps). 3RM leg press, 3RM leg extension, and isokinetic knee extension at 60 and 120 deg/sec using an isokinetic dynamometer were collected on each leg prior to training (PRE), 72 hours following the last training bout (POST), and 10 days following passive recovery (POSTPR). Two-way repeated measures ANOVAs [condition (HL versus HV) x time (PRE, POST, POSTPR)] were performed for all dependent variables. Where appropriate, post-hoc analysis included Fisher's LSD and paired samples t-tests. Significance was set at ($p < 0.05$).

Results: There was a significant condition*time effect for leg extension ($p=0.017$). Both HV and HL significantly increased leg extension from PRE to POST ($p<0.001$) and PRE to POSTPR ($p<0.001$). However, HL was significantly greater than HV at both POST (mean difference 5 ± 6 kg, $p=0.007$) and POSTPR (5 ± 6 kg, $p=0.009$). There was a main effect of time for Est. 1RM leg press ($p<0.001$), with Est. 1RM being higher in both conditions from PRE to POST ($p<0.001$) and PRE to POSTPR ($p<0.001$). Similar trends were evident for mean knee extensor torque at 60 deg/sec ($p=0.041$) with mean knee extensor torque at 60 deg/sec being higher from PRE to POSTPR ($p=0.029$) and from POST to POSTPR ($p=0.43$). There were no significant interactions or main effects for isokinetic knee extension peak torque at 60 and 120 deg/sec or mean torque at 120 deg/sec.

Conclusion:

Our data suggest the effects of different unilateral loading schemes may be expressed to a greater extent in single joint movements. Additionally, isokinetic dynamometry may not be a valid method to detect strength changes to resistance training in a previously-trained population.

891 Board #17 May 27 1:30 PM - 3:00 PM
Men And Women Express Similar Power Profiles In Pull Motions But Not Push

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 (No relevant relationships reported)

Pushing and pulling occurs in athletic and nonathletic settings. Weaknesses in either movement could compromise sport performance or daily functioning. Determination of optimal load may aid in sport performance and reduce the risk of injury. **PURPOSE:** To determine power output differences between men and women using colinear resistance. **METHODS:** We enrolled 32 recreationally active men (n=14) and women (n=18), ages 18-25, to evaluate power profiles in horizontal and vertical push and pull exercises using Proteus (Proteus Motion, USA), which applies continuous, three-dimensional, concentric resistance. Subsequent data collection involved 2 repetitions with the dominant arm at 7lb, 14lb, 21lb, and 28lb in each exercise (32 total repetitions). Proteus software computed power output in watts for each set performed. Analysis of variance (ANOVA) with repeated measures tested the differences in power output at each load. **RESULTS:** In both horizontal and vertical pull motions, there was a significant difference by load ($p < 0.001$) and an interaction effect by sex ($p < 0.001$). The expression of power was most similar between men and women at the lowest resistance horizontally ($p = 0.020$) and vertically ($p = 0.038$); both deviated more as weight increased. No plateaus were demonstrated in either motion; higher loads were required for both sexes to achieve peak power. In horizontal and vertical push motions, there was a significant difference by load ($p < 0.001$) and an interaction effect with sex ($p < 0.001$). Men and women were closest in power at 7lb horizontally ($p = 0.017$) and vertically ($p = 0.004$). Women experienced a plateau at 21lb; further change was insignificant both horizontally ($p = 0.147$) and vertically ($p = 0.519$). Men did not exhibit a plateau; power continued to increase from 21lb to 28lb ($p < 0.001$). **CONCLUSIONS:** In our population, the power produced between sexes was similar in press motions, but differed in pulls. By assigning sex-specific training loads, athletes can optimize performance.

892 Board #18 May 27 1:30 PM - 3:00 PM
Neuromodulation Does Not Enhance Neural Adaptations To Strength Training In Previously Trained Individuals

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 (No relevant relationships reported)

Introducing resistance training to an initially untrained population induces rapid, early strength increases due to neural adaptations and are thereafter increased due to morphological adaptations within the musculotendinous unit. However, transcranial direct current stimulation (tDCS) is a method of neuromodulation that has been speculated to elicit further neural adaptations in already trained individuals, though the efficacy of tDCS to do so remains unsubstantiated. **PURPOSE:** To examine the effect of tDCS on performance following a short-term resistance-training protocol. **METHODS:** Forty-three trained males and females (Age = 20.7 ± 1.4yrs) participated in this investigation and reported on 12 separate occasions for pre- and post-testing and lower-body resistance training. During the initial visit, participants performed submaximal lower-body strength (predicted-1RM) and power testing (countermovement jump height [CMJ], peak power [PP], and peak velocity [PV]), and were familiarized with isometric strength testing procedures (knee extensor maximal voluntary isometric contractions). Participants reported 48-72hrs later for isometric testing to evaluate knee extensor peak torque (PT) and peak rate of torque development (pRTD), and were randomly assigned to either a control (CON), stimulation (tDCS), or sham (S-tDCS) condition thereafter. Each condition engaged in an identical training protocol 2x/wk for four weeks. Individuals in the tDCS and S-tDCS condition received stimulation to the primary motor cortex for 21 minutes prior to training. Post-testing occurred within the 3-7 day period following the final training session. Six separate 2x3 (Time x Condition) repeated-measures ANOVAs were conducted to assess between-condition differences in pre- to post-training measures of strength and power. **RESULTS:** No significant Time x Condition interaction effects were observed within any of the dependent variables (DV). However, a main effect of Time was observed in measures of CMJ, PP, PV, PT, and predicted 1RM strength ($p < 0.05$). When collapsed across condition, significant improvements ($p = 0.000 - 0.048$) were observed in

these DVs. **CONCLUSION:** These results suggest that tDCS did not elicit superior improvements in lower-body strength and power compared to CON and S-tDCS conditions.

893 Board #19 May 27 1:30 PM - 3:00 PM
Agreement Between Kinovea And The Open Barbell System For Barbell Velocity And Range Of Motion

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PURPOSE: The aim of this study was to examine the degree to which Kinovea video analysis software and a linear position transducer, the Open Barbell System (OBS), agree for measurements of average (ACV) and peak concentric velocity (PCV), as well as concentric range of motion (ROM) during the free-weight back squat and bench press exercises.

METHODS: Sixteen males (age: 23.6±2.8yrs, body mass: 82.0±12.2kg, height: 171.8±7.5cm, training age: 7.0±3.6yrs) performed a bench press and squat one-repetition maximum (1RM) in the first session. Then, in 3 different sessions subjects performed 3 (sets) X 1 (repetition) at 60% and 80% of 1RM. On each repetition, ACV, PCV, and ROM were assessed via both Kinovea and OBS. A smartphone was used to obtain videos from the lateral aspect that were later uploaded for analysis via Kinovea software, while the OBS was attached to the barbell via a cord and all outcomes were displayed on the unit in real time. Paired t-tests, intraclass correlation coefficients (ICCs), Bland-Altman plots, and folded empirical cumulative distribution plots (mountain plots) were used to analyze results.

RESULTS: Due to recording errors 348 out of a possible 352 repetitions were recorded. Paired t-tests revealed significant differences between measurement systems in all outcome variables for both the squat and bench press ($p < 0.01$). ICCs for the squat were: 0.929 (ACV), 0.913 (PCV), and 0.188 (ROM). ICCs for the bench press were: 0.930 (ACV), 0.929 (PCV), and 0.683 (ROM). Large limits of agreement were observed in all Bland-Altman plots and visual inspection of the mountain plots revealed deviation from the zero-difference line and long tails in all plots denoting a lack of agreement between devices.

CONCLUSION: In summary, the Kinovea software and OBS do not agree for measurement of ACV, PCV, and ROM during the squat and bench press. The OBS is a validated device versus a motion capture system, therefore we do not recommend Kinovea for these outcomes.

894 Board #20 May 27 1:30 PM - 3:00 PM
Sex Differences In Blood Lactate Concentration And Changes In Lifting Velocity During And After Resistance Exercise For Strength Gain And Muscle Hypertrophy.

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Strength training variants, such as load, repetition, and set, are manipulated for strength gain and muscle hypertrophy. However, there is little evidence of optimal training variants for women. **PURPOSE:** To investigate sex differences in blood lactate concentration and changes in lifting velocity during and after resistance exercise for strength gain and muscle hypertrophy, respectively. **METHODS:** Fourteen subjects (men=8, age 21.1±0.8 years, weight 70.9±7.2 kg, height 170.7±5.0 cm; women=6, age 20.7±1.1 years, weight 58.3±5.0kg, height 159.5±5.5 cm) with significant physical education and resistance training experience participated in this study. Participants performed four sets of parallel squats as part of two protocols, one for strength gain (four repetitions at 85% of 1RM) and one for muscle hypertrophy (10 repetitions at 70% of 1RM) using a cross over design. We measured blood lactate concentration before, during, and after the exercise. We also measured lifting velocity during exercise using a transducer (GymAware). **RESULTS:** Blood lactate concentration significantly increased after both protocols in both men (strength 1.4±0.7 to 4.1±1.7 mmol/l, $p = 0.001$, hypertrophy 1.6±0.5 to 8.3±2.0 mmol/l, $p < 0.001$) and women (strength 1.3±0.3 to 1.8±0.5 mmol/l, $p = 0.012$, hypertrophy 1.5±0.3 to 4.0±2.0 mmol/l, $p = 0.269$). The protocol for muscle hypertrophy, led to a more significant increase in blood lactate concentration in both men ($p = 0.001$) and women ($p = 0.040$) after exercise than the protocol for strength gain. After both protocols were applied, blood lactate concentration immediately after exercise was significantly higher in men than in women (strength $p = 0.008$, hypertrophy $p = 0.005$, respectively). Lifting velocity showed a decreasing tendency for both protocols, especially for muscle hypertrophy, in men, but without any significant differences between men and women. **CONCLUSIONS:** Our results suggest that there are no significant sex differences

in blood lactate concentration and lifting velocity during and after the application of the two protocols for strength gain and muscle hypertrophy. However, blood lactate concentration was significantly higher in men than in women.

B-64 Free Communication/Poster - Running

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

895 Board #21 May 27 1:30 PM - 3:00 PM Distance Runners' Perceptions Of A Strength Training Intervention

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PURPOSE: This study is one part of a Randomised Controlled Trial investigating the effect of strength training on distance runners' mechanics and performance. The aim of this study was to examine runners' perceptions of the strength training intervention. **METHODS:** Thirty distance runners (18 male, 12 female) were recruited for this study. In addition to their normal running training, the experimental group undertook strength training two days per week for 10 weeks. Total training time was matched, with the control group performing additional low-intensity running and body-weight exercises. Running performance and biomechanics during submaximal running (3.8 m/s) and maximal sprinting were assessed immediately before and after the intervention period. At the completion of the 10 week intervention period, the strength training group were also surveyed on their perceptions of the strength training intervention using an online questionnaire in Qualtrics.

RESULTS: Twenty-eight participants completed follow-up testing. Strength training significantly improved two kilometre running performance ($F(1,26) = 10.497, p = .003$, partial $\eta^2 = .288$) more than running training alone. The mean (95% CI) difference between groups was 11.31 (3.73 to 18.98) seconds. However, strength training did not change maximal aerobic capacity, running economy (3.3 m/s) or lower-limb joint kinematics or kinetics during running. Survey responses showed 64% ($n = 9$ of 14) of the experimental group believed the strength training program improved their running performance and 79% ($n = 11$) reported they would continue using strength training. Half ($n = 7$) of the experimental group believed strength training had a considerable effect on their running technique.

CONCLUSIONS: Strength training appears to improve runners' physical and task-specific self-efficacy, and increased confidence may facilitate faster running performance. This study also demonstrated a discrepancy between measured and perceived effects of strength training on running technique.

896 Board #22 May 27 1:30 PM - 3:00 PM Setting A New World Record: The Demands Of Running 833km On Treadmill In 7 Days

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Ultra-running (UR) comprises running events longer than a marathon (>42.2km). Due to the prolonged duration of UR, decrements in most or all physiological parameters are to be expected, and include a decrease in body mass and dehydration, loss of skeletal muscle mass and increased total body water. **Purpose:** to present data on a female multiple world record holding ultra-runner, examining haematological and physiological perturbations, as well as nutritional strategies throughout a successful treadmill world record attempt for total distance completed in seven days on a treadmill (833.05km). **Methods:** Sharon Gayter (SG) 47 years, 162.5cm, 49kg, $\dot{V}O_{2max}$ 48 ml/kg/min⁻¹ ran continuously for 7 days on a treadmill located at Teesside University, UK. 3-hours of running were followed by 30-minute breaks, and night-time rest from 1am-5am. Heart rate (HR), oxygen uptake ($\dot{V}O_2$), weight (kg), blood lactate (La; mmol.L⁻¹), haemoglobin (Hb; g.DL⁻¹), haematocrit (hct; %), glucose (G; g.L⁻¹), and nutrition were recorded. **Results:** SG ran at approx. 7km/h for 17.5 hours/day, covering an average of 120km. Mean $\dot{V}O_2$ 1.2 ± 0.1 L.min⁻¹/24.7 ± 3.2 mL.kg.min⁻¹, RER 0.80 ± 0.03, HR 125 ± 5 b.min⁻¹. Weight increased from 48.6 to 49.5kg. Hb decreased from 13.7 to 11 g.DL⁻¹, and hct decreased from 40% to 33%. Average G was 6.3 ± 1.6 g.L⁻¹, (range 2.65-9.14 g.L⁻¹), and average blood lactate was 1.0 ± 0.5 mmol.L⁻¹, (range 0.4-3.3 mmol.L⁻¹). Energy expenditure (EE) for each 24-hour period was 6878 kcal, and energy intake (EI) was 2701 kcal. Hourly EE was 382 kcal, with 66.6% and

33.4% of the energy coming from fat and carbohydrate oxidation, respectively. 7-day EI was 26,989 kcal and EE was 48,147 kcal, resulting in a total energy deficit (ED) of 21,158kcal. **Conclusion:** The previous record of 753.24km was extended by 79km to a new world record of 833.05km. SG exhibits an enhanced fat metabolism through which she covered the large daily ED. The increase in body weight could be the result of protein catabolism. The corresponding development of hypoproteinaemic oedema, and increased plasma volume, likely lead to the reduced Hb and hct. Her success can be attributed to a combination of physiological and psychological factors, as she remained upbeat throughout the event and stated that she felt that the attempt was easy but became a bit 'tedious' towards the end.

897 Board #23 May 27 1:30 PM - 3:00 PM Prevalence Of Low Bmd Of High-level Kenyan Male And Female Distance Runners Compared To Kenyan Controls

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Kenyan male and female runners have dominated international running events for decades, however the information about their bone health to date is lacking. High training volumes and low energy availability concurrently could potentially impact greatly on bone health. Previous reports lack comparison with the proper control group.

PURPOSE

To determine the bone health indices of Kenyan high-level male and female distance runners.

METHODS

Participants were 26 female (28.7±6.3 yr; 51.8±5.0 kg; 1.63±0.07 m; 19.5±2.0 kg·m⁻²; IAAF performance score: 1029±132 pt) and 30 male (28.1±3.8 yr; 57.7±6.1 kg; 1.73±0.05 m; 19.6±1.8 kg·m⁻²; IAAF performance score: 1087±66 pt) high level Kenyan distance runners. Control group consisted of 29 female (25.0±5.7 yr; 63.4±9.1 kg; 1.65±0.06 m; 23.3±3.2 kg·m⁻²) and 29 male (24.1±3.8 yr; 62.5±10.1 kg; 1.7±0.08 m; 21.8±5 kg·m⁻²) university students of similar age. DEXA was used to measure BMD at the lumbar spine (LS-BMD), right femur (RF-BMD) and total body (TB-BMD). Low BMD was defined as Z-score between -1.0 and -2.0 and osteoporosis < -2.0.

RESULTS

There were no differences in LS-BMD Z-score, RF-BMD Z-score and TB-BMD Z-score between female-male athletes and their respective controls. LS-BMD Z-score, RF-BMD Z-score and TB-BMD Z-score frequency count in the range of -1 to -2 and below -2 is shown in table 1.

Table 1. Number of participants with Z-scores in the range of -1 to -2 and below -2.

	F Athletes (n=26)	M Athletes (n=30)	F control (n=29)	M control (n=29)
LS-BMD Z -1 to -2	7	5*	6	7
LS-BMD Z < -2	3	1*	2	2
RF-BMD Z -1 to -2	5	2*	3	3
RF-BMD Z < -2	2	0*	3	2
TB-BMD Z -1 to -2	3	1	3	3
TB-BMD Z < -2	0	0	1	0

* - sample size for these values was 20; M = male, F = female

CONCLUSION

There was high prevalence of low BMD (Z-score < -1) in high level male and female Kenyan distance runners and somewhat unexpectedly for control groups too; but, no statistical differences in bone health indices between female-male athletes and corresponding control groups. These findings warrant additional investigation be conducted into the energy balance, eating disorders, disordered eating and hormonal markers to further explain causality, both among Kenyan athletes and controls.

898 Board #24 May 27 1:30 PM - 3:00 PM May The Force Be With You: Acceleration-based Estimates Of Vertical Ground Reaction Forces During Running

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(No relevant relationships reported)

Running-related injury (RRI) may be caused by combinations of load magnitudes and numbers exceeding musculoskeletal structure capacity. Few methods exist, however,

to quantify external loads (vertical ground reaction forces; vGRFs) during running in ecologically valid settings. **PURPOSE:** Develop models to accurately estimate vGRF second ("active") peaks during running from iliac crest and sacrum accelerations. **METHODS:** Anthropometric and sex data were collected from 40 runners. Runners wore inertial measurement units (IMUs) ($\pm 100g$, $\pm 2000deg/s$, 1000Hz) secured to their iliac crests and sacra while they ran a 25m track with embedded force plate (1000Hz). Speed, IMU accelerations, and force plate data were synchronously recorded for ten stances per foot at "slow", "typical", and "fast" self-selected speeds. Accelerations were transformed to a segment coordinate system. Force and acceleration signals were 50Hz low-pass filtered and divided into 0-8Hz low frequency (LoF) and ≥ 10 Hz high frequency (HiF) signals. Acceleration and vGRF peaks were extracted from the original, LoF, and HiF signals. Two multiple linear regressions were created to estimate log-transformed vGRF second peak: One used sacrum accelerations to predict bilateral forces, the other used iliac crest accelerations to predict ipsilateral forces. Each model included sex and limb lengths as fixed effects and was validated using an eight-fold cross-over. **RESULTS:** Both models predicted observed vGRF second peaks well ($r^2=0.78$, mean absolute error $<7\%$). Addition of participant as a random effect ($r^2 \geq 0.93$, mean absolute error $<4\%$) or speed as a fixed effect ($r^2 \geq 0.83$, mean absolute error $<6\%$) further improved results. **CONCLUSIONS:** The models developed here demonstrate a single IMU secured over the iliac crest or sacrum can estimate ipsilateral or bilateral vGRF second peak, respectively, with high accuracy. This approach could greatly impact our understanding of RRI by facilitating quantification of the step-by-step external forces experienced by runners over long time periods in ecologically valid settings. Supported by an ACSM Doctoral Student Research Grant, a Sigma Xi Grant-in-Aid of Research, the Maury Hull Endowed Fellowship for Musculoskeletal Biomechanics Research, and an NSERC Post-Graduate Scholarship.

899 Board #25 May 27 1:30 PM - 3:00 PM
Are All Running Workloads Created Equal?
 Megan R. Ryan¹, Tayler M. Vickery¹, Adriana Miltko¹, Richard T. Beltran¹, Christopher Napier², Max R. Paquette¹. ¹University of Memphis, Memphis, TN. ²University of British Columbia, Vancouver, BC, Canada. (Sponsor: Douglas W. Powell, FACSM) Email: mrbriley@memphis.edu
 (No relevant relationships reported)

Training workload (WL) has become a more common monitoring approach in runners and is defined as the product of external and internal training loads. Although rating of perceived exertion (RPE) is a widely accepted measure of internal load, various types of external load metrics can be used in running. **PURPOSE:** The purpose of this study was to compare week-to-week changes among different training WL measures in high school runners. **METHODS:** 12 male cross-country runners from the same high school team participated in two consecutive weeks of training monitoring. Training minutes were prescribed by the team coach. Session internal load was collected after each run using RPE on a 1-10 visual analog scale. Session external loads included miles, minutes, IMU-based proprietary tibial load (Bone Stimulus, IMeasureU), and estimated cumulative peak vertical force obtained from wireless insole data (Force, loadsol, Novel). Different weekly WL measures were calculated from session RPE and external load measures. Paired t-tests and Cohen's *d* effect sizes were used to compare between-week percent change (%Δ) among different WL measures and weekly minutes ($p \leq 0.05$). **RESULTS:** Different between-week %Δ were observed between RPExMinutes ($p = 0.003$; $d = 1.83$), RPExBone Stimulus ($p < 0.001$; $d = 0.74$), RPExForce ($p = 0.002$; $d = 1.91$), and weekly miles ($p = 0.011$; $d = 0.71$) compared to weekly minutes (Figure 1). We also observed greater individual variability in the between-week differences for all three WL measures compared to the volume only measures (Figure 1) due to high variability in the between-week %Δ in average sRPE (SD = 26%). **CONCLUSION:** These findings suggest that only monitoring a prescribed volume metric can greatly obscure week-to-week individual training responses of runners. The inclusion of an internal training load (i.e., session RPE) allows for the monitoring of the physiological response to training and explains the large variability of the three WL measures.

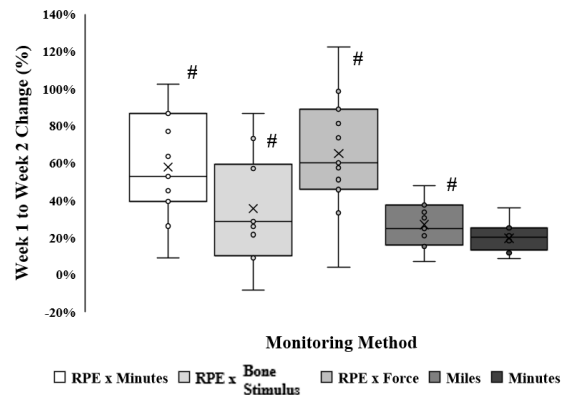


Figure 1. Box plot of week-to-week percent change among different methods of training monitoring. Force (estimated cumulative peak vertical force from combination of wireless force insole peak vertical GRF and cadence), Bone Stimulus (metric from IMeasureU IMU-Step software), and Minutes were used as the external load measures in combination with sRPE to calculate three difference training WLs. #: different than Minutes.

900 Board #26 May 27 1:30 PM - 3:00 PM
Effect Of Cupping Therapy On Respiratory Gas Exchange And Hip Extensor Force Production In Runners
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 (No relevant relationships reported)

Literature on the efficacy of cupping therapy (CT) is limited. Potential mechanisms of action of cupping therapy include increased localized blood and restructuring of fascial protein conformations through mechanotransduction, which has implications for improved running economy (RE) and hip extensor force production (HEFP). **PURPOSE:** To elucidate the effects of myofascial decompression through CT on RE and HEFP in well-trained runners. **METHODS:** Five minutes of CT or placebo gel was applied to bilateral gluteus maximus, biceps femoris, semimembranosus, and semitendinosus of 7 female (29.3 ± 2.1 yrs, 1.68 ± 0.06 m, 60.2 ± 3.4 kg) and 8 male (27.5 ± 6.2 yrs, 1.77 ± 0.04 m, 69.1 ± 4.0 kg) well-trained runners (female 10-km time = 41.4 ± 4.4 min, male 10-km time = 33.5 ± 1.2 min) after a 10-minute treadmill warm-up. Maximal HEFP was measured immediately post CT or gel using an isokinetic dynamometer. Then RE was measured using two 6-minute steady-state treadmill runs (fixed velocity and subject 10-km velocity). Maximal oxygen consumption (VO_2 max) test followed the RE tests. All subjects performed both conditions in randomized order separated by at least 1 week, but not more than 3 weeks. Maximal HEFP, RE, respiratory exchange ratio (RER) during steady-state, and VO_2 max after CT and gel were compared independently using paired two-sample t-tests. Effect size for all variables was calculated using Cohen's *d*. **RESULTS:** Maximal HEFP was not significantly different between conditions (CT: 1.63 ± 0.47 Nm kg^{-1} ; 1.51 ± 0.40 Nm kg^{-1} , $p = 0.18$, $d = 0.29$). There was no difference in RE expressed as % VO_2 max between CT and gel (fixed = $76.9 \pm 10.6\%$ of VO_2 max vs. $76.6 \pm 10.5\%$ of VO_2 max, $p = 0.72$, $d = 0.02$; 10-km = $84.2 \pm 7.2\%$ of VO_2 max vs. $83.7 \pm 6.9\%$ of VO_2 max, $p = 0.17$, $d = 0.07$). There was also no difference in VO_2 max between CT and gel (65.1 ± 9.1 ml $kg^{-1}min^{-1}$ vs. 65.0 ± 10.3 ml $kg^{-1}min^{-1}$, $p = 0.96$, $d = 0.004$); however, RER was significantly increased by CT compared to gel (fixed = 0.92 ± 0.06 vs. 0.90 ± 0.04 , $p = 0.04$, $d = 0.32$; 10-km = 0.94 ± 0.04 vs. 0.92 ± 0.03 , $p = 0.02$, $d = 0.52$). **CONCLUSIONS:** Acute cupping therapy increases steady-state carbon dioxide expiration in well-trained runners without changing oxygen consumption. This has implications for enhanced buffering from putative increased localized blood.

901 Board #27 May 27 1:30 PM - 3:00 PM
Acute Physiological And Cognitive Responses During A 100-mile Ultramarathon
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 (No relevant relationships reported)

Participation in ultra-running events, particularly 100-mile races, is rapidly increasing, yet the physiological demands and dynamics during these events are not well-

understood. It is clear is that physical and metabolic costs of these events are quite high; most participants take 20-35 hours to complete the distance and burn upwards of 10,000 calories. As such, many 100-mi. events are reporting 30-50+% "Did Not Finish" (DNF) rates among their participants. Ultra-runners are also challenged by sleep deprivation, which may lead to the decline of cognitive skills and reaction time over the course of these events, potentially leading to exhaustion or injury. **PURPOSE:** To observe and assess physiological and cognitive dynamics during a 100-mile ultramarathon with relatively flat terrain (~7500 ft. vertical gain). **METHODS:** Nine registered participants (age 46 ± 9.5 yrs., weight 74.0 ± 6.1 kg., height 176.4 ± 7.8 cm.) completed the 100-mile distance (Finish time 24.02 ± 3.23 hrs.). Measurements were collected pre-race, at each 20-mile interval (20, 40, 60, 80), and post-race. Measurements included lap time, foot volume, cognition, and reaction time. Foot volume was measured by making a figure-8 with cloth tape around the subjects' bare foot and ankle. Cognitive performance was assessed using mental calculation and reaction time tests via iOS applications. The mental calculation test involved solving as many equations possible in 100 s, while the reaction test required the participant to tap the screen as many times as possible in 30 s. Comparisons were made across the 20-mile intervals using repeated-measures ANOVA. **RESULTS:** While the duration to complete each 20-mi. lap significantly differed throughout the race ($F_{4,20}=7.896$, $p=0.001$), no differences were found in foot volume ($F_{5,15}=2.13$, $p=0.118$), reaction time ($F_{5,10}=0.945$, $p=0.493$), or cognition ($F_{5,20}=0.896$, $p=0.503$). **CONCLUSIONS:** A relatively flat-terrain 100-mile distance does not elicit cognitive exhaustion or significant foot swelling. More research is needed to determine if there are other physiological or metabolic variables correlated with high DNF rates, and to compare these data to those of more "challenging" courses with greater elevation gain/loss.

902 Board #28 May 27 1:30 PM - 3:00 PM

Is There A Difference In Strength, Flexibility, Range Of Motion Between Postpartum And Nulliparous Runners?

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(No relevant relationships reported)

Research has shown that women are returning to sport as soon as two weeks after birth with most resuming running by two months postpartum. There are significant musculoskeletal and physiologic changes during pregnancy as well as the effects of childbirth that a postpartum runner to recover from to return to running. Research on returning to running guidelines are nonexistent in the postpartum population. **Purpose:** To investigate the differences in strength, range of motion (ROM), and flexibility between postpartum runners (PP) and nulliparous controls (NC). **Methods:** Healthy postpartum (up to 3 years) and nulliparous runners were recruited from local running groups. Three trials of strength, ROM and flexibility of the hip, knee and ankle were collected using a hand held dynamometer, inclinometer or goniometer respectively and then averaged. An independent samples t-test was performed to compare groups. **Results:** 28 runners participated (14 PP, 14 NC) and were matched for BMI (24.2 kg/sq.m). There were no significant differences in strength of the hip, knee and ankle between the groups. Right and left ankle dorsiflexion was significantly greater in PP group (Right Soleus: PP, 10.33 ± 3.9 cm; NC, 6.75 ± 2.68 cm; $p=0.01$; Left soleus: PP, 11.32 ± 3.8 cm; NC, 7.34 ± 2.74 cm; $p=0.004$; Right Gastrocnemius: PP, $7.95 \pm 2.74^\circ$; NC, $4.67 \pm 4.59^\circ$; $p=0.032$; Left Gastrocnemius: PP, $8.48 \pm 3.39^\circ$; NC, $4.5 \pm 5.23^\circ$; $p=0.026$). Knee and Hip ROM were not significantly different between the groups. **Conclusion:** The current study shows that postpartum runners have significantly more dorsiflexion ROM than controls. When breastfeeding, hormones that influence elasticity like prolactin are still present in the body which may be allowing for the postpartum women to have significantly more ROM than nulliparous controls. Future studies should investigate the effect of breastfeeding duration on range of motion in runners as well as if while breastfeeding return to running guidelines should be different than women that cease breastfeeding at different stages.

903 Board #29 May 27 1:30 PM - 3:00 PM

Abstract Withdrawn

904 Board #30 May 27 1:30 PM - 3:00 PM

Effects Of A 4-week Supplemental Breathwork Program On Aerobic Performance Of Recreational Runners

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(No relevant relationships reported)

PURPOSE: This study investigated the effects of a novel supplementary functional breathing program (FBP) on the aerobic performance of recreational runners. **METHODS:** Two groups of recreational runners participated in a 4-week aerobic

endurance training program. One group supplemented the aerobic endurance training program with FBP (FBP; $n=8$, 34.8 ± 5.1 yrs, 25.3 ± 2.5 kg/m²), and one completed the same aerobic endurance program, but not the FBP (CON, $n=8$, 28.8 ± 5.4 yrs, 22.7 ± 2.3 kg/m²). The 4-week running program consisted of 3 days of low intensity running (i.e. below aerobic threshold heart rate), and 1 day of high intensity interval running (i.e. above ventilatory threshold heart rate) per week. FBP consisted of daily breathing exercises completed at rest, and nasal breathing completed during low intensity running sessions. Subjects were tested before (PRE) and after (POST) 4-weeks of training. Testing included a breath holding test (BOLT) followed by a treadmill $\dot{V}O_{2max}$ test using a progressive workload. During the $\dot{V}O_{2max}$ test subjects wore a secure piece of tape covering their mouth under a face mask and were instructed to perform the $\dot{V}O_{2max}$ test to the best of their abilities using this induced nasal breathing condition. When they felt that they could no longer run with nasal breathing, the tape was removed, and the test continued under normal breathing conditions until $\dot{V}O_{2max}$ was reached. The maximal running time using nasal breathing only (MNRT) and maximal nasal breathing oxygen uptake (MNB $\dot{V}O_2$) were recorded and data were assessed using a two-way ANOVA ($p < 0.05$). **RESULTS:** No significant groupXtime interactions were found in MNRT, MNB $\dot{V}O_2$, or $\dot{V}O_{2max}$. There was a significant groupXtime interaction in BOLT times [Δ from PRE: +1.9 sec (CON), +11.7 sec (FBP); $p = 0.04$]. There were significant time effects in MNRT (+58.7 sec, $p=0.038$), MNB $\dot{V}O_2$ (+2.34 ml/kg/min, $p=0.007$), and $\dot{V}O_{2max}$ (+1.26 ml/kg/min, $p=0.028$), suggesting the training stimulus was adequate for the relatively short training program. **CONCLUSION:** This study demonstrated that the 4-week supplementary functional breathing protocol was effective in increasing breath hold time at rest, but not MNRT, MNB $\dot{V}O_2$, and $\dot{V}O_{2max}$ in recreational runners.

905 Board #31 May 27 1:30 PM - 3:00 PM

Should Runners Pay Less Life Insurance

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(No relevant relationships reported)

PURPOSE: An ad "Can You Run An 8 Minute Mile?" (so that you could qualify for lower rates on life insurance) has brought lots of public attention and discussions, and the purpose of this study was to examine the scientific basis for this claim by estimating the impact of physical fitness on modifiable health risk behaviors and related health care expenditures.

METHODS: Using keywords "Physical Fitness," "Cardiorespiratory," "Health Risks," "Health Care Costs," etc., a comprehensive literature search was conducted, and identified publications were reviewed and analyzed.

RESULTS: Over 45 research publications were documented, and 15 articles were included in this review, focusing mostly on 10 modifiable health risks. Over 23 components were found in influencing the future medical costs, e.g., emotional health, stress, blood glucose levels, extreme bodyweight, tobacco user, sedentary lifestyle, per metabolic equivalents (METs) increase, and so on. Amount them, the key components rising the potential health care costs are high blood glucose levels ranging from 12.5% to 111.5%, high stress ranging from 17.45% to 70%, depression ranging from 8.5% to 46%, etc. The most effective measure to reduce potential health care costs is increasing metabolic equivalents (METs) per unit by aerobic exercises ranging from 5.4% to 13.4%.

CONCLUSION: A set of measures has been developed to assess the relationships between health risks and aerobic fitness, and there is a foundation to support the claim that a fit runner will likely have better aerobic fitness, less likely to have health risks, therefore spend less money in health care and medical expense. Yet, significant work is still needed to develop specific and accurate prediction equations so that the cost of life insurance can be determined based on aerobic fitness and other risk factors.

906 Board #32 May 27 1:30 PM - 3:00 PM

Abstract Withdrawn

907 Board #33 May 27 1:30 PM - 3:00 PM

Validity Of A Field-based Critical Velocity Test On Predicting 5,000 M Running Performance

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(No relevant relationships reported)

Measuring and modeling known adaptations to endurance training can be achieved through a variety of physiological parameters. A unique and emerging performance parameter receiving attention is the notion of critical velocity (CV). This concept allows an athlete's performance to be mathematically modeled based on the relationship that exists between distance and time. **PURPOSE:** To assess the validity

of a field-based CV test on predicting 5,000 m running performance. **METHODS:** Five runners ($VO_{2peak} = 60.14 \pm 4.96 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) completed a graded exercise test to determine VO_{2peak} , a CV test to predict performance, and a 5,000 m time-trial. The CV assessment protocol included time-trials of 3,600 m, 2,400 m, and 1,200 m at maximal exertion on a standard 200 m indoor track. Running performance was predicted using the distance-time model where CV was given by the slope and the anaerobic work capacity (D') was given by the intercept from linear regression analysis of distance covered against time for each of the three time-trials. Statistical significance was determined *a priori* at $p < 0.05$. **RESULTS:** Predicted 5,000 m performance ($18.28 \pm 4.38 \text{ min}$) and actual 5,000 m performance ($18.17 \pm 4.07 \text{ min}$) were not significantly different, $t(4) = 0.58$, $p = 0.594$, $d = 0.26$. The mean difference in performance was $0.11 \pm 0.42 \text{ min}$ [95% LoA, -0.71 min , 0.93 min]. CV ($4.59 \pm 0.88 \text{ m}\cdot\text{s}^{-1}$) was significantly slower than actual 5,000 m velocity ($4.73 \pm 0.82 \text{ m}\cdot\text{s}^{-1}$), $t(4) = -3.081$, $p < 0.05$, $d = -1.37$. The mean difference in velocity was $-0.14 \text{ m}\cdot\text{s}^{-1} \pm 0.10 \text{ m}\cdot\text{s}^{-1}$ [95% LoA, $-0.34 \text{ m}\cdot\text{s}^{-1}$, $0.06 \text{ m}\cdot\text{s}^{-1}$]. **CONCLUSION:** The linear distance-time model can be used to predict 5,000 m running performance. This field-based approach allows performance predictions to be made in a relatively short period of time without the need for access to expensive laboratory equipment.

908 Board #34 May 27 1:30 PM - 3:00 PM
Attempting To Acutely Manipulate Ground Contact Time Imbalances Impairs Running Economy

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(No relevant relationships reported)

Running economy (RE) is a key performance determinant. Biomechanical markers have been linked to RE, including ground contact time (GCT), cadence, and vertical oscillation (VO). Recently, we showed a strong relationship between GCT imbalances and RE. Because these markers can be tracked real-time with consumer-wearable devices, runners now have access to instant feedback concerning their mechanics. **Purpose:** Determine if attempting to correct GCT imbalances real-time alters mechanics and RE. **Methods:** 7 recreational runners ($38 \pm 15 \text{ years}$, $24.7 \pm 2.8 \text{ kg/m}^2$, 5 male) completed 2, 10-minute running trials (9.65 km/hr) on separate days. For both trials, subjects ran with a heart rate (HR) monitor/watch that measured GCT, GCT imbalances, cadence, and VO. For the control trial, subjects were not permitted to receive feedback from the watch. During the feedback trial, the watch was set to display GCT imbalances, and subjects were prompted every 20-30 seconds to monitor/attempt to correct any imbalances. Both trials were preceded by a dynamic warmup and 5-minute jog. For the feedback trial warmup, subjects were acclimated to the watch and allowed to experiment with manipulating their GCT imbalances. VO2 was monitored continuously throughout each 10-minute trial, and average values from 6 to 9 minutes were determined for each trial. Average values for all running biomechanical variables were calculated from 0.5 minutes to 9.5 minutes. Comparisons between trials were made with a dependent sample t-test. **Results:** Data are displayed in Table 1. **Conclusions:** Acutely attempting to correct GCT imbalances did not result in improved mechanics and actually impaired RE. Altering mechanics based on real-time feedback from consumer-wearable devices may impair performance in the short term. Given that GCT imbalances have been linked to impaired RE, future research should determine how to better correct these imbalances rather than attempting to acutely manipulate them.

	Control	Feedback	p-value
VO2 (ml/kg/min)	33.4 (1.8)	35.5 (1.6)	0.011*
RER	.91 (.04)	.92 (.05)	0.170
Heart Rate (beats/min)	159 (26)	163 (24)	0.191
GCT Difference (%)	1.69 (.67)	1.70 (1.70)	0.983
GCT Difference (ms)	9 (3)	8 (7)	0.717
GCT (ms)	272 (26)	268 (31)	0.536
Cadence (steps/min)	165 (9)	167 (9)	0.486
VO (cm)	9.3 (2.0)	9.2 (1.9)	0.856
VO ratio (cm/m)	9.5 (1.6)	9.5 (1.6)	0.947

Values represent mean (SD). p-values from dependent t-test. * $p < .05$

909 Board #35 May 27 1:30 PM - 3:00 PM
Changes In Step Time And Length Between Kilometer Eleven And Thirty-nine Of A Marathon

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(No relevant relationships reported)

Purpose: Marathon running invokes neuromuscular fatigue which has been shown to result in kinematic changes in a laboratory setting. However, there are limited studies on changes that take place during a race. The purpose of this study was three-fold: 1) to evaluate the step time and step length at an early and late time point in a full marathon and quantify the change between the two points; 2) to identify differences in step time and length associated with sex; and 3) to determine if step time and length are predictors of race finish time.

Methods: This is an observational study in which runners were filmed at two stations, at kilometer 11 (S1) and kilometer 39 (S2) of a full 42.2 kilometer marathon. Each station incorporated two cameras, one in the sagittal plane to assess kinematics and the second to identify the runners' bib numbers. A 5-meter section of roadway was marked with chalk, delineating each meter, to allow for assessment of step length using Dartfish 5.5 Video Analysis software (Dartfish, Fribourg, Switzerland).

Results: Step time was slower at S2 compared to S1 with a mean difference \pm SD of $0.290 \pm 0.403 \text{ m/s}$ (95%CI $0.246 - 0.334$; $p < 0.001$). Step length was shorter at S2 compared to S1 with a difference of $0.098 \pm 0.111 \text{ m}$ (95%CI $0.086 - 0.110$; $p < 0.001$). There was no interaction in step time for males or females between S1 and S2 (S1, Male $0.35 \pm 0.02 \text{ s}$, Female $0.33 \pm 0.02 \text{ s}$; S2, Male $0.35 \pm 0.02 \text{ s}$, Female $0.34 \pm 0.02 \text{ s}$; $p = 0.099$) however, an interaction was detected for step length (S1, Male $1.16 \pm 0.13 \text{ m}$, Female $1.05 \pm 0.11 \text{ m}$; S2, Male $1.05 \pm 0.13 \text{ m}$, Female $0.98 \pm 0.11 \text{ m}$; $p = 0.01$). A regression model to predict finish time found that step length at S1 accounted for 47% of the variability ($F(1,323) = 283.7$; $p < 0.001$), this increased to 68.3% when S1 step time was included ($F(2,322) = 350.4$; $p < 0.001$), S2 step length increased this to 75.2% ($F(3,321) = 328.4$; $p < 0.001$) while including S2 step time increased it to 76.7% ($F(4,320) = 268.4$, $p < 0.001$).

Conclusion: Step time was slower and step length was shorter at the 39-kilometer point of the full-marathon compared to the 11-kilometer point. Step time did not differ at either time point in the race for males or females; however, they both demonstrated a reduction in step length. Step time and step length at both points in the race are able to account for a significant amount of finish-time variability.

910 Board #36 May 27 1:30 PM - 3:00 PM
CHARACTERIZING PERFORMANCE IN ELITE TRACK AND FIELD SPRINTERS IN RELATION TO THE ACUTE:CHRONIC WORKLOAD RATIO

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(No relevant relationships reported)

PURPOSE: The acute:chronic workload ratio is a method of training load quantification that quantifies internal and external responses to training. Chronic training load is a rolling average of the most recent 28 days of training, and the acute workload is the most recent 7 days. The purpose of this study was to explore the relationship between the acute:chronic workload ratio and peak performance in elite track and field sprinters over the course of the 2018 outdoor season. **METHODS:** The acute:chronic workload ratio was determined retrospectively by calculating the sum of the 7 days before a competition session ratings of perceived exertion of training load (acute load) and dividing it by the average weekly session rating of perceived exertion of training load over the 28-days prior to competition (chronic workload). Partial correlations were used to characterize the relationship between race time (covaried for confounding variables of temperature, humidity, and wind) and the acute:chronic workload ratio. Secondly, the adjusted race times were used to create Z-scores for each sprinters' race time. Bins were then created for the acute:chronic workload ratio ranges, and the Z-scores were pooled into the acute:chronic workload ratio bins with which they corresponded. **RESULTS:** Moderate, positive correlations between the acute:chronic workload ratio and race times for the 100m ($r = 0.542$) and 200m ($r = 0.711$) races were observed. 85% of 100m sprinters and 60% of 200m sprinters had their lowest times within the 0.8-1.3 z-score bin: a range cited in previous research as being associated with a lowest risk of injury. **CONCLUSIONS:** Maintaining an acute:chronic workload ratio between 0.8 and 1.3 may be optimal for elite track and field sprinters to reach their peak performance in the 100m and 200m races. An individualized approach to training load using the acute:chronic workload ratio should help coaches and performance staff with individualized training-load prescription for the sprinters to reach peak performance.

WEDNESDAY, MAY 27, 2020

- 911** Board #37 May 27 1:30 PM - 3:00 PM
Evaluating The Validity Of Heart Rate Measured By The Suunto Spartan Sport Watch During Trail Running
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 (No relevant relationships reported)

Purpose: In the last decade or so, a plethora of fitness tracking devices have come to market. With this, use of these devices has increased exponentially. Among these devices' many functions is the ability to monitor heart rate (HR). The purpose of this investigation was to determine if HR measured by the Suunto Spartan Sport watch was statistically comparable to that of our criterion, the Polar H7 HR monitor.

Methods: Twenty-one participants (male n = 11, female n = 10, age = 31±2 yrs [mean±SE], ht = 173±2 cm, wt = 76±3 kg) completed a two-mile trail run which included elevation changes of 48 m (McCullough Hills Trail, Henderson, NV), 55m (Three Peaks Trail, Cedar City, UT) or 104m (Bristlecone Trail, Mt Charleston, NV). Heart rate was obtained from the Suunto Spartan Sport watch with accompanying heart strap and the Polar H7 chest-worn heart rate monitor as the criterion reference. Validity was determined using the Mean Absolute Percent Error (MAPE), Bland-Altman analysis with accompanying bias and Limits of Agreement (LoA), and single measures Intraclass Correlations (ICC). A Pearson Product Moment Correlation Coefficient was used to determine the relationship between the validity measures with significance accepted at p<0.05. **Results:** During uphill running, the MAPE was 1.46%, and the lower and upper LoA were -11.53 and 12.34, respectively. The single measures ICC was 0.95 with a 95% CI of 0.953 to 0.956 (F(14834, 14834) = 43.15, p < 0.000). During downhill running, the MAPE was 2.18% with the lower and upper LoA at -15.76 and 14.15, respectively. The single measures ICC was .94 with a 95% CI of 0.946 to 0.951 (F(9075, 9075) = 38.45, p < 0.000). **Conclusions:** These results demonstrate a there was a very low percentage of error for the Suunto Spartan Sport watch in recording HR for both uphill and downhill running. This suggests that The Suunto Spartan Sport might be a valid and reliable option for consumers wishing to monitor HR during outdoor trail running activities.

- 912** Board #38 May 27 1:30 PM - 3:00 PM
The T10 Treadmill Test Is Reliable And Valid To Determine Critical Speed In Recreational Runners
 Sergio G. da Silva, Lucio Follador, Edilson F. de Borba, Armando L. Bonfim Neto. UFPR, Curitiba, Brazil. (Sponsor: Carlo Baldari, FACSM)
 (No relevant relationships reported)

Current methods to assess critical speed (CS) are limited by the need for subjects to perform a set number of time-to-exhaustion trials at a constant speed on a treadmill or through several maximal runs on separate days on a running track. **Purpose:** To assess the reliability and validity of a 10-minute submaximal treadmill test of critical speed (CS). **Methods:** Twenty-nine recreational road runners (21 men, 8 women; age: 31.8 ± 5.7 years; VO_{2max}: 52.5 ± 6.9 ml.kg⁻¹.min⁻¹) completed a familiarization trial consisted of running 10 minutes (T10) at a vigorous self-selected speed plus two experimental trials (T10-test and T10-retest). Speed from the T10-test and T10-retest were assessed using coefficient of variation (CV), limits of agreement (LoA) and intraclass correlation (ICC). Next the CS assessed from an additional T10-test was compared with the CS assessed through Field tests. The Field tests consisted of 3 runs on separate days on a running track over 1200, 2400 and 3600 m. **Results:** Reliability analysis between the T10-test and T10-retest showed a CV of 3.2% (95% CI: 2.5-4.3%), LoA of ± .32 m.s⁻¹, and an ICC of .94 (95% CI: .87, .97). Validity data showed that speed (m.s⁻¹) (T10-test: 3.79 ± .47; Field-test: 3.80 ± .49) did not differ between trials (p = 1). Also, the T10-test was highly correlated with the Field-test (r = .90, p < .001) and presented a CV of 4% (95% CI: 3.2-5.4%) and LoA of ± .41 m.s⁻¹. **Conclusion:** The submaximal 10-minute treadmill test (T10) yields reliable and valid estimates of CS providing a useful alternative for assessing CS on a treadmill.

- 913** Board #39 May 27 1:30 PM - 3:00 PM
Comparison Of Running Economy Between Straight-line Running And Running With Change Of Direction In Collegiate Males
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 (No relevant relationships reported)

Running economy (RE) is one of the important indicators for evaluating endurance. However, treadmill running (TR) test, seems not to be specific enough for team sport, considering their running characteristics with change of direction. **PURPOSE:** To investigate the RE of TR and 20m-shuttle running (SR).

METHODS: 18 physically-active collegiate man (22.4 ± 2.4yrs, 177.4 ± 7.5cm, 69.3 ± 8.2kg, VO_{2max}: 48.9 ± 6.2 ml/kg/min, training experience: 4.6 ± 1.6yrs) volunteered to participate in one incremental TR (8, 10, 12 and 14km/h) and one incremental SR (6, 8, 10 and 12km/h), with the duration of 5 min for each step, and the interval of 1 min between each 2 steps. The VO_{2max} was also assessed in combination with the TR test. The portable gas metabolism system (K4b², Cosmed, Italy) was used to measure the breathing gas during running. The RE for each speed was calculated as the averaged VO₂ of the last 1 min during each step.

RESULTS: At the same running speed (8, 10 and 12km/h), the RE of the SR are lower (oxygen consumption is higher) than the TR (34 ± 3.6 vs. 32.5 ± 4.9 ml/kg/min, 47.9 ± 5 vs. 37.9 ± 5.9 ml/kg/min, 54.9 ± 6.2 vs. 42.0 ± 7 ml/kg/min), with the difference significant at the two higher speed (p<0.05). **CONCLUSIONS:** At the same running speed, the RE of SR is lower than that of TR. Assessment of RE with TR might overestimate the RE in running with change of direction. Running test with change of direction (e.g. SR) is recommended for examining the RE in team sport players.

- 914** Board #40 May 27 1:30 PM - 3:00 PM
Roller Massage Prior To Running Does Not Affect Gait Mechanics In Well-trained Runners
 Jessica G. Hunter, Ross H. Miller. University of Maryland, College Park, MD. (Sponsor: Irene S. Davis, FACSM)
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 (No relevant relationships reported)

Fatigue is often considered an injury risk factor due to gait adjustments that occur during prolonged running, and 41% of physical therapists recommend roller massage (RM) for injury prevention. However, whether RM prior to running affects gait mechanics and fatigue is currently unknown.

PURPOSE: To investigate the effects of an acute bout of RM on gait mechanics and fatigue after a treadmill run.

METHODS: Fourteen well-trained runners (mean VO₂ max: 53 ml/kg/min) completed 3 sessions each on separate days. In a Baseline session, participants sequentially ran overground at their 5k pace, performed 3 maximal countermovement jumps (CMJ), and completed a maximal oxygen consumption test. Force and motion data were measured during running and jumping. In fatigue sessions, run and CMJ protocols identical to the Baseline session were performed before (PRE) and after (POST) a 30-minute fatiguing treadmill run at a pace associated with 84% of ventilatory threshold. Before the fatiguing run, participants rested for 12 minutes (REST) in one visit, and performed a 12-minute RM protocol (ROLL) in the other visit. Two-way analysis of variance (ANOVA) compared end tidal pressure of carbon dioxide (PETCO₂) every 5 minutes of the treadmill runs to assess fatigue. From the run and CMJ data, 2-way multiple analysis of variance (MANOVA) compared vertical average loading rate (VALR), free moment, tibial shock, and jump height between REST and ROLL conditions at times PRE and POST.

RESULTS: PETCO₂ decreased throughout both treadmill runs, indicating general fatigue (p < 0.001). VALR, free moment, tibial shock, and jump height did not differ significantly between PRE and POST treadmill run on both REST and ROLL days (Table 1).

CONCLUSIONS: Well-trained runners exhibited fatigue in respiratory measures but not in neuromuscular performance, or gait mechanics. RM had no effect on any outcomes. We can conclude no benefits of pre-run RM on resistance to fatigue-induced changes in running mechanics.

Table 1. Outcomes by Condition and Time (mean (SD))

Condition	Time	VALR (BW/s)	Free Moment (%BW*Ht)	Shock (g's)	Jump Height (m)
REST	PRE	100.0 (31.0)	16.6 (7.7)	2.37 (1.06)	0.35 (0.08)
	POST	110.0 (32.5)	17.0 (5.3)	2.57 (0.76)	0.34 (0.08)
ROLL	PRE	95.9 (28.9)	16.1 (5.3)	2.35 (0.70)	0.35 (0.07)
	POST	100.7 (28.6)	17.0 (5.8)	2.61 (0.74)	0.30 (0.06)

B-65 Free Communication/Poster - Blood Flow

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

**915 Board #41 May 27 2:30 PM - 4:00 PM
Impact Of Cell-free Hemoglobin On Exercising Muscle Vascular Control In Rats**

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(No relevant relationships reported)

Hemolysis associated with Sickle Cell Disease (SCD) compromises nitric oxide (NO) bioavailability and results in a plethora of cardiopulmonary and skeletal muscle complications causing severe exercise intolerance. Recent evidence suggests that cell-free Hb reduces NO bioavailability and lowers the skeletal muscle microvascular PO₂ during contractions, likely due to a reduction in blood flow. Despite these observations, the effects of Hb on skeletal muscle vascular control during locomotory exercise remain unknown. **Purpose:** We tested the hypothesis that acute exposure to Hb would increase mean arterial pressure (MAP) and decrease hindlimb muscle blood flow in the exercising rat. **Methods:** MAP and hindlimb skeletal muscle blood flow (fluorescent microspheres) were measured in male Sprague-Dawley rats (3-6 months, n=8) during submaximal treadmill running (20 ml/min, 5% grade) following a vehicle (0.2 ml of saline) and Hb (50 mg/kg) infusion. **Results:** Relative to control, Hb resulted in a significantly greater exercising MAP (control: 137 ± 3, Hb: 150 ± 3 mmHg, p<0.05) and blood [lactate] (control: 2.51 ± 0.25, Hb: 3.13 ± 0.42 mM, p<0.05). Total exercising hindlimb skeletal muscle blood flow (control: 179 ± 14, Hb: 111 ± 7, ml/min/100 g, p<0.05) and vascular conductance (control: 1.34 ± 0.13, Hb: 0.75 ± 0.05 ml/min/100 g/mmHg, p<0.05) were lower following Hb infusion when compared to control. **Conclusion:** These data support the hypothesis that free Hb impairs vascular control and lowers skeletal muscle O₂ delivery during exercise and provides a potential mechanism by which hemolytic diseases like SCD impair exercise tolerance in humans. Support: NIH-P30DK048520 (SKF), NIH-1R01HL125642-01A1 (DCI)

**916 Board #42 May 27 2:30 PM - 4:00 PM
Peripheral Revascularization Reverses The Decline In Active Muscle Oxygen Saturation In Peripheral Artery Disease**

J. Carter Luck¹, Danielle JK Kim¹, Cheryl A. Blaha¹, Samuel Pai¹, Faisal Aziz¹, John F. Radtka, III¹, Kimberly S. Faszewski², Abigail SL Stickford², Amanda J. Miller¹, Matthew D. Muller³, Lawrence I. Sinoway¹. ¹Penn State College of Medicine, Hershey, PA. ²Appalachian State University, Boone, NC. ³University Hospitals Cleveland Medical Center, Cleveland, OH.
(No relevant relationships reported)

Peripheral artery disease (PAD) is a progressive atherosclerotic disease that limits blood flow to the skeletal muscles in the lower extremity. Reductions in blood flow may be more pronounced during ambulation or exercise and produce leg cramping or pain known as intermittent claudication. Recent studies have shown an exaggerated blood pressure response with lower muscle oxygen saturation (SmO₂) during foot exercise in patients with PAD. However, it is unclear whether surgical and/or

endovascular interventions normalize this response. **PURPOSE:** To examine whether revascularization procedures improve calf muscle SmO₂ and reduce blood pressure responses during dynamic foot exercise in patients with PAD. We hypothesized that revascularization would improve SmO₂ responses (indicating greater tissue perfusion) and that the blood pressure response would be attenuated during exercise. **METHODS:** Patients with symptomatic PAD (n = 6) performed incremental supine plantar flexion exercise, starting at 0.5 kg and increased by 0.5 kg every minute for up to 6 minutes, pre- and one-month post peripheral revascularization procedure. SmO₂ was measured continuously from the gastrocnemius muscle, while heart rate and blood pressure were measured beat-by-beat. **RESULTS:** Reductions in SmO₂ from baseline to end-exercise were attenuated post-revascularization (-6.5 ± 6.2% vs. -39.8 ± 22.5%, P < .05). The change in mean arterial blood pressure was reduced post-revascularization (4 ± 4 mmHg vs. 16 ± 12 mmHg P < .05). PAD patients exercised longer post-revascularization (5.8 ± 0.4 min vs. 4.0 ± 1.5 min P < .05). **CONCLUSIONS:** These data suggest that revascularization lessens the degree and rapidity of decline in SmO₂ during exercise, and lowers the exaggerated blood pressure response in patients with PAD. Supported by NIH Grant P01 HL134609

**917 Board #43 May 27 2:30 PM - 4:00 PM
Endothelial Shear Stress In The Common Carotid Artery During Boxing Training**

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(No relevant relationships reported)

PURPOSE: Endothelial function is highly regulated by the interaction between blood flow and the endothelium. Endothelial shear stress (ESS) is defined as the dragging force generated by this interaction and it has been reported that low ESS affects nitric oxide bioavailability which in turn might increase blood pressure. Exercise programs are one of the best suited approaches to prevent high blood pressure, however, there are no studies describing changes on ESS in the common carotid artery during specific modalities of exercise, such as boxing training. Therefore, the purpose of this study was to quantify ESS in the common carotid artery during maximal and submaximal boxing training in normotensive and pre-hypertensive subjects. **METHODS:** A cohort of 5 healthy normotensive and 5 pre-hypertensive subjects matched by age, gender, height, and weight were recruited for this study. All 10 subjects performed two boxing tests. The first was a graded maximal boxing test to estimate their maximal oxygen uptake (VO₂max). The second one, performed 48 hours after the first evaluation, was a 2-workload steady-state boxing test at 60%VO₂max and at 95%VO₂max for 3 minutes each. A high-definition Doppler ultrasound recorded common carotid artery diameters and blood flow velocities throughout each steady-state condition. ESS was estimated using Womersley's approximation. **RESULTS:** There was a significant increase in antegrade ESS with higher workloads in both groups (p < 0.05 for all). No difference were found in antegrade ESS at baseline (Normotensive: 33.9±13.9 dynes/cm², Pre-HTA: 34.7±5.5 dynes/cm²; p = 0.936), at 60%VO₂max (Normotensive: 51.3±19.1 dynes/cm², Pre-HTA: 49.6±7.6 dynes/cm²; p = 0.894, and at 95%VO₂max (Normotensive: 72.9±30.9 dynes/cm², Pre-HTA: 85.2±12.5 dynes/cm²; p = 0.560) between both groups. Meanwhile, no retrograde blood flow was present at baseline for either groups, but it was identified at 60%VO₂max (Normotensive: 8.1±0.7 dynes/cm², Pre-HTA: 7.8±7.8 dynes/cm²; p = 0.971) and 95%VO₂max (Normotensive: 22.5±18.9 dynes/cm², Pre-HTA: 20.8±5.6 dynes/cm²; p = 0.891). **CONCLUSIONS:** ESS increases in an exercise-intensity manner during boxing training in normotensive and prehypertensive population. Boxing training might be beneficial in high blood pressure prevention due to increments on ESS.

**918 Board #44 May 27 2:30 PM - 4:00 PM
The Effects Of A High Fat Meal On Blood Flow Regulation During Arm Exercise**

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A diet high in saturated fats results in endothelial dysfunction and can lead to atherosclerosis, a precursor to cardiovascular disease. Exercise training is a potent stimulus though to mitigate the negative effects of a high saturated fat diet; however, it is unclear how high-saturated fat meal (HSFM) consumption impacts blood flow regulation during a single exercise session. **PURPOSE:** This study sought to examine the impact of a single HSFM on peripheral vascular function during an acute upper limb exercise bout. **METHODS:** Ten young healthy individuals completed two sessions of progressive handgrip exercise. Subjects either consumed a HSFM (0.84 g of fat/kg of body weight) 4 hours prior or remained fasted before the exercise

bout. Progressive rhythmic handgrip exercise (6kg, 12kg, 18kg) was performed for 3 minutes per stage at rate of 1 Hz. The brachial artery (BA) diameter and blood velocity was obtained using Doppler Ultrasound (GE Logiq e) and BA blood flow was calculated with these values. **RESULTS:** BA blood flow and flow mediated dilation (normalized for shear rate) during the handgrip exercise significant increased from baseline in all workloads, but no differences were revealed in response to the HFSM consumption. **CONCLUSION:** Progressive handgrip exercise augmented BA blood flow and flow mediated dilation in both testing days; however, there was no significant differences following the HFSM consumption. This suggests that upper limb blood flow regulation during exercise is unaltered by a high fat meal in young healthy individuals.

919 Board #45 May 27 2:30 PM - 4:00 PM

A Physiological Analysis Of Vibrating Orthotics

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(No relevant relationships reported)

INTRODUCTION: Orthotics are commonly used to aid individuals with foot disorders such as foot or arch pain and gait abnormalities. A new development of vibrating orthotics, which sends out safe vibration frequencies, are gaining popularity on the market. Future developments could lead to vibrating insoles being beneficial for individuals with restricted blood flow, nerve damage, or balance issues caused by diseases such as diabetes or multiple sclerosis. However, few studies have been done on the efficacy and potential benefits. **PURPOSE:** The purpose of this study was to determine if vibrating orthotic insoles increased the amount of blood flow to the foot and ankle at rest. **METHODS:** Participants included 5 students ages 22-26 years. An Initial baseline test was administered upon arrival and again after resting for 30 minutes on the examination table. The Logiq 7 ultrasound Doppler transducer (9L probe at 5 Mhz) was used to locate the posterior tibial artery for the baseline measurement and probe placement was marked on the skin for consistent measuring. Following the second baseline measurement, vibrating orthotics were turned on and blood flow measurements were taken in 5 minute increments for 45 minutes. For each measurement, the artery was found and blood flow was measured for 7 seconds. Blood flow was calculated in milliliters per minute based on blood velocity and arterial radius utilizing the following equation: $\text{Blood flow} = \text{Vmean} \pi (\text{vessel diameter}/2)^2 \times 60$. **RESULTS:** Blood flow was analyzed across time using a multi-level model with subject as a random effect and time (categorical) as a fixed effect. There was a significant main effect of time. Tukey post hoc analysis revealed a difference between the first baseline and after 45 minutes of vibration ($p=0.0375$), but no significant difference between any other measurements. After 45 minutes of vibration, blood flow increased 3.46 ml/min (126%). **CONCLUSION:** The results suggest that the use of vibrating insoles may be beneficial for increasing blood flow in the foot and ankle. The use of vibrating insoles may be beneficial for individuals with conditions that restrict blood flow in the foot and ankle such as peripheral artery disease, diabetes, or poor circulation.

920 Board #46 May 27 2:30 PM - 4:00 PM

Upper Body Exercise And Passive Limb Movement To Increase Limb Blood Flow In Paraplegics

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(No relevant relationships reported)

Previous investigations on the ability of upper body exercise (UBE) to increase femoral artery blood flow (FABF) in the paraplegic population have produced a wide range of results. However, this could have been the result of a non-homogenous population with a wide range of injury level and severity. The use of a more homogenous population, controlling for both level and severity of injury may result in more robust data. In addition, previous reports suggest passive limb movement (PLM) could be used as a modality to increase femoral artery blood flow in this population. A combination of UBE and PLM may provide a sufficient stimulus for a robust increase in femoral artery blood flow. **PURPOSE:** To determine the effectiveness of UBE when used alone and in combination with PLM to increase FABF in the paraplegic population. **METHODS:** Nine paraplegics with a clinically confirmed complete lesion between the 3rd and 11th thoracic vertebra participated in the study. The subjects underwent 10 minutes of (UBE), 5 minutes at a low intensity (LI) and 5 minutes at a moderate intensity (MI), during which FABF was measured. After a 30 minute break, the protocol was replicated with the addition of repeated bouts of passive limb movement being conducted every other minute during the upper body exercise (CMB). **RESULTS:** Two-way repeated measures ANOVA showed no statistically significant interactions ($p>0.05$) between the two exercise modalities for changes in FABF. During the UBE condition, while not statistically significant, FABF increased from

113±78 ml/min to 160±130 ml/min ($p=0.06$) and 162±131 ml/min ($p=0.06$) during the LI and MI conditions, respectively. FABF for the CMB protocol was 119±93 ml/min and increased to 150±125 ($p=0.09$) and 155±136 ($p=0.13$) ml/min during LI and MI conditions, respectively. **CONCLUSIONS:** While not statistically significant, these data indicate the upper body exercise when used in combination with passive limb movement can invoke a large increase in femoral artery blood flow. This could have a profound clinical application for this population.

921 Board #47 May 27 2:30 PM - 4:00 PM

Dietary Nitrate Does Not Increase Exercising Muscle Blood Flow In Rat With Pulmonary Arterial Hypertension

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PURPOSE: Pulmonary arterial hypertension (PAH) is a disease characterized by pulmonary artery remodeling, right ventricular hypertrophy, and exercise intolerance. We have previously found a significant reduction in skeletal muscle blood flow during exercise in a rat model of PAH, accompanied by an increase in blood lactate. In an attempt to increase flow, we administered beetroot juice (BRJ) to severely afflicted PAH rats, as BRJ has previously been shown to be effective in animal models and patient populations.

METHODS: Male Sprague Dawley rats ($n=18$, 200-250 g) were injected with 60 mg/kg monocrotaline to elicit a severe PAH phenotype. At 3 wk post-injection, rats performed two trials of a $\text{VO}_{2\text{max}}$ treadmill test 2 h after oral gavage of a single dose (1 mmol/kg) of BRJ (BRJ, $n=9$), or placebo (PL, $n=9$), in counterbalanced order. Three days later, rats performed a final treadmill run 2 h after gavage of either BRJ or PL, in which fluorescent microspheres were administered during running (at 50% $\text{VO}_{2\text{max}}$) to determine skeletal muscle blood flow. Nitrate and nitrite concentrations in plasma and skeletal muscle samples were determined via HPLC, whereas muscle cGMP was measured using ELISA.

RESULTS: As expected, MCT induced impaired exercise tolerance with a 26±6% (+/-SE) reduction in $\text{VO}_{2\text{max}}$ at 3 wk post-injection, that was not improved with BRJ ($p=0.15$). BRJ significantly increased plasma nitrate ($p<0.001$) and nitrite ($p=0.002$) compared to PL; however only nitrate was elevated in the soleus ($p=0.006$) and vastus lateralis ($p=0.02$) by BRJ, with no significant differences in nitrite ($p=0.13-0.66$) or cGMP ($p=0.08-0.68$). BRJ did not increase blood flow in any of the 8 muscles sampled when compared to PL ($p=0.23-0.96$), nor did it reduce lactate accumulation during exercise ($p=0.37$).

CONCLUSIONS: A single dose of dietary nitrate does not enhance exercising muscle blood flow or $\text{VO}_{2\text{max}}$ in a PAH rat, despite significantly increasing plasma nitrate and nitrite. This may be explained by a lack of efficacy in BRJ increasing muscle nitrite and cGMP, known mediators of the nitric oxide pathway and tissue perfusion. Future work should examine mechanisms for reduced skeletal muscle blood flow and further exploration of nitric oxide signaling in PAH patients. Funding: NIH HL121661 (MB Brown) and AG053606 (AR Coggan)

922 Board #48 May 27 2:30 PM - 4:00 PM

Racial Differences In Exercising Limb Blood Flow During Elevated Sympathetic Activity

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(No relevant relationships reported)

PURPOSE: Young, healthy African Americans (AA) exhibit lower vascular conductance during an exercise bout compared to Caucasian Americans (CA). This disparity may be due to greater sympathetic vasoconstriction and an impairment in functional sympatholysis during exercise in AA. Thus, the purpose of this study is to examine racial differences in vascular conductance during lower limb exercise in the presence of elevated sympathetic activity administered via cold pressor test (CPT). **METHODS:** A total of 5 African American (AA) and 4 Caucasian (CA) young (24 ± 2 yrs), healthy males were recruited. Subjects then underwent 6 minutes of rhythmic plantar flexion (PF) exercise at 30% of their previously determine maximum voluntary contraction (MVC). Doppler ultrasonography was utilized to measure superficial femoral artery blood flow on the exercising leg while simultaneous measures of mean arterial pressure (MAP) were obtained via finger plethysmography. Subjects underwent the CPT (minutes 4-6) during which the hand was placed in cold water (4 °C) during PF exercise. Measures were obtained during steady state exercise blood flow

(measured at minutes 3-4) and during the CPT (measured at minute 5-6) to determine differences in vascular conductance with and without the presence of elevated sympathetic activity.

RESULTS: The CPT resulted in similar increases in MAP in both AA (+24.8 ± 3 mmHg) and CA (+25.56 ± 13 mmHg) (p = 0.95) when compared to PF exercise alone. Exercising leg blood flow [AA (-38.89 ± 62 mL/min); CA (+137.97 ± 62 mL/min) (p = .09)] or leg vascular conductance [AA (-1.00 ± .6 mL/min/mmHg); CA (-0.28 ± .4 mL/min/mmHg) (p = .35)] was not different between groups when evaluated during the CPT and expressed as change from PF exercise alone.

CONCLUSIONS: This study suggests that during lower limb exercise, young AA males, when compared to CA, are similarly resistant to reductions in lower limb vascular conductance in response to elevated sympathetic activity.

923 Board #49 May 27 2:30 PM - 4:00 PM
Abstract Withdrawn

924 Board #50 May 27 2:30 PM - 4:00 PM
Sex-differences In Exercising Hemodynamics: Role Of Exercising Muscle Mass

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(No relevant relationships reported)

Sex-differences in O₂ transport include O₂ content (C_aO₂) and quantity of muscle mass. **PURPOSE:** To determine their consequences on exercising hemodynamics with large (e.g., 2-leg cycling (BIKE)) vs. small (e.g., 1-leg knee extension (KE)) muscle mass. **METHODS:** Healthy young subjects (4M, 3W) completed BIKE and KE exercise tests. The femoral artery and vein were catheterized to measure leg blood flow (Q), C_aO₂, and mean arterial pressure (MAP). Vascular conductance (VC), O₂ delivery, and leg O₂ uptake (VO₂) were calculated. Measures were normalized to the right leg (BIKE) or quadriceps (KE) lean mass. Whole body VO₂ was measured with a metabolic cart. Men and women were compared at similar and maximal work rates. **RESULTS:** Body mass was greater in men (M: 80±6 vs. W: 59±12 kg, p=0.03). Although quadriceps mass (3.3±0.2 vs. 2.0±0.3 kg, p<0.001) and C_aO₂ were lower, women had a higher mass-specific Q, VC (p=0.054), O₂ delivery, and leg VO₂ to maintain whole body VO₂ during similar KE (Table 1). These differences were maintained during maximal KE, at which women tended to achieve a higher mass-specific work rate (21±2 vs. 25±3 W·kg⁻¹, p=0.10). They were also apparent during similar BIKE despite a lower leg lean mass in women (8.7±0.3 vs. 5.3±0.7 kg, p<0.001). However, the differences were no longer present during maximal BIKE when mass-specific work rate was similar (21±2 vs. 20±2 W·kg⁻¹, p=0.70) and whole body VO₂ was lower in women. **CONCLUSION:** These findings highlight a greater hemodynamic capacity for women to overcome differences in C_aO₂ and maintain whole body VO₂ at similar work rates during exercise. They also implicate the quantity of exercising muscle in facilitating the greater hemodynamic capacity and mass-specific work rate during maximal exercise with a small but not large muscle mass. Support: The Swedish National Centre for Research in Sports, Ministerio de Educacion y Ciencia of Spain, Dr. Manuel Morales Foundation, NSERC

Table 1 - Exercising hemodynamics (*p<0.05, **p<0.01, ***p<0.001 men vs. women)

	Similar KE		Maximal KE		Similar BIKE		Maximal BIKE	
	M	W	M	W	M	W	M	W
Work rate (W)	40	40	70±8	50±10*	230	213±42	365±17	220±53**
VO ₂ (L·min ⁻¹)	1.02±0.16	1.08±0.02	1.73±0.47	1.43±0.37	3.40±0.20	3.03±0.46	5.01±17	3.06±0.51**
Q (mL·min ⁻¹ ·kg ⁻¹)	1599±213	2934±636*	2294±301	3351±288**	616±55	1254±19***	1186±160	1300±88
C _a O ₂ (mL·dL ⁻¹)	19.3±1.2	16.7±1.9	19.7±0.9	16.9±1.4*	20.1±0.5	18.3±1.3*	20.2±0.8	18.5±1.0*
MAP (mmHg)	113±10	136±10*	135±17	145±15	113±7	121±6	120±17	123±11
VC (mL·min ⁻¹ ·mmHg ⁻¹ ·kg ⁻¹)	14.6±2.2	23.7±6.9**	18.3±1.6	28.6±2.8**	5.8±11	11.7±0.4***	11.3±1.6	12.4±0.9
O ₂ delivery (mL·min ⁻¹ ·kg ⁻¹)	310±50	488±102*	452±61	567±65***	124±13	230±15***	240±30	240±3
Leg VO ₂ (mL·min ⁻¹ ·kg ⁻¹)	163±31	307±83*	292±19	394±22**	91±12	190±15***	196±25	201±12

925 Board #51 May 27 2:30 PM - 4:00 PM

Effects Of Dietary Sodium Intake On Blood Flow Regulation During Exercise In Salt Resistant Individuals

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(No relevant relationships reported)

Effects of Dietary Sodium Intake on Blood Flow Regulation During Exercise in Salt Resistant Individuals

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PURPOSE: Dietary guidelines for sodium intake is less than 2,300 mg/day, yet 90% of Americans exceed this value. This study examined individuals resistant to salt-induced changes in blood pressure to determine the impact of a high sodium diet on blood flow regulation during upper and lower limb exercise. **METHODS:** Six young (25 ± 2 years) males followed recommended dietary sodium intake guidelines on two separate weeks, with one week supplemented with salt capsules (HS: 6,900 mg/day of sodium) and the other week supplemented with placebo capsules (LS: 2,300 mg/day of sodium). Resting central hemodynamic measurements [heart rate (HR), heart rate variability (HRV), and mean arterial pressure (MAP)] were evaluated the end of each diet. Peripheral hemodynamic measurements [blood flow (BF), shear rate (SR), and flow mediated dilation (FMD)/SR] of the brachial and superficial femoral artery were taken during rhythmic (1 Hz), progressive handgrip (HG) and plantar flexion (PF) exercise, respectively. Exercise workloads were three minutes in length and increased by increments of 8 kilograms until exhaustion. **RESULTS:** Between each diet (LS and HS) there were no significant differences in resting MAP (82 ± 4 v 80 ± 5 mmHg; p = 0.3), HR (56 ± 6 v 59 ± 10 bpm; p = 0.4), or HRV (2.7 ± 1.9 v 8.3 ± 15.1 LF/HF; p = 0.4). During progressive HG and PF exercise the BF, SR, and FMD/SR were significantly increased by workload (p < 0.03 for all), but not different between diets (p > 0.05 for all). **CONCLUSION:** Despite previous evidence reporting a HS diet can impair resting vascular function, this study revealed that peripheral vascular function and blood flow regulation during exercise is not impacted by a HS diet in salt resistant individuals.

WEDNESDAY, MAY 27, 2020

926 Board #52 May 27 2:30 PM - 4:00 PM
Impact Of 6-month Exercise Training On Neurovascular Function In Persons With Spinal Cord Injury

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(No relevant relationships reported)

Accumulating evidence shows an exacerbated incidence of cognitive impairment after spinal cord injury (SCI); however, the physiology that underlies this apparent post-SCI cognitive decline is unknown.

PURPOSE: To investigate the impact of injury and 6-month full-body exercise training on neurovascular coupling in individuals with SCI.

METHODS: In 24 participants with SCI and 16 controls, we investigated hemodynamic (heart rate, blood pressure, CO₂) and middle cerebral artery blood flow velocity responses to a working memory task (neurovascular coupling) before and after training. Neurovascular coupling was compared across groups while accounting for injury parameters. Within individuals with SCI, 6-month changes in neurovascular coupling and its relation to changes in aerobic capacity were compared via linear mixed effect model.

RESULTS: Reaction time tended to be higher in individuals with SCI, especially those with high-level ($\geq T4$) injuries, possibly due to upper motor impairments. Neurovascular coupling was graded across task difficulty ($p < 0.01$), while injury did not have a significant impact (group effect $p = 0.99$, interaction $p = 0.70$). Individuals with low-level injuries ($< T4$) had higher aerobic capacity than those with high-level injuries ($p < 0.01$). Aerobic capacity increased significantly with training in both groups ($p < 0.01$). While there was no overall significant improvement in neurovascular coupling with training at the group level, the degree of improvement was closely related to that in aerobic fitness in individuals with high-level ($R^2 = 0.19$, $p = 0.03$) but not low-level ($R^2 = 0.04$, $p = 0.46$) injuries, which translated to an increase in reaction time ($R^2 = 0.16$, $p = 0.05$).

CONCLUSIONS: The apparent cognitive impairment after SCI is primarily due to physical deconditioning, rather than injury itself, and can be mitigated by aerobic exercise training. This has significant implications for long-term care and management for individuals with SCI.

Supported by AHA Grant 15SDG2329000 (COT), Ellen R. and Melvin J. Gordon Center for the Cure and Treatment of Paralysis (COT). EDO was in part supported by the Harvard College Research Program.

927 Board #53 May 27 2:30 PM - 4:00 PM
L-citrulline Does Not Change Blood Flow Kinetics At The Onset Of Exercise In Young Women

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(No relevant relationships reported)

Oral supplementation with L-citrulline (CIT) has been reported to improve muscle oxygenation during moderate-intensity exercise in young men; however, examination of the impact of CIT in young women is scarce. **PURPOSE:** To examine the influence of CIT on muscle blood flow responses to exercise in young women. **METHODS:** Women were assessed during the follicular ($n = 13$, 24 ± 2 y) and luteal ($n = 11$, 25 ± 2 y) phases of the menstrual cycle. Supplementation with CIT (6 g/day) or placebo occurred 7 days prior to the testing day in a crossover design across two menstrual cycles. All women performed rhythmic handgrip exercise at 10% maximal grip strength while forearm blood flow (FBF) was measured in the right brachial artery using Doppler ultrasound. FBF was calculated per duty cycle (contract:relax, 1:2s) before being fit with a monoexponential model. Amplitude of the FBF response and the number of duty cycles for FBF to reach 63% of the steady-state amplitude (τ FBF) were derived from the model. **RESULTS:** Menstrual cycle groups were similar in age, body mass index, resting brachial artery diameter, and maximal grip strength (all $p > 0.10$). CIT did not change the amplitude of FBF or τ FBF as compared to placebo in women tested during the follicular (CIT vs. placebo: 166 ± 50 vs. 158 ± 52 ml/min, $p = 0.41$; 7 ± 5 vs. 6 ± 3 duty cycles, $p = 0.28$) or luteal phases (163 ± 41 vs. 173 ± 49 ml/min, $p = 0.34$; 11 ± 5 vs. 9 ± 4 duty cycles, $p = 0.26$). Interestingly, the amplitude of the FBF response was similar between women tested during the follicular (163 ± 44 ml/min) and luteal (170 ± 41 ml/min, $p = 0.68$) phases, but τ FBF was slower for women tested during the luteal as compared to the follicular phase (11 ± 4 vs. 7 ± 3 duty cycles, $p = 0.01$). **CONCLUSION:** Muscle blood flow response to rhythmic handgrip exercise was not changed by short-term supplementation with CIT in young women irrespective of menstrual cycle phase.

B-66 Free Communication/Poster - Disease

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

928 Board #54 May 27 2:30 PM - 4:00 PM
Hypertrophic Cardiomyopathy And Heart Failure With Preserved Ejection Fraction: A Common Phenotype Explaining Exercise Intolerance

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(No relevant relationships reported)

Hypertrophic cardiomyopathy (HCM) is characterized by diastolic dysfunction which contributes to exercise intolerance despite a preserved ejection fraction. This phenotype is strikingly similar to that reported in HFpEF. While disease etiologies clearly differ and HCM patients may not have heart failure, the degree of exercise intolerance is comparable and may be due to similar impairments in cardiac function. **PURPOSE:** To compare systolic function and early diastolic relaxation during submaximal cycle exercise in HCM and HFpEF patients. **METHODS:** Patients with HCM without heart failure ($n = 12$, 48 ± 7 years) were compared to HFpEF patients ($n = 12$, 67 ± 5 years), and old ($n = 11$, 70 ± 5 years) and young ($n = 11$, 31 ± 3 years) controls. Subjects underwent semi-recumbent echocardiography at rest and during steady state exercise at a heart rate of 100bpm. Tissue Doppler velocities of the septal and lateral mitral annulus were averaged during systole (S') and early diastole (E'), and the difference in resting and exercise velocities were calculated. **RESULTS:** There were no differences in resting S' between groups, and all subjects similarly increased S' from rest to exercise (Figure). HCM patients had significantly lower resting E' velocities compared to HFpEF patients and young controls ($P = 0.032$ and $P < 0.001$, respectively). While all groups augmented E' from rest to exercise ($P < 0.05$), the magnitude of the increase was significantly less in patients with HCM compared to young and old controls but indistinguishable from HFpEF patients. **CONCLUSION:** Patients with HCM are unable to increase E' from rest to exercise to the same extent as healthy young and old individuals. In fact, augmentation of early diastolic relaxation was similar between HCM and HFpEF patients, despite the HCM cohort being almost 20 years younger and without heart failure. Although the disease etiologies differ, these data suggest a common phenotype explaining exercise intolerance in HCM and HFpEF.

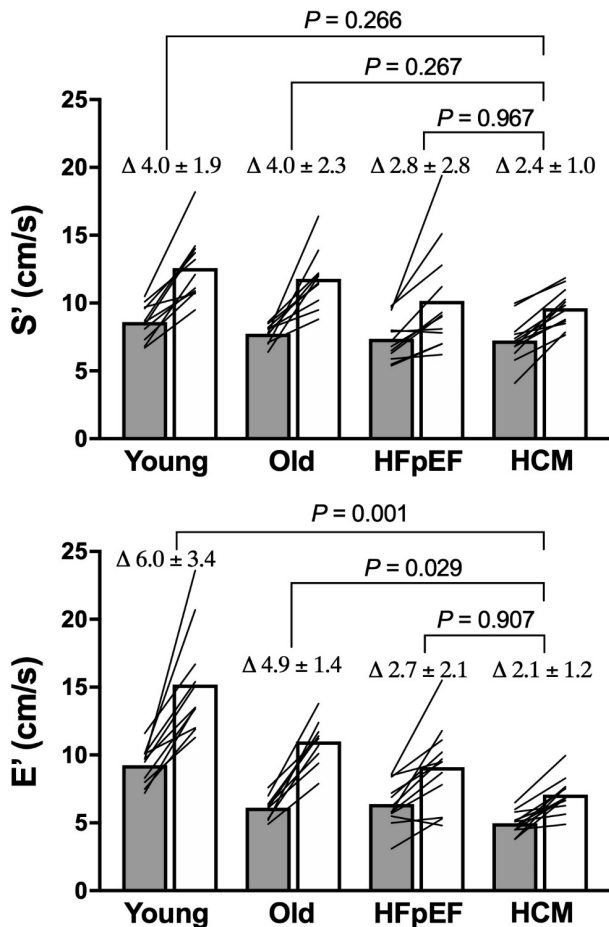


Figure. Systolic (S') and diastolic (E') tissue Doppler velocities at rest (grey bar) and during steady state exercise (white bar) in healthy young and old subjects, and patients with HFpEF and HCM. Δ indicates the mean change and standard deviation from rest to exercise.

and CON (86±12 mmHg; $P=0.17$) and MAP increased similarly during IHG (ARNi: Δ 10±12 vs. CON: 8±10 mmHg) and PEI (ARNi: Δ 6±4 vs. CON: 5±10 mmHg; ANOVA $P>0.90$). Resting MAP was reduced after 12 weeks of ARNi (87±7 mmHg) and was unchanged in CON (91±20 mmHg; ANOVA interaction $P=0.048$). However, the increase in MAP during IHG (ARNi: Δ 11±8 vs. CON: 13±6 mmHg; $P>0.60$) and PEI (ARNi: Δ 8±6 vs. CON: 12±3 mmHg; $P>0.60$) after 12 weeks was not impacted by ARNi (ANOVA time $P=0.24$) or different between groups. Maximal raw force and RPE ratings during IHG were similar between groups and not different following 12 weeks of ARNi (ANOVA $P>0.70$). **CONCLUSION:** These preliminary data suggest that although 12 weeks of ARNi therapy reduces resting MAP in HFREF, there are no significant reductions on MAP response to exercise. Additional data are needed to fully understand the impact of ARNi on cardiovascular responses to exercise in HFREF. Supported by ACSM grant 19-00934 and P20 GM 113125.

930 Board #56 May 27 2:30 PM - 4:00 PM
The Feasibility And Physiological Responses Of Single Leg Cycling In Individuals With Hemiparesis
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 (No relevant relationships reported)

INTRODUCTION: The primary treatment for individuals post stroke is intensive rehabilitation focusing on improving and restoring motor control. Typically, the rehabilitation does not focus on increasing cardiovascular fitness due to the inability of these individuals to coordinate those modalities of aerobic exercise (i.e. walking and cycling). Both cycling and walking can promote increases in cardiovascular fitness in individuals' post-stroke but most of the increases are minimal. Single leg cycling (SLC) is a modality of exercise that has never been attempted by this population. Working around their affected side while utilizing SLC may be what they need as a means to get a quality cardiovascular workout. **PURPOSE:** The purpose of this study aims to examine feasibility and safety of SLC in this population as well as how effective it may be at increasing oxygen consumption, heart rate, blood pressure, cognitive function, cerebral blood flow and proprioception compared to traditional double leg cycling (DLC). **METHODS:** Individuals with completed a bout of DLC and SLC. We continuously collected metabolic data (Oxygen consumption, resting exchange ratio), cardiovascular data (Heart rate, blood pressure, cardiac output, stroke volume) as well as tissue saturation via Near infrared spectroscopy. The subjects were randomized into either SLC or DLC. We started both exercise bouts at a wattage they could handle and increased by 10w every 30 seconds until volitional fatigue or they reached a goal of 55% of their heart rate reserve. They had a 15-minute washout period in between exercise bouts. **RESULTS:** Vo₂ was elevated during the SLC trial compared to the DLC trial ($p=0.05$). HR and BP were also elevated during the SLC trial compared to DLC ($p=0.01$). There was no significant difference in RPE across the two conditions. **CONCLUSION:** The results suggest that single leg cycling may be more beneficial to individuals with hemiparesis. Elevated Vo₂, HR, and BP during SLC suggest that they were able to work around their affected side and coordinate this exercise more effectively than traditional DLC.

929 Board #55 May 27 2:30 PM - 4:00 PM
Effects Of Angiotensin Receptor Neprilysin Inhibition On Blood Pressure Response To Exercise In Heart Failure
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Angiotensin Receptor Neprilysin inhibitors (ARNi) is a new class of drug approved for heart failure patients with reduced ejection fraction (HFREF). ARNi reduces resting blood pressure (BP) in HFREF. However, the effect of ARNi on BP response to exercise in HFREF has not been established. **PURPOSE:** We hypothesized that BP response to isometric handgrip exercise (IHG) would be attenuated in HFREF after 12 weeks of ARNi therapy. **METHODS:** HFREF participants were recruited from local cardiology clinics and completed a baseline experimental visit and follow up visit 12 weeks later: 6 patients were prescribed ARNi by their cardiologist [64±10 years, Men: 5, BMI: 30±6 kg/m², EF: 26±7%; 4 with Non-ischemic cardiomyopathy (NICM)], and 5 participants continued on conventional treatment [CON: 57±6 years, Men: 2, BMI: 27±5 kg/m², EF: 30±4% and NICM: 3; all $P = NS$]. During each experimental visit, BP was measured at rest and during 2-minutes IHG at 30% maximal voluntary contraction followed by post-HG exercise ischemia (PEI) to isolate the metaboreflex. The change in mean arterial pressure (Δ MAP) from baseline to exercise and PEI was assessed; statistical comparisons were performed using 2x2 repeated-measures ANOVA. **RESULTS:** At baseline, resting MAP was similar between ARNi (96±14 mmHg)

931 Board #57 May 27 2:30 PM - 4:00 PM
Sensory Neuron Sensitization By Pkc-induced Trpv1 Phosphorylation In Type 2 Diabetic Rats
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 (No relevant relationships reported)

Skeletal muscle reflex-induced increases in blood pressure are exaggerated during exercise in type 2 diabetes mellitus (T2DM). We previously demonstrated that skeletal muscle afferent discharge in response to capsaicin, a transient receptor potential cation channel subfamily V member 1 (TRPV1) agonist, is heightened in T2DM likely contributing to the potentiated pressor response. However, the underlying mechanisms remain unclear. Evidence suggests that the high glucose levels in T2DM sensitize sensory neurons through the receptor for advanced glycation end products (RAGE)/ protein kinase C (PKC) pathway in dorsal root ganglia (DRG). Moreover, early-stage diabetes associated with TRPV1 overactivity is mediated through PKC. Therefore, it was hypothesized that the augmentation in muscle afferent discharge in T2DM previously reported is due to the phosphorylation of TRPV1 via an overactive RAGE/PKC pathway. **PURPOSE:** To investigate 1) the impact of T2DM on plasma levels of advanced glycation end products (AGE) and high-mobility group box-protein 1 (HMGB-1), both RAGE ligands, and 2) the impact of T2DM on the RAGE/PKC pathway including the phosphorylation of TRPV1 in DRG subserving skeletal muscle afferents. **METHODS:** For 14-16 weeks, Sprague-Dawley rats were given either a normal diet (control) or a high fat diet in combination with a low dose (35 mg/kg) of

streptozotocin (T2DM). Plasma insulin, HMGB1 and AGE were determined using ELISA. RAGE, phosphorylated PKC and TRPV1 protein levels were quantified in DRG by western blotting. **RESULTS:** After overnight fasting, T2DM rats exhibited hyperglycemia (95 ± 6 vs. 156 ± 18 mg/dL, $P < 0.05$) and hyperinsulinemia (1.6 ± 0.2 vs. 4.1 ± 0.4 ng/mL, $P < 0.05$). HMGB1, AGE and RAGE did not differ between groups. Phosphorylated PKC (1.0 ± 0.1 vs. 1.2 ± 0.2 arb unit, $P = 0.08$) and TRPV1 (1.0 ± 0.3 vs. 1.3 ± 0.4 arb unit, $P = 0.08$) levels in DRG tended to be greater in T2DM than control.

CONCLUSIONS: These findings suggest that phosphorylated TRPV1 may be increased by PKC overactivity in DRG of T2DM but acts independently of RAGE. Importantly, these changes may mediate the sensitization of skeletal muscle afferents facilitating the exaggerated pressor response to exercise characteristic of T2DM.

Supported by Lawson & Rogers Lacy Research Fund and SHP Interdisciplinary Research Grant Program.

932 Board #58 May 27 2:30 PM - 4:00 PM
Acute Effect Of Hyperglycemia On The Mechanoreflex And Metaboreflex

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 (No relevant relationships reported)

Recent studies in both humans and rodents have shown that the mechanoreflex and metaboreflex are exaggerated in type 2 diabetes mellitus (T2DM). Hyperglycemia is a main characteristic of T2DM and is known to cause damage to both cardiovascular and nervous system structures. However, the effects of the presence of hyperglycemia on the mechanoreflex and metaboreflex are not known. **PURPOSE:** To determine the acute effect of hyperglycemia on the mechanoreflex and metaboreflex.

METHODS: Experiments were conducted after an overnight fast in unanesthetized, decerebrated healthy male and female Sprague-Dawley rats. The mechanoreflex was evoked by stretching the Achilles tendon for 30 s and the metaboreflex was evoked by locally injecting lactic acid (0.2ml, 24mM) into the hindlimb. Time and dosage for glucose infusion were selected based on a preliminary study that showed infusing 250 mg/ml of glucose solution for 15 min into the hindlimb circulation, with blood flow to and from the hindlimb restricted, would elevate local blood glucose concentration to the same degree as that seen in T2DM rats with an exaggerated exercise pressor reflex. To elicit an acute hyperglycemia environment while preventing an endogenous insulin response, somatostatin (3.9 ug/100 ul) was infused systemically and simultaneously along with local glucose infusion. Changes in mean arterial pressure (Δ MAP) and heart rate (Δ HR) in response to tendon stretch and lactic acid injection were measured and compared before and after infusion.

RESULTS: We found that the peak pressor and cardioaccelerator responses to tendon stretch were not significantly affected by acute hyperglycemia (Δ MAP before: 12 ± 2 mmHg, after: 12 ± 3 mmHg, $n=6$, $p>0.05$; Δ HR before: 10 ± 3 bpm, after: 10 ± 3 bpm, $n=6$, $p>0.05$). Likewise, the pressor and cardioaccelerator responses to lactic acid were not significantly affected by acute hyperglycemia (Δ MAP before: 13 ± 2 mmHg, after: 16 ± 3 mmHg, $n=10$, $p>0.05$; Δ HR before: 10 ± 2 bpm, after: 12 ± 5 bpm, $n=10$, $p>0.05$).

CONCLUSIONS: The acute presence of hyperglycemia in the local circulation of the hindlimb does not contribute to the exaggerated mechanoreflex or metaboreflex. This project was supported by NIH R01 HL144723.

933 Board #59 May 27 2:30 PM - 4:00 PM
The Role Of Camk2δ-MEF2 Signaling Pathway In Aerobic Exercise-induced Improvement Of Cardiac Function In Hypertension

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 (No relevant relationships reported)

Objective: The purpose of this study was to investigate the effects of aerobic exercise on the Calcium/calmodulin-dependent protein kinase II δ (CaMKII δ)-Myocyte enhancer factor-2(MEF2) signaling pathway in SHR myocardial cells, and the role of the A-kinase anchoring protein 150(AKAP150).

Methods: 12-week-old male SHR and WKY rats were randomly assigned to sedentary groups (WKY-SED, SHR-SED) and exercise training groups (WKY-EX, SHR-EX). Exercise groups were performed a 12-week moderate intensity treadmill running. After 12 weeks, the myocardial cells were enzymatically isolated. The experimental methods include HE staining, the Langendorff technique of isolated heart perfusion, immunohistochemistry, immune cell fluorescence, Western blot.

Results: 1) After 12 weeks of exercise, SBP in both WKY-EX and SHR-EX were significantly lower than that of their sedentary counterparts. 2) Compared with the WKY-SED group, the SHR-SED group +dp/dtmax, -dp/dtmax significantly decreased, and the SHR-EX group was significantly higher than the SHR-SED group, +dp/dtmax significantly increased, -dp/dtmax decreased ($P < 0.01$), LVSP increased ($P < 0.01$). 3) The fluorescence intensity of CaM and AKAP150 in the SHR-SED group was higher

than WKY-SED group ($P < 0.01$), and the fluorescence intensity of the SHR-EX group AKAP150 was higher than SHR-SED group ($P < 0.01$), and the expression of CaM was lower than the SHR-SED group ($P < 0.01$). 4) The protein expression of p-CaMKII δ , CaMKII δ and AKAP150 in the SHR-SED group was higher than that in the WKY-SED group ($P < 0.01$). The expression of p-CaMKII δ /CaMKII δ , p-HDAC4/HDAC4 and MEF2 of SHR-EX group are lower than the SHR-SED group ($P < 0.01$). The expression of AKAP150 of SHR-EX was higher than SHR-SED group ($P < 0.01$).

Conclusion: Aerobic exercise reduced the activity of the CaMKII δ -MEF2 signaling pathway and increased the expression of AKAP150 in the SHR myocardial, which is one of the molecular mechanisms to improve the function of the heart.

Key words: cardiac function; CaMKII δ -MEF2 signaling pathway; aerobic exercise; AKAP150

B-67 Free Communication/Poster - Renal Physiology

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

934 Board #60 May 27 2:30 PM - 4:00 PM
Physical Activity Is An Important Prescription For Kidney Transplant Patients And Those Receiving Dialysis

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Chronic kidney disease (CKD) affects 13% of U.S. adults. Patients endure a disproportionate amount of cardiovascular complications with nearly 50% of dialysis patients experiencing a premature death related to cardiovascular disease. Although participation in regular physical activity can mitigate CKD complications, more than half of nephrologists fail to recommend it to their patients. **PURPOSE:** To investigate the effects of physical activity on hemoglobin and health outcomes in CKD patients.

METHODS: We analyzed patients admitted to a hospital in the Midwestern United States. A comprehensive metabolic panel and health history, including physical activity (PA) levels, were obtained upon admittance. Patients were assigned a status of either active (N=23) or sedentary (N=45). Independent-samples t-tests and chi-squared tests compared sedentary and active groups. Linear and negative binomial regression models tested the effect of PA on Hb and hospital length of stay (LOS). **RESULTS:** Across the total sample, patients were 64.7 ± 17.4 years old, 40.3% were obese, they remained in the hospital for 6.9 ± 7.5 days, 16.2% received dialysis during treatment, 5.9% had a history of kidney transplant, and 4.4% died. Patients with a history of transplant had a reduction in Hb of 3.7 g/dL ($p < 0.001$) and exhibited a trend for a higher rate of engagement in PA ($p = 0.073$). Patients receiving dialysis had 2.4 g/dL lower Hb ($p = 0.006$) and comparable rates of PA ($p = 0.616$). All cases of mortality occurred in the sedentary group, and the Hb of patients who expired was 2.2 g/dL lower; owing to a small sample, this failed to reach significance ($p = 0.179$). Physically active patients had 1.4 g/dL higher Hb ($p = 0.041$). Holding constant transplant status and whether patients received dialysis, PA predicted an increase in Hb of 1.75 g/dL ($p = 0.007$; 95% CI: 0.489 to 3.011) and a 96.4% shorter LOS ($p = 0.005$; 95% CI of IRR: 0.003 to 0.373). In turn, Hb was a trending predictor of mortality; each additional g/dL predicted a 38.3% reduction in odds ($p = 0.069$; 95% CI of OR: 0.367 to 1.038). **CONCLUSION:** Independent of dialysis and transplant status, engagement in regular physical activity elicited an increase in Hb and shortened hospital stays among CKD patients. Our findings reinforce the importance of physical activity prescription as a standard component of care.

935 Board #61 May 27 2:30 PM - 4:00 PM
Evaluating Acceptability Domain Of An Intradialytic Exercise Program-Patient Adherence And Nursing Documentation

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 (No relevant relationships reported)

For patients with end stage renal disease, exercise during hemodialysis (HD), intradialytic exercise (IDE), may mitigate treatment related symptoms including

cramping, restless legs, and fatigue. In Alberta Kidney Care North, IDE is supervised by a clinical exercise physiologist (CEP) and dialysis unit staff assist with program delivery.

PURPOSE: The aim of this study was to examine program responsiveness to the patients' needs (acceptability) by evaluating documentation of patient adherence. **METHODS:** 1,752 exercise sessions were audited at 6 hemodialysis units. Patient reported participation was collected directly from patients within 10 days of the audit. Baseline and subsequent physical reassessments were examined to verify the validity of patient recall, relative to the required exercise dose. Data points were divided into 2 categories: active IDE participants (A-IDE) and non-active IDE (NA-IDE) participants. A-IDE were defined as patients who completed at least 1 IDE session/week for 4 weeks. NA-IDE participants were defined as those previously assessed and programmed but recently discharged, on a medical hold, or participating in a home exercise program at the time of the audit.

RESULTS: Of the 1,332 A-IDE sessions audited, nurses documented patient participation 28.08%, no participation 49.4%, and did not document 22.52%. Patients reported adherence 63.74%. Physical reassessment data showed improved outcome measures thereby, validating patient recall of adherence. Of 420 NA-IDE HD data sheet analyzed, nurses documented patient participation 1.9%, no participation 70.24%, and did not document 27.85%. Patient report and documentation agreed 2.7%. **CONCLUSIONS:** Assessment of IDE participation is an integral component to the evaluation of an IDE program. Discrepancies between patient report and documented adherence exist. We found that patient report is valid, based on improved measures at reassessments; however, we must establish feasible methods for dialysis staff to collect adherence when CEPs are not present. Staff training, including regular surveys to assess staff knowledge of processes, may provide valuable information on units with a high staff turnover. Implementing an IDE prescription confirmation, as a standard practice in HD treatment preparation, may affirm participation.

936 Board #62 May 27 2:30 PM - 4:00 PM
Resveratrol Ameliorates Exhaustive Exercise-induced Acute Kidney Injury In Rats Via Sirt1/nf-κB Pathway Modulation

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(No relevant relationships reported)

PURPOSE: Resveratrol is a naturally sirtuin1 activator, its renal protective effects have been validated in a variety of animal models of kidney disease, however, there is still no systematic study on resveratrol to improve rat kidney damage caused by exhaustive training, and whether the regulation of renal inflammatory response is through SIRT1/NF-κB signaling pathway.

METHODS: In this study, 32 SD rats were randomly divided into: control group (Con), resveratrol group (Rsv), exhaustive exercise group (Ex), exhaustive exercise+resveratrol group (Ex+Rsv). Rsv and Ex+Rsv group were given resveratrol(50mg/kg body weight)by gavage, Ex and Ex+Rsv group performed four weeks of exhaustive training. Anesthesia treatment was taken 24 hours after the last training. **RESULTS:** The results showed that Scr in the Ex group (175.66 ± 16.08 vs. 153.34 ± 8.67 , $P < 0.01$), BUN (6.67 ± 0.53 vs. 5.37 ± 0.19 , $P < 0.01$) and urinary NGAL (9.01 ± 0.18 vs. 7.48 ± 0.31 , $P < 0.01$) were increased significantly compared with the Con group. The expression of NF-κB P65 in Ex group was significantly increased (0.77 ± 0.10 vs. 0.27 ± 0.03 , $P < 0.01$). The expression of SIRT1 in Rsv and Ex+Rsv group were significantly higher than that in the Con (0.90 ± 0.14 vs. 0.43 ± 0.15 , $P < 0.05$) and Ex (1.0 ± 0.28 vs. 0.38 ± 0.12 , $P < 0.01$) respectively; Compared with the Ex group, the NF-κB P65 (0.77 ± 0.11 vs. 0.27 ± 0.03 , $P < 0.05$) and Ac-NF-κB P65 (0.52 ± 0.13 vs. 0.78 ± 0.11 , $P < 0.05$) in Ex+Rsv showed a significant decrease in protein level expression. **CONCLUSIONS:** The above results indicate that high-intensity exhaustive exercise leads to renal injury in rats and activates the expression of NF-κB in rat kidney. Resveratrol can significantly increase the expression of SIRT1 at the protein level and increase the deacetylation to reduce the level of acetylation of NF-κB P65 protein, further reducing the expression of NF-κB. The mechanism by which resveratrol reduces the inflammatory response induced by exhaustive training in rats may be related to the SIRT1/NF-κB pathway.

937 Board #63 May 27 2:30 PM - 4:00 PM
Role And Determinants Of Chronotropic Incompetence In A Kidney Transplant Recipients Population

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Hemodialysis patients reveal a significantly reduced exercise capacity, often associated with the presence of Chronotropic Incompetence (CI). Both these conditions are well known cardiovascular risk factors. Very limited data exists on CI in Kidney Transplant Recipients (KTRs).

PURPOSE: To describe the prevalence of CI in a KTRs population and to analyze its potential determinants and its effects on functional capacity. **METHODS:** Consecutively recruited KTRs 3 months after transplantation underwent a Cardiopulmonary Exercise Test with an incremental protocol. 175 KTRs were included and the test was repeated in 60 subjects after a mean period of 22 months. Laboratory and drug therapy data were collected. CI was defined by the formula: $MCI = (HR_{peak} - HR_{rest}) / (HR_{predicted} - HR_{rest}) / (\dot{V}O_{2,peak} - \dot{V}O_{2,rest}) / (\dot{V}O_{2,predicted} - \dot{V}O_{2,rest})$ (MCI: metabolic chronotropic index, HR: heart rate, $\dot{V}O_2$: oxygen consumption). The prevalence of CI was calculated on 175 KTRs, while the multivariate regression analysis was conducted on 60 KTRs that repeated the test.

RESULTS: In the whole population the CI prevalence was 30.9%. The 60 reassessed KTRs (age 51.6 ± 1.3 years, 77% men) showed significant differences between 3 and 22 months after transplantation in the hemoglobin level (123.4 ± 16.6 vs 136.4 ± 17.8 g/L, $p < 0.001$) and in the proportion of beta-blocker therapy (50 vs 23.3%, $p < 0.001$), but no differences in $\dot{V}O_2/kg$ peak (26.5 ± 7.0 vs 26.8 ± 8.2 ml/kg/min, $p = 0.85$) nor in CI prevalence (31.7 vs 36.7 , $p = 0.41$). KTRs with CI demonstrated no significant differences of $\dot{V}O_2,peak$ nor at 3 or at 22 months after transplantation, compared to KTRs without CI. The only determinant of CI at the two visits was the presence of arterial hypertension. Gender, age, BMI, the presence of diabetes, the type of immunosuppressive therapy, the duration of follow-up and beta-blocker therapy did not appear to be determinants of CI. **CONCLUSIONS:** KTRs are characterized by reduced functional capacity but the CI does not seem to significantly limit their functional level. In contrast to what it would be expected, beta-blocker therapy does not appear to be a CI determinant, while its only significant determinant was arterial hypertension.

938 Board #64 May 27 2:30 PM - 4:00 PM
Circulating Steroid Changes In Response To Extreme Physical Stress In Male Athletes

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PURPOSE: Athletes put themselves on a regular physical load to stay competitive. Steroids play a significant role in the regulation of cardiovascular, metabolic and many other functions in stress situations. Our aim was to monitor the response of steroid hormones to physical stress.

METHODS: We investigated the plasma levels of 14 different endogenous steroid molecules in a model of extreme acute physical stress (vita maxima treadmill test) in male athletes (n=45; median age=21). Steroid levels were measured using liquid chromatography-tandem mass spectrometry. Cardiovascular-, metabolic-, and gas-exchange parameters were also evaluated. All values were measured at baseline, at maximum stress and 30 minutes into the rest period.

RESULTS: The plasma concentrations of 9 steroids elevated significantly ($p < 0.05$) at the peak compared to baseline, and 11 metabolites elevated significantly ($p < 0.05$) in the rest period compared to baseline. After load 9 steroid showed an increase of at least 50% compared to baseline. Aldosterone showed the highest increase at peak, with 75.83%, and in the rest phase corticosterone elevated with 123.36%. Blood pressure, heart rate and lactate parameters increased significantly at the peak of the load ($p < 0.01$). Cardiac and metabolic values did not correlate with the steroid concentrations. We calculated 11 enzyme activities from the product and substrate ratios, and we found significant differences. There were 4 enzymatic pathway which showed significant increase. 11β-HSD ($p < 0.01$) and aldosterone-synthase ($p < 0.01$) elevated at the peak. In the restitution 17,20-lyase and 11β-HSD in another pathway increased significantly ($p < 0.01$).

CONCLUSIONS: All three lines of the adrenal cortex are affected by extreme physical stress. Cardiovascular, metabolic and gas-exchange parameters increase early,

followed by changes in the levels of endogenous steroids, as a later response. We showed for the first time in this model the elevation of some steroids, like aldosterone, corticosterone and others, and identified the enzymatic pathways involved. Literature results were partially reproduced, with further changes in steroid levels revealed by our model. This research was supported by: GINOP-2.3.2-15-2016-00047, Széchenyi 2020., 20765/3/2018 FEKUTSRAT projects.

939 Board #65 May 27 2:30 PM - 4:00 PM
Renal And Segmental Artery Hemodynamic Response To Mild Hypercapnia

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The risk of kidney disease is elevated in conditions associated with sustained or transient elevations in the partial pressure of carbon dioxide, such as chronic obstructive pulmonary disease or sleep apnea. Indirect evidence indicates that hypercapnia induces renal vasoconstriction, a response that differs from the vasodilatory response that occurs in most other vascular beds. Thus, one mechanism underlying an increased risk of kidney disease is that repeated hypercapnia-induced episodes of renal vasoconstriction reduce oxygen delivery and compromise renal oxygenation. However, it is unknown if hypercapnia elevates vascular resistance in vessels going to or within the kidneys. **PURPOSE:** To test the hypothesis that breathing a hypercapnic gas mixture increases vascular resistance in the renal and segmental arteries. **METHODS:** After 45 min of supine rest, renal hemodynamics were assessed in eleven healthy adults (27 ± 4 years, 5 females) immediately prior to (AIR) and while breathing a 3% CO₂, 21% O₂, 76% N₂ gas mixture for 5 min (CO₂). The partial pressure of end-tidal CO₂ (PETCO₂, capnography) and mean arterial pressure (MAP, finger photoplethysmography) were measured continually. Blood velocity (BV) in the distal segment of the right renal artery (Renal) and the middle portion of the same segmental artery within a given subject (Segmental) were assessed using the coronal approach via Doppler ultrasound. Vascular resistance (VR) was calculated as MAP/BV. **RESULTS:** CO₂ increased PETCO₂ (45 ± 3 vs. 48 ± 3 mmHg, P<0.01). CO₂ did not change MAP (AIR: 90 ± 4, CO₂: 90 ± 5 mmHg, P=0.83). In the renal artery, CO₂ reduced BV (33.7 ± 8.0 vs. 31.3 ± 7.7 cm/s, P=0.02), and elevated VR (2.8 ± 0.9 vs. 3.1 ± 1.0 mmHg/cm/s, P=0.03). Similarly, in the segmental artery, CO₂ reduced BV (24.5 ± 5.9 vs. 22.0 ± 4.6 cm/s, P<0.01) and increased VR (4.0 ± 1.1 vs. 4.3 ± 1.1 mmHg/cm/s, P<0.05). **CONCLUSION:** These findings suggest that mild hypercapnia elevates vascular resistance in the renal and segmental arteries.

940 Board #66 May 27 2:30 PM - 4:00 PM
Heart Rate Variability Responses To Exercise In Mid-spectrum Chronic Kidney Disease

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 (No relevant relationships reported)

BACKGROUND: Heart rate variability (HRV) is a measure of autonomic nervous system (ANS) activity, and decreased HRV is associated with many cardiovascular conditions. Chronic kidney disease (CKD) is characterized by a decrease in renal function and may be associated with ANS imbalances in the renal vasculature. Low HRV is associated with CKD incidence. Exercise is able to alter HRV by modulating the ANS. The effect of exercise on HRV in mid-spectrum CKD patients remains understudied. **PURPOSE:** To determine the effect of steady-state exercise (SSE) and high-intensity interval exercise (HIIE) on post-exercise HRV in patients with stage 3 or 4 CKD. **METHODS:** Twenty participants with stage 3 or 4 CKD (n = 6 men; n = 14 women; age 62.0 ± 9.9 yr; weight 80.9 ± 16.2 kg; body fat 37.3 ± 8.5% of weight; VO_{2max} 19.4 ± 4.7 ml/kg/min, eGFR 51.5 ± 6.82). On separate days, each participant completed 30 minutes of aerobic exercise on the treadmill with exercise intensities set at 65% VO₂ reserve for SSE and 90% and 20% of VO₂ reserve in 3:2 min ratio for HIIE in a randomized crossover design. Both conditions averaged ~ 65% VO₂ reserve. HRV was measured at baseline, immediately post-exercise (IPE), 1-hr post-exercise, and 24-hr post-exercise. HRV was measured for 5 mins in the supine position using an elastic belt and Bluetooth monitor (Polar H7). CardioMood software was used to process HRV variables high frequency (HF), low frequency (LF), and standard deviation of all NN intervals (SDNN). Data were analyzed using 2 (condition) by 4 (time) repeated-measures ANOVAs. Data violated normality and were natural log (ln) transformed prior to analysis. Significant main effects were followed up using pairwise comparisons using a Bonferroni adjustment for multiple comparisons. All analyses were performed using SPSS (v.26). **RESULTS:** For ln LF/HF there were no significant main effects for exercise condition, time, or their interaction (p > 0.05). For ln HF (F

= 3.507, p < 0.05, η_p² = 0.156). In LF (F = 3.093, p < 0.05, η_p² = 0.140), and ln SDNN (F = 3.761, p < 0.05, η_p² = 0.165) there was a significant main effect for time. Post-hoc comparisons revealed that HF, LF, and SDNN were lower IPE than for all other time points. **CONCLUSION:** Thirty minutes of aerobic exercise transiently decreases HRV in mid-spectrum CKD patients. This response was not modified by exercise condition.

941 Board #67 May 27 2:30 PM - 4:00 PM
INCREASES IN PHYSICAL CAPACITY (VO2 PEAK) IMPROVES RENAL PROTECTIVE EFFECTS IN CKD AND MITOCHONDRIAL FUNCTION

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 (No relevant relationships reported)

PURPOSE: Physical exercise improves mitochondrial function and biogenesis. It is common for CKD patients to be physically inactive having less physical and functional capacity when compared to the general population. The aim of this study was to evaluate physical capacity, renal function and mitochondrial function in rats with CKD by nephrectomy 5/6 (Nx5/6)

METHODS: Adult Wistar rats were divided into groups (n=8): SHAM; Sedentary+Nx5/6+Sedentary (Sed), Sedentary+Nx5/6+Exercise (SE), Exercise+Nx5/6+Sedentary (ES) and Exercise+Nx5/6+Exercise (Exe). The physical capacity was performed with ergospirometry test (Vo2 peak) and maximal exercise test (Mtest). EXE periods were as follows: 40-60min/day, 5 days a week, during 8 weeks, 40 to 60% of Mtest. We evaluated proteinuria (uProt), blood urea nitrogen (BUN) and blood pressure (BP). By Western Blotting evaluated renal AMPK Pathway (AMPK and PGC1- alpha) was

RESULTS: The Physical Capacity (VO2 peak) was increased in SE and Exe vs Sed (31.8±0.7; 35.2±0.9 vs 23.1±1.8. p<0.05, respectively), and Mtest was improved in SE and Exe vs Sed (34.2±2.1; 37.9±1.7 vs 24.8±0.6. p<0.05, respectively). The Exe group presented a significant reduction in proteinuria when compared to the SE and ES (61.1±20.9 vs 173±39.2 vs 124.4±14.1. p <0.05, respectively). BUN was higher in SE and ES vs Exe (57.2±7.4 vs 65.6±7.8 vs 51.1±7.4. p <0.05, respectively). There was a decrease in BP in the SE and Exe groups when compared with the Sed group (215±1 and 219±2 vs 251±2, p <0.05, respectively), but the blood pressure values still remained high. The Renal AMPK Pathway was reduced in all group vs Sed in terms of protein levels (AMPK and PGC1- alpha)

CONCLUSIONS: The Increased physical capacity Vo2 peak and Mtest minimized the impact of Nx5/6 in the CKD, attenuating proteinuria, an important index of progressive loss of renal function and to improve mitochondrial function. Finally, previous exercise induced protection for CKD, especially under this experimental protocol. Thus, it is reasonable to suggest that exercise may be an additional strategy to be employed in CKD

942 Board #68 May 27 2:30 PM - 4:00 PM
Overshoot Of The Respiratory Exchange Ratio During Recovery From Maximal Exercise In Kidney Transplant Recipients

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 (No relevant relationships reported)

PURPOSE: The overshoot of the respiratory exchange ratio (RER) during recovery from maximal cardiopulmonary exercise testing (CPET) has been found reduced in magnitude among patients with heart failure, possibly due to the slow recovery kinetics of VO₂. To investigate whether this phenomenon could be present also in patients with peripheral limitations to exercise, a population of kidney transplant recipients (KTRs) was specifically studied, since these patients may present peripheral alterations at the muscular and microvascular level. **METHODS:** RER was retrospectively evaluated during recovery after maximal exercise (peak RER > 1.1) in KTRs without history of systolic dysfunction that underwent CPET for clinical purposes. Variables assessed were the maximum RER during recovery (RER-max), the RER overshoot magnitude (RER-OM: (RER-max - peak RER) / peak RER %) and the time from peak RER to RER-max. Patients signed informed consent. **RESULTS:** 57 KTRs were included in the study (28% females). The median value of peak RER was 1.2 (IQR 0.1). Mean RER-max and RER-OM were 1.6 ± 0.2 and 28.4 ± 12.7%, respectively. The time to reach RER-max was on average 131.4 ± 42.8 s. RER-OM showed significant correlations with peak VO₂ (ρ=0.57; P<0.01), VO₂ at the anaerobic threshold (r=0.44; P<0.01), VE/VCO₂ slope (r=-0.32; P<0.05) and oxygen uptake efficiency slope (r=0.48; P<0.01). RER-max showed comparable correlations with these parameters, however, conversely to RER-OM, it was conditioned by peak RER (ρ=0.50; P<0.01). Finally, RER-OM was found significantly different among sub-populations of KTRs when stratified by patients' aerobic capacity (Weber class A vs. B+C: 31.1 ± 12.1% vs. 18.6 ± 9.9%; P<0.01) or ventilatory efficiency (Ventilatory class I vs. II: 30.9 ± 13.3% vs.

23.2 ± 9.6%; P=0.03). CONCLUSIONS: This is the first study in KTRs investigating the recovery of RER, which seems to be affected by patients' cardiorespiratory fitness. The present data showed that the RER-OM values of this population are similar to normal subjects' values reported in literature. Moreover, RER-OM appears as a valuable parameter to assess the recovery of RER, being independent from peak RER and directly correlated to other prognostic CPET parameters.

B-68 Free Communication/Poster - Vascular Function I

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

943 Board #69 May 27 2:30 PM - 4:00 PM

A Practical Measure Of Endothelial Function Applicable To The Routine Clinical Setting?

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(No relevant relationships reported)

Background: The VENDYS-II is an alternative, fully automated and noninvasive methodology to evaluate endothelial function using temperature change on finger as a surrogate measure of the magnitude of vascular reactivity index (VRI). Due to the simplicity, it could provide more feasible technique to assess vascular endothelial function in the clinical setting. A most recent modification to the technique includes the application of occlusion cuff at the base of a finger. **Purpose:** To assess the validity of the VENDYS-II device compared with the standard flow-mediated dilation (FMD) protocol. **Methods:** Twelve participants (7 males; 37±16 years) varying widely in age, health, ethnic, and socioeconomic status were studied. Occlusion cuff was placed over the right antecubital fossa or at the base of the right index finger. Temperature monitors were placed on bilateral index fingers to assess change in temperature throughout 5-minute occlusion and recovery phases. FMD was obtained simultaneously using high-resolution ultrasound. **Results:** Mean brachial artery FMD was 7.2±2.6%. Measures of VRI obtained with the upper arm occlusion were significantly associated with simultaneously obtained brachial artery FMD (r=0.73). VRI values obtained with the finger occlusion (1.6±0.4AU) were not significantly different from VRI measured with the brachial artery occlusion (1.7±0.3AU), and both VRI values were moderately correlated with each other (r=0.50). **Conclusion:** Finger-based VRI may be a valid and novel alternative measure of endothelial function that is more suitable than the standard FMD for the assessment of endothelial function in the routine clinical setting.

944 Board #70 May 27 2:30 PM - 4:00 PM

Chronic And Acute Benefits Of Reduced Sitting In Individuals With Increased Cardiovascular Risk

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(No relevant relationships reported)

Sedentary behavior increases the risk for cardiovascular and cerebrovascular disease. However, little work examined the causal link between a decline in sedentary behavior and cardio- and cerebrovascular function, and the potential underlying mechanisms for this relation. **PURPOSE** to examine the chronic (16-week) and acute (3-hour) impact of reducing sedentary behavior on vascular and cerebrovascular function in subjects with increased cardiovascular risk. **METHODS** This prospective study included 24 individuals with increased cardiovascular risk (65±5 years, 29.8±3.9 kg/m²). Before and after 16-week reduced sitting, using a mobile-Health device with vibrotactile feedback, we examined: *i.* vascular function (flow-mediated dilation (FMD)), *ii.* cerebral blood flow (CBFv, transcranial Doppler), and *iii.* cerebrovascular function (cerebral autoregulation (CA) and cerebral vasomotor reactivity (CVMR)). To better understand potential underlying mechanisms, before and after intervention, we evaluated the effects of 3-hour sitting with and without light-intensity physical activity breaks (every 30-minutes). **RESULTS** The first wave of participants showed no change in sedentary time (n=9, 10.3±0.5 to 10.2±0.5 hours/day, P=0.87). Upon intervention optimization, the subsequent participants (n=15) decreased sedentary time (10.2±0.4 to 9.2±0.3 hours/day, P<0.01). This resulted in significant increases in FMD (3.1±0.3 to 3.8±0.4%, P=0.02) and CBFv (48.4±2.6 to 51.4±2.6 cm/s, P=0.02), without altering CA or CVMR. Before and after the 16-week intervention, 3-hour exposure to uninterrupted sitting decreased FMD and CBFv, whereas physical activity breaks prevented a decrease (both P<0.05). CA and CVMR did not change (P>0.20).

CONCLUSION Long-term reduction in sedentary behavior in older subjects with increased cardiovascular risk improves peripheral vascular function and cerebral blood flow, and acutely prevents impaired vascular function and decreased cerebral blood flow. These results highlight the potential benefits of reducing sedentary behavior to acutely and chronically improve cardio/cerebrovascular risk. Study is registered at the Netherlands Trial Register (NTR6387) (<https://www.trialregister.nl/trial/6215>).

945 Board #71 May 27 2:30 PM - 4:00 PM

EXPLORING SEX DIFFERENCES ON ARTERIAL STIFFNESS IN RESPONSE TO HEAVY ROPE EXERCISE

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(No relevant relationships reported)

PURPOSE: To evaluate sex differences on aortic and carotid arterial stiffness, and carotid artery compliance (CAC), following heavy rope exercise (HRE). **METHODS:** Twenty-seven resistance-trained individuals (Men: n=14, Mean±SD: Age: 23 ± 3 yrs; Women: n=13, Age: 22 ± 2 yrs) participated. All measurements were collected at Rest, and 15 (Rec1), 30 (Rec2), and 60 (Rec3) minutes following HRE. Aortic arterial stiffness was assessed by pulse wave velocity (PWV), while carotid arterial stiffness, via beta stiffness index (BSI), and CAC, were collected via Doppler ultrasound. HRE utilized six 15-second exercise bouts using a double wave pattern (180bpm), with 30-second seated recovery. Two-way repeated measures ANOVAs were used to determine differences in PWV, BSI, and CAC, between the sexes across time. **RESULTS:** Men had significantly greater height ($p \leq 0.001$) and weight ($p \leq 0.001$). There were no significant sex by time interactions for PWV ($p = 0.96$) or BSI ($p = 0.09$). A significant main effect of time ($p \leq 0.001$) showed that PWV significantly increased during Rec1, however, returned to below resting value at Rec3 (Men= Rest: 5.9 ± 0.7 m/s, Rec1: 6.2 ± 0.7 m/s, Rec2: 6.0 ± 0.7 m/s, Rec3: 5.7 ± 0.7 m/s; Women= Rest: 5.3 ± 0.8 m/s, Rec1: 5.7 ± 0.9 m/s, Rec2: 5.3 ± 0.7 m/s, Rec3: 5.1 ± 0.5 m/s). A main effect of time for BSI ($p = 0.002$) showed a significant increase during Rec1 and Rec2 from Rest, while Rec3 returned to Rest (Men= Rest: 3.2 ± 1.1 units, Rec1: 4.0 ± 1.5 units, Rec2: 3.5 ± 1.6 units, Rec3: 3.3 ± 1.5 units; Women= Rest: 2.6 ± 1.0 units, Rec1: 3.6 ± 1.6 units, Rec2: 4.3 ± 1.7 units, Rec3: 2.4 ± 0.8 units). There was a significant sex by time interaction for CAC ($p = 0.05$). Men did not significantly change across time, however, from Rest women significantly decreased during Rec2, then significantly increased from Rec2 to Rec3 (Men= Rest: 0.2 ± 0.1 mm²/mmHg, Rec1: 0.2 ± 0.1 mm²/mmHg, Rec2: 0.2 ± 0.1 mm²/mmHg, Rec3: 0.2 ± 0.1 mm²/mmHg; Women= Rest: 0.3 ± 0.1 mm²/mmHg, Rec1: 0.2 ± 0.1 mm²/mmHg, Rec2: 0.2 ± 0.1 mm²/mmHg, Rec3: 0.3 ± 0.1 mm²/mmHg). **CONCLUSIONS:** These data suggest that HRE does not produce differences in aortic or carotid arterial stiffness between sexes. The initial decrease in women's CAC is likely due to greater relative intensity, while the increase in CAC back to resting values is potentially due to the cardioprotective effects of estrogen.

946 Board #72 May 27 2:30 PM - 4:00 PM

Abstract Withdrawn

947 Board #73 May 27 2:30 PM - 4:00 PM

L-citrulline Supplementation Attenuates Aortic Pressure And Wave Reflection Responses To Cold Stress In Older Adults

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PURPOSE: Aging is a major risk factor for cardiovascular events due to increased pressure wave reflection. Cold exposure augments central blood pressure and wave reflection due to sympathetic-mediated vasoconstriction, which elevates the risk for adverse cardiovascular events in older adults. L-citrulline (L-CIT) supplementation improves endogenous synthesis of nitric oxide and contributes to reduce aortic systolic blood pressure (SBP) and pulse pressure (PP) responses to cold pressor test (CPT) in young men; however, the impact on wave reflection in older adults is unknown. The purpose of this study was to elucidate the efficacy of L-CIT to attenuate aortic hemodynamic responses to CPT in older adults. **METHODS:** Sixteen adults (n=16, 60-85 yrs) were randomly assigned to placebo or L-CIT (6g/day) for 14 days in a crossover, double-blind design. Brachial and aortic SBP, PP, augmented pressure (AP), augmentation index standardized at 75 bpm (AIx@75), and pressure of the forward (Pf) and reflected (Pb) waves were evaluated at

rest and during CPT before and after the assigned intervention. An analysis of variance with repeated measures was used to determine if there were differences within and between interventions at rest and during CPT.

RESULTS: No significant changes with either intervention were observed at rest. Responses in aortic PP (-9.1 vs. 2.9; $P=.008$), AP (-4.1 vs. 2.1; $P=.004$), AIx (-3.7 vs. 2.1; $P=.015$), AIx@75 (-3.4 vs. 2.4; $P=.024$), Pf (-5.1 vs. 2.9; $P=.034$), and Pb (-3.4 vs. 1.7; $P=.027$) were significantly attenuated following L-CIT supplementation compared with placebo.

CONCLUSIONS: Although L-CIT had no effect on resting aortic hemodynamics, L-CIT attenuated aortic pressure and wave reflection responses during CPT in older adults. Therefore, short-term L-CIT supplementation may elicit cardioprotection during cold exposure in older adults.

948 Board #74 May 27 2:30 PM - 4:00 PM
Single Dry Cupping Treatment On Vascular Function In Healthy Young Individuals

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(No relevant relationships reported)

Cupping, part of traditional Chinese medicine, is regularly observed to bring about pain relief and to increase a patient's general feeling of well-being. It has been suggested that cupping promotes hyperemia (i.e., increased blood flow). Flow-mediated dilatation (FMD) is a widely used method of assessment of vascular function that provides a surrogate index for arterial health. **PURPOSE:** To examine the effect of a single dry cupping treatment on vascular function among healthy young individuals. **METHODS:** Five apparently healthy young individuals (3 women and 2 men, average age: 22 ± 1.48 years) participated in this study. Dry cupping treatment was performed applying two plastic cups on the non-dominant arm of each participant. Before and after a 10-minute cupping treatment, brachial FMD was evaluated using a high-resolution ultrasound with a 7.5-MHz linear array transducer. **RESULTS:** Following the 10-minute cupping treatment, brachial FMD increased significantly after the treatment from 7.40 ± 0.65 to $8.98 \pm 1.4\%$, $p < 0.05$. Participants did not experience complications as a result of the intervention. **CONCLUSIONS:** These findings demonstrated that in healthy individuals, dry cupping treatment, was capable of increasing vascular function. This study underlies the role of cupping treatment in promoting vascular function improvements. Finally, cupping is an inexpensive and low-risk alternative therapeutic modality.

949 Board #75 May 27 2:30 PM - 4:00 PM
Dietary Nitrate Counteracts The Elevated Blood Pressure Response To Nitric Oxide Synthase Inhibition In Humans

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(No relevant relationships reported)

Decreased production of nitric oxide (NO) via the endogenous NO-synthase (NOS) pathway is a hallmark of impaired endothelial function and is associated with elevated blood pressure. Potentiation of the alternative nitrate-nitrite-NO pathway via the diet has been suggested as a possible therapeutic strategy to counteract NOS dysfunction, but proof-of-concept that exogenous nitrate treatment compensates in situations of NOS inhibition in humans is lacking. **Purpose:** To determine whether dietary supplementation with nitrate-rich beetroot juice attenuates the detrimental effects of acute NOS inhibition achieved by intravenous infusion of N^o-monomethyl-L-arginine (L-NMMA) on vascular function. **Methods:** Seven male volunteers (age 23 ± 3 years, body mass 77.9 ± 6.8 kg) completed four conditions in a double-blind, randomised cross-over design: 1) 5-d dietary placebo supplementation with acute saline infusion (PL-CON), 2) 5-d placebo supplementation with acute L-NMMA infusion (3 mg/kgBM over 5 min followed by 55 μ g/kgBM/min; PL-LNMMA), 3) 5-d dietary nitrate supplementation (12 mmol/d) with acute saline infusion (BR-CON), and 4) 5-d nitrate supplementation with acute L-NMMA infusion (BR-LNMMA). Heart rate (HR), brachial mean arterial pressure (MAP), and femoral artery blood flow (FBF) were measured every 5 min during 20 min of infusion and compared between conditions using repeated measures ANOVA. **Results:** L-NMMA infusion resulted in decreases from baseline in HR (PL-LNMMA -5 ± 3 , BR-LNMMA -6 ± 5 bpm) and FBF (PL-LNMMA -114 ± 85 , BR-LNMMA -95 ± 71 mL/min) that were greater than after saline infusion (HR: PL-CON -2 ± 5 , BR-CON -1 ± 4 bpm, $P < 0.05$; FBF: 20 ± 40 and 18 ± 36 mL/min, $P < 0.05$), with no effects of dietary supplementation. MAP was elevated by L-NMMA (PL-LNMMA 9 ± 2 , BR-LNMMA 4 ± 2 mmHg) compared to saline infusion (PL-CON -2 ± 2 , BR-CON 0 ± 2 mmHg, $P < 0.05$), and this response was attenuated by ~56% following BR ingestion ($P < 0.05$). **Conclusions:** Acute NOS blockade through systemic infusion of L-NMMA resulted in reduced HR and FBF, and elevated MAP, in healthy humans, resembling cardiovascular impairments

observed in conditions of chronic NOS-dysfunction. BR attenuated the elevation in MAP, highlighting the potential for exogenous nitrate to improve vascular control in situations where NOS function is impaired.

950 Board #76 May 27 2:30 PM - 4:00 PM
Association Between Arterial Stiffness, Body Mass Index And Cardiorespiratory Fitness In 7-to-17 Years Old Children

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Excess adiposity is a risk factor for cardiovascular disease, however, the obesity paradox suggests the existence of a subpopulation of obese individuals that do not suffer from those cardiovascular risks. Cardiorespiratory fitness (CRF) is a strong indicator of cardiovascular health in children and adults. Both obesity and low CRF have shown to independently increase the risk of cardiovascular diseases. **PURPOSE:** The aim of this study was to investigate how central arterial stiffness is associated with aerobic capacity and body fat percentage and body mass index (BMI) in children aged 7-to-17-years. **METHODS:** Seventy healthy children, 34 boys and 36 girls (age 7-17 years; BMI 21.5 ± 5.4 kg/m²; fat mass $23.4 \pm 11.5\%$), participated in this study. Percentage of fat mass (FM%) and fat free mass (FFM) were assessed using air displacement plethysmography (Bod Pod COSMED). Arterial stiffness was assessed measuring carotid-femoral PWV (cfPWV) with the SphygmoCor XCEL (AtCor Medical, Inc.). CRF was assessed through breath-by-breath gas analysis (K5, COSMED) using a 15 watts per minute graded exercise test on a cycle ergometer. The VO₂ at the first ventilatory threshold (VT1) was identified using the V-slope technique and as the lowest respiratory equivalent for oxygen. Differences in cfPWV between quartiles of VO₂ at VT1, %BF, and BMI were assessed using a multivariate general linear model. **RESULTS:** cfPWV was higher in the first VO₂ at VT1 quartile compared to the fourth when VO₂ is normalized by FFM (4.99 ± 0.73 vs 4.24 ± 0.69 m/s, $p < 0.05$). No differences in cfPWV were observed between first and fourth VO₂ at VT1 quartiles when VO₂ is normalized by body mass (5.05 ± 0.92 vs 4.34 ± 0.71 m/s). cfPWV was higher in the fourth and third BMI quartile compared to the first (4.26 ± 0.53 and 4.90 ± 0.66 vs 5.09 ± 0.89 , $p < 0.05$) but no differences in cfPWV were observed between fourth, third and first BF% quartiles (5.06 ± 1.04 , 4.57 ± 0.54 , 4.61 ± 0.64). **CONCLUSION:** Low central arterial stiffness in children is associated with high CRF expressed as VO₂ at VT1, and with low BMI.

951 Board #77 May 27 2:30 PM - 4:00 PM
Brachial And Aortic Blood Pressure Soon After Delivery In Women With Versus Without A Past Adverse Pregnancy Outcome

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PURPOSE: Adverse pregnancy outcomes (APOs), such as preterm birth, gestational diabetes, and hypertensive disorders of pregnancy, are associated with excess maternal risk of hypertension and cardiovascular disease years later. Little is known about the effect of an APO on aortic blood pressure (BP) in the first few years after delivery. Our purpose was to test the hypothesis that women with a history of APO would have higher peripheral and aortic BP in the 6 months- 3 years after delivery. **METHODS:** We recruited 37 women aged 18-45 years (26 white/9 black /2 other), from the greater Columbia, SC area who delivered a singleton infant 6 months - 3 years ago to participate in our study. Women were excluded if they were smokers, had diabetes, HIV/AIDS, or were receiving cancer therapy. Participants completed a single visit following an overnight fast during which brachial and aortic BP were measured using an oscillometric cuff and applanation tonometry, respectively. History of APO and sociodemographic information were determined via self-report. After assessing the distribution of the data with Shapiro-Wilk tests, we tested for differences in brachial and aortic systolic, diastolic, and mean BP between groups using t-tests or Kruskal-Wallis tests, as appropriate. **RESULTS:** Mean age was 33 ± 1 yrs and mean BMI was 26.6 ± 1.0 kg/m² with no difference between groups. Of the 37 women in the study, 12 had a history of APO with no difference in race distribution by group. Mean brachial and aortic systolic BP tended to be higher in women with a history of APO: 116 ± 4 versus 108 ± 3 mmHg, $p = 0.07$ (brachial) and 105 ± 4 versus 97 ± 1 mmHg, $p = 0.08$ (aortic). There was no difference in brachial or aortic diastolic or mean BP between groups.

CONCLUSIONS: Women with a history of APO tended to have higher peripheral and aortic systolic BP 6 months- 3years after delivery. The effects of an APO on BP may be detectable soon after the pregnancy ends and might represent a target for prevention of overt cardiovascular disease in affected women.

952 Board #78 May 27 2:30 PM - 4:00 PM
The Effect Of A High-fat Meal On Sympathetic Vasoconstrictor Responsiveness In Men And Women

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(No relevant relationships reported)

Consumption of a high-fat (HF) meal has been shown to reduce flow-mediated dilation (FMD) in men, but not women. This decline in FMD may be a result of decreased nitric oxide (NO) bioavailability. NO inhibits sympathetic vasoconstriction and a HF meal may, therefore, heighten sympathetic vasoconstrictor responsiveness. However, the effect of a HF meal on sympathetic vasoconstriction in men and women has not been investigated. **PURPOSE:** The purpose of this study was to investigate the hypothesis that consumption of a HF meal would heighten sympathetic vasoconstrictor responsiveness in men, but have no effect in women. **METHODS:** In a randomized cross-over design, young males (n=15) and females (n=15) consumed a HF or an isocaloric low-fat (LF) meal on separate days. Two hours post-meal, subjects underwent a cold pressor test (CPT) and measurement of brachial artery FMD to determine sympathetic vasoconstrictor responsiveness and endothelial function, respectively. Beat-by-beat blood pressure was measured by Finometer and mean arterial pressure (MAP) was calculated. Forearm blood flow (FBF) was measured by Doppler ultrasound at the brachial artery and forearm vascular conductance (FVC) was calculated as FBF/MAP. Sympathetic vasoconstrictor responsiveness was calculated as the percentage decrease in FVC (%ΔFVC) in response to CPT. FMD was calculated as the percentage increase in brachial artery diameter from baseline and normalized for cumulative shear rate. **RESULTS:** Sympathetic vasoconstrictor responsiveness was not different (p>0.05) between meal conditions or between females (LF: -27±14%; HF: -30±15%) and males (LF: -29±23%; HF: -24±16%) in either meal condition. FMD was higher (main effect of sex; p<0.05) in females (LF: 8.1±2.1%; HF: 7.4±1.4%) compared to males (LF: 6.2±1.5%; HF: 5.1±1.1%) and FMD was lower (main effect of meal; p<0.05) in the HF compared to the LF meal condition. No interaction (p>0.05) was observed between meal condition and sex for FMD. FMD normalized for shear rate was not different (p>0.05) between meal conditions or between females and males in either meal condition. **CONCLUSION:** These data suggest that, despite evidence of a post-prandial decrease in endothelial function, a HF meal does not alter sympathetic vasoconstrictor responsiveness in men or women.

953 Board #79 May 27 2:30 PM - 4:00 PM
The Relationship Between Estimated Pulse Wave Velocity With Cardiorespiratory Fitness In Young Adults

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Introduction: Carotid-femoral pulse wave velocity (cfPWV) is used to measure aortic stiffness and offers insight into cardiovascular disease (CVD) risk. The measurement requires specialized equipment and technical expertise to perform accurately. Estimated carotid-femoral pulse wave velocity (ePWV) is an easily calculated alternative to objectively measured cfPWV that offers comparable CVD risk prediction. Whether ePWV also offers similar insight into CVD resiliency has not been explored. Cardiorespiratory fitness (CRF) is associated with lower CVD risk and individuals with greater CRF have lower cfPWV. **Purpose:** To investigate the relationship between ePWV and CRF in young adults. **Methods:** Sixty young, healthy adults (mean age 25±7 years; mean body mass index 24.7±4.0 kg/m²; female n=30) volunteered for this study. cfPWV was assessed using applanation tonometry via simultaneous measurements of carotid and femoral pressure waves. ePWV was calculated from a regression equation using age and mean arterial pressure. A treadmill protocol with metabolic gas analysis was used to measure VO₂ peak. Pearson correlation coefficients were used to analyze the association between PWV measures and VO₂ peak. **Results:** cfPWV and ePWV were moderately associated (r=-0.34, p=0.007) with a mean difference between measures of 0.6 m/s and a coefficient of variation of 13%. There was a significant, inverse correlation between measured cfPWV and VO₂ peak (r=-0.26, p=0.045). There was also a significant, inverse correlation between ePWV and VO₂ peak (r=-0.30, p=0.021). **Conclusions:** Individuals with higher CRF have lower aortic stiffness. ePWV and measured cfPWV were similarly associated with CRF. As such, ePWV may offer comparable insight into CVD resiliency as measured cfPWV.

954 Board #80 May 27 2:30 PM - 4:00 PM
Effects Of Methionine Restriction And Exercise On Cardiac Fibrosis Of Spontaneously Hypertensive Rats.

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PURPOSE: To investigate the effect of low methionine diet and endurance exercise training on cardiac function of spontaneously hypertensive rats. **METHOD:** A total 80 male spontaneously hypertensive rat (SHR) (six-week-old) were randomly divided into four groups: (1) 0.86% methionine diet and sedentary lifestyle (C), (2) 0.17% methionine diet and sedentary lifestyle (MR), (3) 0.86% methionine diet and endurance exercise (EX), (4) 0.17% methionine diet and endurance exercise (MR+EX). The body weight, water intake, and food consumption were recorded once per week. In the exercise group, the rats were adapted to exercise on treadmill (10 m/min, 10 min/day) for three days. The endurance exercise protocol on the treadmill started from 15 m/min, and progressively enhanced to 27 m/min during eight weeks, and then maintain to 12 months. The rats were trained on treadmill 5 days/week, 60 min/day for 2 or 12 months. We measured the rats' diameter of left ventricle (LVD), and left ventricular posterior wall (LVPW) during diastole and systole period by using echocardiography at beginning and after 2 and 12 month intervention. All data were presented as mean±SEM. One-way ANOVA was used to evaluate differences between the changes, while Dunnett T3 post-hoc analysis was used to compare significant differences between test conditions. Statistical significance was accepted at p<0.05. **RESULTS:** Compared with C group, MR restriction and endurance training significantly reduced the gain of body weight during 12-months intervention (p<0.05), but there is no difference between Ex and EX+MR. Age, Ex, and MR reduce the LVD during diastole (p<0.05). The LVPW of diastole and systole were thickened as growth, endurance training, and restricted with methionine of individual (p<0.05). Cardiomyocytes were enlarged as growth (p<0.05), but endurance training and methionine restriction decelerate the effect. Cardiac fibrosis also increased as growth, endurance training and methionine restriction limited the development of fibrosis. **CONCLUSIONS:** The MR diet might be used as a strategy to ameliorate the pathological effect of hypertension evidenced by reducing the cardiac fibrosis.

955 Board #81 May 27 2:30 PM - 4:00 PM
Sleep Variability Is A Predictor Of Peripheral Vascular Function In Apparently Healthy Undergraduate College Students

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Experimental studies suggest that highly variable sleep-wake patterns may impair vascular function, suggesting a potential mechanism for the increased risk of cardiovascular (CV) diseases seen in shift workers and those with sleep disorders. However, it is unclear if naturalistic, day-to-day variability in sleep-wake patterns of generally healthy individuals poses a risk to vascular function. **PURPOSE:** To examine the association between sleep variability (SLV) and vascular function in undergraduate college students. **METHODS:** SLV metrics were estimated in 39 healthy undergraduate students (20 ±0.2 years) using wrist actigraphy for 14 days and nights. Sleep timing was defined by sleep midpoint (halfway point between sleep onset and wake onset). Sleep timing variability (STV) was then quantified as the standard deviation (SD) of sleep midpoint, and sleep duration variability (SDV) as the SD of sleep duration across 14 days. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Peripheral vascular function was indexed as the magnitude of hyperemia in response to passive leg movement (PLM) and was performed immediately following the end of sleep monitoring. Blood velocity and femoral artery diameter were measured via Doppler ultrasound. **RESULTS:** In a linear regression model adjusting for sex and body mass, SDV predicted peak leg blood flow (LBF) (β=-0.49, p<0.01), change in LBF from baseline to peak (β=-0.50, p<0.01), and LBF area under the curve (AUC) (β=-0.57, p<0.01) during PLM. Associations remained significant when the model included PSQI score (all p<0.01). Similarly, models adjusting for sex and mass found that STV predicted LBF AUC (β=-0.30, p=0.05). **CONCLUSION:** In adjusted models, greater SLV is associated with less optimal peripheral vascular function in healthy college students. These data support the growing body of literature suggesting that regular sleep schedules may be important for CV health, even in otherwise healthy young adults. Supported, in part, by NIH P20GM113125.

956 Board #82 May 27 2:30 PM - 4:00 PM

Influence Of Type 2 Diabetes And Cardiovascular Disease Family History On Metabolic Syndrome Severity

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INFLUENCE OF TYPE 2 DIABETES AND CARDIOVASCULAR DISEASE FAMILY HISTORY ON METABOLIC SYNDROME SEVERITY

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Background: Family history of cardiovascular disease (CVD) is considered a strong predictor of developing metabolic syndrome (MetS), in part through promoting endothelial dysfunction. In addition, a family history of type 2 diabetes (T2D) relates to lower metabolic insulin sensitivity and may compound their MetS risk severity. We examined in people with MetS if a family history of CVD and T2D (CVD+T2D) increases MetS risk severity compared to individuals with a family history of CVD only (CVD). **Methods:** Twenty, middle-aged obese individuals with MetS (55.9 ± 6.5 yrs; 32.5 ± 3.6 kg/m²) were divided into CVD (n=9; 6F) or CVD+T2D (n=11; 9F). MetS was defined using the NCEP ATP III criteria. MetS severity Z-score was calculated from waist circumference, blood pressure, fasting blood glucose, triglycerides, and high-density lipoproteins. Metabolic insulin sensitivity (i.e. glucose infusion rate, GIR) was measured using a 2-hr hyperinsulinemic-euglycemic (40 mU/m²/min, 90 mg/dl) clamp. Insulin-stimulated brachial artery flow-mediated dilation (FMD) was also measured as the change from fasting to 2-hr during the clamp to assess endothelial function and gain tissue-specific insight into the origin of insulin action. **Results:** There was no difference in anthropometrics between groups. There was also no statistical difference between CVD and CVD+T2D in MetS severity (2.62 ± 1.12 vs. 1.65 ± 0.56 , $P=0.42$), GIR (2.35 ± 0.55 mg/kg/min vs. 2.63 ± 1.56 mg/kg/min, $P=0.86$), or insulin-stimulated FMD ($0.33 \pm 1.57\%$ vs. $1.68 \pm 1.19\%$, $P=0.52$). However, waist circumference was inversely correlated to GIR ($r=-0.63$, $P=0.01$). **Conclusion:** In adults with MetS, T2D family history does not exacerbate MetS severity in adults with CVD family history. However, waist circumference appears to be important for lowering metabolic insulin sensitivity. Thus, targeting abdominal fat may contribute to improved metabolic health independent of T2D and/or CVD family history.
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957 Board #83 May 27 2:30 PM - 4:00 PM

High Fat Relative To Low Fat Ground Beef Consumption Lowers Blood Pressure And Does Not Negatively Alter Arterial Stiffness

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(No relevant relationships reported)

Beef consumption has been stigmatized as an unhealthy dietary choice. However, randomized control trials to support this claim are lacking. **PURPOSE:** To examine the effect of low-fat (5%) and high-fat (25%) ground beef consumption on blood pressure (BP) and carotid-femoral pulse wave velocity (PWV). **METHODS:** Twenty-three male subjects (age 40 ± 11 yrs, height 177.4 ± 6.7 cm, weight 97.3 ± 25.0 kg, lean mass 64.5 ± 9.5 kg, fat mass 30.6 ± 19.1 kg) volunteered to participate in this cross-over design study. Each participant completed two, 5-week ground beef interventions in a randomized order with a 4-week washout period in-between. All participants visited the lab four times after an overnight fast. Each visit to the lab consisted of supine BP, dual energy x-ray absorptiometry (DXA) scan to assess body composition, and PWV analysis. The PWV recording was assessed on the right carotid and femoral arteries. The distance used for the PWV calculation was 80% of the actual distance between carotid and femoral sites. All PWV measures were completed according to previously published procedures (Van Bortel, 2011). BP and PWV results were analyzed separately via 2x2 repeated measures ANOVA. **RESULTS:** Our results indicate there was a significant decrease in systolic BP ($p=0.01$) following the high-fat ground beef intervention compared to the low-fat. The BP values for low-fat beef and high-fat beef are 120/74 and 116/73 mmHg, respectively. Further, there were no significant differences between the PWV measures. **CONCLUSION:** Based on our results, high fat ground beef favorably alters systolic BP and does not negatively affect PWV measures.

958 Board #84 May 27 2:30 PM - 4:00 PM

Association Of Physical Activity With Depression And Estimated Pulse Wave Velocity In Older Male Veterans

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Physical inactivity is associated with an increased risk for cardiovascular disease (CVD) and depression. Veterans are a physically inactive population with a higher risk of developing CVD and depression than the general population. Whether objectively measured physical activity is associated with CVD risk and depressive symptoms in veterans has not been widely studied. **PURPOSE:** To examine the relationship between accelerometer measured moderate-vigorous physical activity (MVPA) and novel measures of CVD risk (estimated aortic stiffness and systemic inflammation) and depression in older veterans. **METHODS:** 152 older male veterans (mean age 71.9 ± 9.2 years) from the 2005-2006 NHANES were used in this analysis. Valid accelerometer data and MVPA were determined using standard NHANES procedures. Cardiovascular disease risk was determined by calculating estimated pulse wave velocity (ePWV) from a regression equation using age and mean blood pressure. Systemic inflammation was determined as C-reactive protein (logCRP). Depression score was determined through the Depression Screener Questionnaire (DPQ). One-tailed Spearman correlations were conducted to determine associations between variables. **RESULTS:** Physical activity guidelines were met by 17% of the veterans in this analysis. There was a significant, inverse relationship between MVPA and ePWV ($r=-0.34$, $p<0.01$), MVPA and logCRP ($r=-0.24$, $p<0.01$), and MVPA and depression score ($r=-0.16$, $p<0.05$). In addition, a significant positive association between ePWV and depression score ($r=0.17$, $p<0.05$) was noted. **CONCLUSION:** Decreased moderate-vigorous physical activity levels in older male veterans are associated with elevated aortic stiffness, systemic low-grade inflammation, and depressive symptomatology. This suggests that veterans who do not meet recommended physical activity guidelines may be at higher risk for CVD and depression.

959 Board #85 May 27 2:30 PM - 4:00 PM

Sex Differences In Microvascular Function In Pre-pubertal Children

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There is little research examining the effect of sex on skin blood flow (SkBF) in adults, and less in children. Sex-related differences in SkBF may help explain known thermoregulatory differences between males and females. **Purpose:** To determine whether there are sex-related differences in the SkBF response to exercise, local heating, and acetylcholine (ACh). Additionally, the role of nitric oxide (NO) was examined. **Methods:** Laser-Doppler flowmetry was used to assess forearm SkBF. Responses to exercise (30 min cycling, 60%V_{O₂}max), local heating (44°C), and ACh iontophoresis were assessed in 15 pre-pubertal boys (age=10±1y, V_{O₂}max=1.66±0.25 l/min) and 10 girls (age=10±1y, V_{O₂}max=1.58±0.35 l/min), with and without NO synthase inhibition, using L-NAME iontophoresis. Three-way (group, time, treatment) repeated measures ANOVA was used to examine sex-related differences in the SkBF response during exercise and in the SkBF-ACh dose response. A two-way (group, treatment) repeated measures ANOVA was used to examine local heating-induced increase in SkBF. **Results:** Exercise-induced SkBF was greater in boys compared with girls (654 ± 355 and $316 \pm 182\%$ of baseline, respectively, $p<.0001$). L-NAME blunted the SkBF response more in boys than in girls (group-by-treatment interaction, $p=.004$). Local heating-induced SkBF was not significantly different between boys and girls ($1705 \pm 739\%$ and $1488 \pm 600\%$, respectively, $p=.35$), with no effect of L-NAME. The maximal ACh-induced SkBF was similar in boys and girls ($650 \pm 420\%$ and $612 \pm 411\%$, respectively). L-NAME similarly blunted the SkBF response in boys and girls (group-by-treatment interaction, $p=.52$). **Conclusion:** These findings demonstrate that while maximal SkBF and the vasodilatory response to ACh stimulation are similar in boys and girls, boys display a greater increase in SkBF during exercise of similar intensity. Further, the role of NO in the SkBF response appears greater in boys than girls only during exercise. Since absolute and relative exercise intensity was similar in the two groups, it is suggested that sex-related factors (e.g., hormones) may interact with the exercise response or with other vasodilators, resulting in different SkBF response.

960 Board #86 May 27 2:30 PM - 4:00 PM
Improved Endothelial Function Following Eight Weeks Of Low-intensity Resistance Training In Young Adults

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Cardiovascular diseases (CVD) are the leading cause of death worldwide, and compelling evidence indicates that exercise prevents and attenuates CVD. Resistance training (RT) exerts positive health effects; however, there is a lack of evidence regarding the RT intensities that could be prescribed to improve vascular endothelial function. **PURPOSE:** To compare the effects of two RT intensities during eight weeks on vascular endothelial function in sedentary young males. **METHODS:** Thirty-four sedentary men were recruited (age = 20.6 ± 1.8 yr., height = 171.3 ± 5.2 cm, weight = 65.2 ± 10.6 kg, DXA fat mass = 22.3 ± 7.4 %), and randomly assigned to a control group (CTRL, no exercise), RT at 50% of a maximum repetition [1-RM] and RT at 80% 1-RM. The RT program was performed twice a week for eight weeks, and except for the CTRL group, participants performed the same RT exercises at similar total workloads (1920 arbitrary units [AU] for the 80%RM and 1950 AU for the 50%RM). Vascular endothelial function was measured before (pre) and after (post) eight weeks by ultrasound and determined by the percentage of flow-mediated dilatation (%FMD). Mixed factorial ANOVA (3 groups x 2 measurements x 2 occlusions), effect size (ES) and 95% confidence interval (CI_{95%}) were computed for %FMD. **RESULTS:** A significant triple interaction was found on %FMD (p = 0.021). The eight-week post-intervention follow-up analyses showed a significant increase (p = 0.010) in %FMD in the 50%RM (Mean = 9.93 ± 3.73%, ES = 3.70, CI_{95%} = 1.59 to 5.79) compared to the control group (Mean = 5.72 ± 1.71%, ES = 1.67, CI_{95%} = -0.21 to 3.55), and no significant differences between 50%RM and 80%RM (Mean = 7.90 ± 2.51%, ES = 2.18, CI_{95%} = 0.27 to 4.10), and between 80%RM and control groups. **CONCLUSION:** A 50%RM intensity RT program elicited a positive vascular endothelial function adaptation following eight-weeks of training. It seems unnecessary to perform high-intensity RT to obtain arterial health benefits.

961 Board #87 May 27 2:30 PM - 4:00 PM
Sacubitril-Valsartan Treatment Improves Vascular Function And Functional Capacity In Heart Failure With Reduced Ejection Fraction

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The PARADIGM-HF (Prospective Comparison of ARNI with an ACE-Inhibitor to Determine Impact on Global Mortality and Morbidity in Heart Failure) trial identified a marked reduction in the risk of death from cardiovascular causes or hospitalization for heart failure (HF) in patients with HF with reduced ejection fraction (HFrEF) treated with sacubitril-valsartan. The mechanisms responsible for this improvement have not been fully identified, but may be related, in part, to improvements in vascular function and functional capacity, two important predictors of mortality and morbidity in this patient group. **PURPOSE:** We sought to test the hypothesis that short-term treatment with sacubitril-valsartan would improve vascular function and functional capacity in patients with HFrEF. **METHODS:** Eleven stable, class II/III patients with HFrEF (10M/1F, age: 69±3 yrs; BMI: 29.0±1.0 kg/m²; ejection fraction: 27±3%) were studied prior to initiation of treatment and at months 1, 2 and 3 of sacubitril-valsartan therapy. Vascular function was evaluated by brachial artery flow-mediated dilatation (FMD) and reactive hyperemia (RH), while functional capacity was determined using the six-minute walk test (6MWT). **RESULTS:** Treatment with sacubitril-valsartan improved brachial artery %FMD after 1 month of treatment, and this favorable response persisted during months 2 and 3 (baseline: 3.25±0.53%; 1-month: 5.23±0.71%; 2-month: 5.81±0.54%; 3-month: 6.35±0.84%, p<0.05). Likewise, %FMD normalized for the shear stimulus improved significantly at months 2 and 3 (baseline: 0.08±0.01%; 1-month: 0.13±0.01%; 2-month: 0.17±0.02%; 3-month: 0.20±0.03%). There was no change in RH, an index of microvascular function, at any time point (p>0.05). The 6MWT distance also increased significantly at months 2 and 3 (baseline: 420±28m; 1-month: 436±30m; 2-month: 465±35m; 3-month: 460±33m), but the changes in 6MWT distance were not correlated to the changes in %FMD or %FMD normalized for the shear stimulus (r=0.13, p=0.39 and r=0.01, p=0.97, respectively). **CONCLUSIONS:** These preliminary findings provide new evidence for the efficacy

of short-term treatment with sacubitril-valsartan to improve vascular function and functional capacity, two possible mechanisms underlying this treatment's benefits, in patients with HFrEF.

962 Board #88 May 27 2:30 PM - 4:00 PM
Insulin Stimulation Reduces Arterial Stiffness In Adults With Metabolic Syndrome

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Purpose: Adults with metabolic syndrome (MetS) have increased fasting arterial stiffness compared with healthy counterparts, and this, in turn, increases risk for cardiovascular disease (CVD) and cardiac events. Although insulin acts to reduce arterial stiffness in healthy adults, the effects in obese individuals with MetS are unclear. We hypothesized that insulin stimulation would reduce measures of arterial stiffness in relation to aerobic fitness and body fat. **Methods:** Thirty-one obese adults (24F; 53.7±6.0yrs; 37.4±4.8kg/m²) were screened for MetS (NCEP ATP III criteria) following an overnight fast. Augmentation index (AIx), augmentation pressure (AP) and brachial systolic (bSBP) and diastolic blood pressure (bDBP) were assessed using SphygmoCor before and after a 2hr euglycemic-hyperinsulinemic clamp (90 mg/dl, 40 mU/m²/min). Aerobic fitness (VO_{2peak}; ml/kg/min) was measured through a treadmill protocol while body fat (BF; %) was determined using DEXA. **Results:** Compared to fasting, insulin significantly reduced AIx (28.5 ± 9.9 vs. 23.2 ± 9.9%, P<0.01) and AP (15.1 ± 6.7 vs. 21.1 ± 5.8 mmHg, P<0.01). However, there was no effect of insulin on bSBP (P=0.19) or bDBP (P=0.21). Fasting AIx and AP correlated with VO_{2peak} (r=-0.42, P=0.02 and r=-0.37, P=0.04) and BF (r=0.64, P<0.01 and r=0.68, P<0.01). Interestingly, neither the change in AIx nor AP from fasting to insulin stimulation correlated with VO_{2peak} (r=-0.18, P=0.33 and r=-0.12, P=0.95) or BF (r=-0.29, P=0.24 and r=-0.17, P=0.58). **Conclusion:** Insulin stimulation reduces indices of arterial stiffness in adults with MetS. While high aerobic fitness and lower BF may contribute to less arterial stiffness in the fasted state, they were not associated with insulin action. This suggests that insulin impacts arterial stiffness through another mechanism. Future research is warranted to determine the role of insulin on arterial health in order to optimize CVD prevention/treatment. Funding was supported by the National Institutes of Health RO1-HL130296.

963 Board #89 May 27 2:30 PM - 4:00 PM
The Protective Mechanism Of Exercise Training For Coronary Vascular Dysfunction In Atherosclerosis: Er Stress And Ucp-2

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PURPOSE: Endoplasmic reticulum (ER) stress and uncoupling protein-2 (UCP-2) are a key modulator for endothelial dysfunction in atherosclerosis. We determined the effects of exercise on ER stress and UCP-2 in endothelial dysfunction in atherosclerosis. **METHODS:** We used 4 groups of mice; wild type (WT), WT with exercise training, running on the treadmill for 12 weeks (WT-EX), apolipoprotein E knockout (ApoE KO) and ApoE KO with exercise training (ApoE KO-EX). We measured endothelium-dependent acetylcholine (ACh)-induced vasodilation of isolated and pressurized coronary arterioles in a concentration-dependent manner. Also, ACh-induced vasodilation was elicited in the presence of an inhibitor of eNOS and UCP-2 (L-NAME and Genipin) and the ER stress inducer (Tunicamycin). Immunoblotting was performed to measure the protein expression of ER stress markers (GRP78, IRE1, eIF2α, and CHOP), NLRP3 inflammasome signaling (NLRP3, caspase-1, IL-1β), Bax, TXNIP, and UCP-2 in the heart. The expression of p67^{nox} and superoxide were visualized using immunofluorescence and DHE staining in coronary arterioles. NO production was measured by nitrate/nitrite assay. **RESULTS:** ACh-induced endothelium-dependent vasodilation was attenuated in coronary arterioles of ApoE KO, but it was improved in ApoE KO-EX. L-NAME, tunicamycin, and Genipin attenuated vasodilation in WT, WT-EX and ApoE KO-EX, but not in ApoE KO. Exercise training reduced the expressions of ER stress (GRP78, p/t-IRE1, p-eIF2α, and CHOP), NLRP3 inflammasome (TXNIP, caspase-1 p20, and IL-1β), Bax, superoxide production, and NADPH oxidase p67^{nox}, but it increased NO production in ApoE KO-EX mice. **CONCLUSION:** Our findings suggest that exercise training alleviates endothelial dysfunction in atherosclerotic coronary arterioles through the NOS, UCP-2, and ER stress signaling pathways including TXNIP/NLRP3 inflammasome and oxidative stress.

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Isometric Exercise Training, Regardless Of Muscle Mass, Reduces Resting Blood Pressure In Normotensive Healthy Males

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(No relevant relationships reported)

PURPOSE: Isometric exercise training (IET) is an effective adjunct for the management of resting blood pressure (RBP) but responsible mechanisms have not yet fully been identified. Isometric contractions reduce blood flow as a result of vascular compression altering intramuscular metabolism. In response, active muscle could increase the production and circulation of vasoactive molecules (e.g., VEGF) and alter inflammatory biomarkers (e.g., IL-6 and TNF- α), which may lead to adaptations in resistance vessels. We studied the influence of bilateral arm or leg IET on blood pressure and plasma VEGF, IL-6, and TNF- α over the course of 6-weeks.

METHODS: The study was approved by the UNC Charlotte IRB. Twenty-eight healthy and recreationally active normotensive males (19-25 years) gave written informed consent and were randomized to one of three conditions; double bicep curl IET (IBC), double leg extension IET (ILE), or control (CON). IET groups completed exercise sessions at 15% maximal voluntary contraction (6 x 2-minute contractions) 3 days per week for 6-weeks with RBP assessed at each visit. For a subsample (n=17), 3 blood samples (pre-, 1 hour post-, 24 hours post-training) were collected at the first and last training visits. The CON group performed all study procedures except IET.

RESULTS: Using a repeated-measures ANCOVA (controlling for acclimation RBP and cohort), a significant time by treatment effect was observed from Week 1 to Week 6, $F(2, 23) = 4.10$, $p=.03$, $\eta^2 = .263$. Specifically, IET resulted in a lower systolic RBP, but did not differ by IET group: IBC -4.4 ± 4.0 mmHg; ILE -4.3 ± 7.6 mmHg; CON 2.3 ± 4.0 mmHg. Diastolic RBP did not significantly change for any group. Currently, there are no acute or chronic IET effects on the systemic biomarker levels.

CONCLUSIONS: 6-weeks of bilateral arm or leg IET resulted in significant reductions in systolic RBP. Due to the small sample size (n=17), power may have limited the ability to detect significant effects on circulating VEGF, TNF- α and IL-6. Research should continue to examine how IET alters RBP. The research was funded by Faculty Research Grant (JMB & HR) and the Thomas L. Reynolds Graduate Student Research Award (B.D.H.G)

965 Board #91 May 27 2:30 PM - 4:00 PM

Oscillometric Ambulatory Blood Pressure Monitors Are Prone To Errors In A Controlled Laboratory Setting

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We developed a dual monitor protocol for testing the accuracy and reliability of 24-hr ambulatory blood pressure monitors (ABPMs) and determined in normotensives (n=15), hypertensives (n=14) and alcohol-dependents (n=11) that a popular auscultatory ABPM was highly variable, misclassifying up to 70% of patients.

Purpose: To determine the accuracy and reliability of two widely used oscillometric ABPMs, the Oscar 2 (Suntech Medical, Morrisville, NC) and the Spacelabs 90207 (Spacelabs Healthcare, Snoqualmie, WA) under controlled lab conditions. **Hypothesis:** Oscillometric proprietary algorithms were developed from auscultatory reference BPs, thus ABPMs would differ from each other and from observers (O1, O2) using a Hg column and Thinklabs digital stethoscope. **Methods:** BPs were measured in triplicate on both arms in 17 seated subjects (10 ♂, 7 ♀) with simultaneous same arm BPs by O1 & O2 alternating with simultaneous opposite arm BPs by ABPMs. **Results:** The average (x \pm SE) systolic (SBP) and diastolic (DBP) BPs for O1, O2, Oscar & Spacelabs ABPMs were 114.2/67.3 \pm 2.0/1.8 mm Hg, 114.1/67.1 \pm 2.0/1.8 mm Hg, 124.0/67.7 \pm 2.1/1.4 mm Hg, and 119.3/67.9 \pm 1.9/1.3 mm Hg, respectively. Compared to O1O2, the Oscar overestimated SBP by 9.8 \pm 0.9 mm Hg ($P < 0.001$), while the Spacelabs overestimated SBP by 5.2 \pm 0.8 mm Hg ($P < 0.001$). SBP also differed significantly between ABPMs ($P < 0.001$). Though the DBP difference was small between observers and ABPMs, (O1O2 - Oscar = -0.6 mm Hg; O1O2 - Spacelabs = -0.7 mm Hg), there was a high degree of variability with the Oscar ranging from 23 mm Hg above to 20 mm Hg below and the Spacelabs 23 mm Hg above to 26 mm Hg below the observers. Compared to O1O2, Oscar SBP and DBP differed by > 5 mm Hg in 15/17 (88%) and 7/17 (41%), while the Spacelabs SBP and DBP differed by > 5 mm Hg in 11/17 (65%) and 8/17 (47%) of subjects, respectively. **Conclusions:** Controlled lab testing revealed significant measurement errors in widely used oscillometric ABPMs. Given light exercise during 24-hr ambulatory monitoring, the outlook for

accuracy and reliability appears worse. Oscillometric nomogram-like equations are population-specific and indirect 2nd generation estimations and cannot account for individual variations making them highly susceptible to errors, though more testing is required in a greater number of hypertensives.

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Associations Of Objectively Measured Sedentary Time With Endothelial Function Biomarkers In Young Male Adults

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PURPOSE: Sedentary behavior (SB) is recognized as a serious global health issue. SB-induced down regulation of shear rate and blood flow play a key role in the pathogenesis of endothelial dysfunction, an important prognostic marker for cardiovascular disease. The purpose of this study was to assess the association between objectively measured sedentary time and endothelial function biomarkers in young male adults.

METHODS: A total of 93 participants (age, 21.8 \pm 3.8 yr; body height, 171.6 \pm 6.4 cm; body weight, 62.1 \pm 6.4 kg; % body fat, 15.6 \pm 4.6%; body mass index (BMI) 21.1 \pm 1.7 kg/m²; waist circumference 74.5 \pm 5.1 cm; heart rate (HR) 67.6 \pm 9.5 bpm; systolic blood pressure (SBP) 108.4 \pm 9.1 mmHg; diastolic blood pressure (DBP) 71.6 \pm 8.1 mmHg) wore the activPALTM continuously for 7 days without removal. Total sedentary time was assessed using PALanalysis v8.0. Bedtime and wake-up time were recorded by participants. Sleep duration was determined as the time between bed time and wake-up time. Sedentary time during waking hours was calculated as the total sitting/lying time minus sleep duration. A fasting venous blood sample was drawn from each of the participants from which serum endothelial cell adhesion molecules E-selectin, P-selectin, Intercellular Adhesion Molecule 1 (ICAM-1) and Vascular Cellular Adhesion Molecule 1 (VCAM-1) were measured using flow cytometry. Multiple linear regression models examined the associations of sedentary time with endothelial function biomarkers using SPSS version 23.0.

RESULTS: E-selectin ($\beta = 0.226$, 95% confidence interval [CI]: 0.021, 0.431) and P-selectin ($\beta = 0.216$, 95% CI: 0.017, 0.415) were positively associated with sedentary time after controlling for age and BMI. After moderate-to-vigorous physical activity (MVPA) was added to the model, there were no significant association between E-selectin and sedentary time. No significant associations were found between ICAM-1 or VCAM-1 with sedentary time or between ICAM-1 or VCAM-1 with sedentary time after controlling age, BMI, and MVPA.

CONCLUSIONS: Objectively measured sedentary time was positively associated with E-selectin and P-selectin in young male adults independent of age and BMI. MVPA may alleviate the adverse effects of sedentary time on biomarkers of endothelial function.

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Regular Resistance Training Enhances Fibrinolytic Potential

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Blood clots cause most cardiovascular events, such as heart attack and stroke. Blood markers of fibrinolysis, the capacity to dissolve blood clots, are independently associated with cardiovascular morbidity and mortality. Regular resistance training (RT) produces various muscular and vascular adaptations that are theorized to influence thrombotic potential, but there are no published longitudinal studies that examine fibrinolytic adaptations to RT. **PURPOSE:** The purpose of this study was to identify effects of an 8-week RT program on fibrinolytic potential. **METHODS:** Sixteen healthy adults (n = 12 women, 4 men; age = 23 \pm 5 years) completed a RT program that targeted all major muscle groups, 3 times per week for 8 weeks. Exercises included 2-3 sets of 8-12 repetitions performed at approximately 60-80% of 1 RM. Body composition, circumferences, and 1 RM leg and chest press strength measures were obtained via standard methods. Resting blood samples were obtained by clean venipuncture at baseline and after 8 weeks of RT. Enzyme-linked immunosorbency assays were used to assess plasma concentrations of the following fibrinolytic variables: active tissue plasminogen activator (tPA:c), tissue plasminogen activator antigen (tPA:g), active plasminogen activator inhibitor-1 (PAI-1:c), and plasminogen activator inhibitor-1 antigen (PAI-1:g). Statistical analyses were conducted using paired t-tests. **RESULTS:** Significant increases in lean mass (PRE = 52.18 \pm 10.03, POST = 53.64 \pm 10.42 kg), arm circumference (PRE = 29.89 \pm 5.12, POST = 30.97 \pm 4.92 cm), and mid-thigh circumference (PRE = 49.96 \pm 5.43, POST = 51.08 \pm 5.83 cm) were observed (all $p < 0.05$). Maximal chest press (PRE = 57.8 \pm 37.5, POST = 73.3 \pm 43.2 kg) and leg press strength (PRE = 189.5 \pm 95.8, POST = 256.7 \pm 97.9 kg) significantly increased ($p < 0.01$). PAI-1:c (PRE = 20.3 \pm 32.5, POST

= 9.5 ± 20.9 U/ml, p=0.05) and PAI-1:g decreased (PRE = 10.18 ± 8.98, POST = 7.20 ± 5.74 ng/dl, p<0.05). No change in tPA:c or tPA:g occurred. **CONCLUSION:** The decrease in plasma concentrations of total and active PAI-1 indicate reduced inhibition of fibrinolytic activation, suggesting that the risk of a cardiovascular event is reduced after resistance training. The mechanisms underlying this specific adaptation may relate to increased skeletal muscle mass, but additional research is warranted.

968 Board #94 May 27 2:30 PM - 4:00 PM
Evaluation Of Inter-rater And Test-retest Reliability For Near-infrared Spectroscopy Reactive Hyperemia Measures
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Near-Infrared spectroscopy (NIRS) is a non-invasive tool used to measure blood flow in peripheral tissues. More information on test-retest reliability and inter-rater agreement of NIRS-based reperfusion assessments is needed. **PURPOSE:** To assess inter-rater agreement for NIRS based data analysis, and evaluate the measurement's reliability across days. **METHODS:** On three separate days, participants' (N=15 males, 22± 2 yr.) reactive hyperemia was measured in the left gastrocnemius muscle using Continuous-Wave NIRS. A blood pressure cuff was placed proximal to the knee and inflated to occlude lower leg blood flow for 5 minutes. The cuff was rapidly deflated, and the blood flow responses were measured until values returned to baseline. Raw NIRS data were exported and analyzed in a custom-written routine in MATLAB by two individuals. The following NIRS parameters were selected:(1) the time for the O₂Hb signal to reach 50% peak post-occlusion hyperemia (T_{1/2}), (2) The O₂Hb range used to normalize the NIRS signal; (3) the post peak-hyperemic O₂Hb recovery slope, taken as an index of sustained microvascular dilation. Inter-rater agreement was assessed using Intraclass Correlation Coefficients (ICC), calculated using an absolute agreement two-way mixed effects model. 95% confidence intervals (CI) of ICCs are reported. Cronbach's alpha was used to assess day to day reliability for each of the measures. **RESULTS:** The ICC data indicate that there is "good" to "excellent" agreement between NIRS analyzers as shown in table 1.

	Visit 1 Rater 1 (SD)	Visit 1 Rater 2 (SD)	Visit 1 ICC (CI)	Visit 2 ICC (CI)	Visit 3 ICC (CI)
T _{1/2}	9.03 (2.43)	9.71 (3.07)	.63 (.22-.86)	.99 (.98-1.0)	.97 (.91-.99)
O ₂ Hb Range	31.72 (8.57)	33.06 (6.47)	.71 (.33-.89)	.98 (.94-.99)	.97 (.92-.99)
Post peak-hyperemic O ₂ Hb recovery slope	-.17 (.05)	-.18 (.06)	.77 (.45-.92)	.91 (.71-.97)	.86 (.65-.95)

The Cronbach's alpha for raters 1 and 2 were: T_{1/2} (α =.89, α = .91), O₂Hb (α =.95, α = .89), and post peak-hyperemic O₂Hb recovery slope (α =.74, α = .83). **CONCLUSION:** Our data indicate multiple raters can be used to analyze NIRS based reperfusion measures with good agreement and that the method has sufficient test-retest reliability to use in experimental designs involving multiple laboratory visits.

969 Board #95 May 27 2:30 PM - 4:00 PM
The Influence Of Sleep On Blood Pressure In Healthy Children
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Loss of ideal cardiovascular health can begin in childhood with the development of cardiovascular disease (CVD) risk factors occurring on a continuum. Central blood pressure (BP) values may be more reflective of CVD risk than peripheral BP but are rarely measured in children. Additionally, in adults, poor sleep quality is associated with higher BP and incidence of CVD, however these relations are not as well elucidated in children. **PURPOSE:** To evaluate the role of sleep duration, sleep quality, and sleep variability (SLV) on resting central and peripheral BP in apparently healthy 7-12 yr old children. **METHODS:** Sleep duration, total time in bed (TTIB), sleep quality (assessed by sleep efficiency (SE) and wake after sleep onset (WASO)),

and SLV (assessed by sleep midpoint standard deviation (SMSD)) were recorded in 20 healthy children (10 ± 0.5 yrs, 10 boys, 10 girls) for 7 consecutive nights outside of the laboratory via wrist accelerometry. Following sleep monitoring, peripheral BP was measured and using pulse wave analysis (PWA) central BP was estimated. Central and peripheral BP were measured and averaged over 3 trials. Pearson's r correlations were used to assess relations between sleep metrics and BP values. Independent samples t-tests were used to determine group (low vs. high SE) differences. **RESULTS:** Sleep duration averaged 7.9 ± 0.2 hrs/night, while TTIB averaged 9.6 ± 0.1 hrs/night. SE was 82 ± 2%, WASO was 89 ± 9 mins, and SMSD was 48 ± 6 mins. Sleep duration, TTIB, SE, WASO, and SMSD were not significantly associated with central or peripheral BP values. When using an 85% cutoff for SE, central and peripheral BP were not significantly different between groups. Additionally, using the same cutoff for SE, TTIB was not significantly different between groups, however sleep duration was significantly different (7.4 hrs <85% vs 8.4 hrs >85%, p < 0.001). **CONCLUSION:** Preliminary data suggest that children age 7-12 are not getting the recommended amount of sleep (9-11 hrs/night) despite adequate time in bed. Thus far, there seems to be no effect of shortened, poor-quality, and more variable sleep on BP in healthy children age 7-12, but further research is needed. Supported by NIH grant P20GM113125

970 Board #96 May 27 2:30 PM - 4:00 PM
THE IMPACT OF REPEATED, EXERCISE-INDEPENDENT INCREASES IN BLOOD FLOW ON LOWER LIMB ENDOTHELIAL FUNCTION
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(No relevant relationships reported)

Exercise training improves endothelial function partially through increases in blood flow-associated shear stress. Local heat training can be used to isolate the exercise-independent effect of increased shear stress on endothelial function. Forearm heat training has been found to improve brachial artery endothelial function, however, this has never been investigated in the lower limb. **PURPOSE:** To examine the effect of heat training on superficial femoral artery (SFA) endothelial function in young, healthy females utilizing reactive hyperemia flow-mediated dilation (RH-FMD) and sustained stimulus FMD (SS-FMD). **METHODS:** Female participants (n=13, 23±2 yrs) had one leg randomized to the heat training intervention (EXP; other leg: control (CON)). The EXP leg underwent 8 weeks of heat training via immersion in 42.5°C water for five 35-minute sessions per week. At week 0, 2, 4, 6, and 8, SFA RH-FMD and SS-FMD were measured in each leg via duplex ultrasound. RH-FMD was characterized as the peak % change in diameter following release of 5 min of thigh occlusion. SS-FMD was characterized as the peak % change in diameter during 6 min of plantar flexion exercise at a target shear stress of 13 dynes/cm². **RESULTS:** Week zero RH and SS-FMD were as follows: RH-FMD: CON 7.3±3.1, EXP 5.1±4.2; SS-FMD: CON 8.1±4.3, EXP 9.2±6.4. RH-FMD and SS-FMD did not change over the training period (RH: p=0.128; SS: p=0.063) or differ between EXP and CON legs (RH: p=0.685; SS: p=0.337; interaction RH: p=0.076; SS: p=0.958). Covariation for the shear stress stimulus did not alter the results. **CONCLUSION:** 8-weeks of leg heat training in young, healthy females did improve SFA endothelial function. These results are in contrast with previous findings that heat training improves upper limb endothelial function. The increased blood flow-associated shear stress elicited by the heating protocol may have been inadequate to elicit adaptation in the SFA. Future studies are needed to determine whether other lower limb conduit arteries or the microvasculature benefit from local, lower limb heat training.

971 Board #97 May 27 2:30 PM - 4:00 PM
High Intensity But Not Moderate Intensity Exercise Attenuates Carotid Shear-mediated Dilation
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(No relevant relationships reported)

PURPOSE: Exercise training improves cerebrovascular function. It has been recently speculated that shear-mediated dilation of the internal carotid artery (ICA) is a useful marker of cerebrovascular function. Although exercise intensity is a major factor of exercise prescription, the effects of exercise intensity on shear-mediated dilation of the ICA remain unknown. This study investigated the shear-mediated dilation of the ICA following acute, moderate-, and high-intensity exercise in healthy males. **METHODS:** Twelve healthy males (22 ± 2 years) completed a 30 min leg cycling exercise at moderate [(55-65% of age-predicted maximal heart rate (HR_{max}))] and high (75-85% HR_{max}) intensities. Shear-mediated dilation of the ICA was assessed at pre-exercise (Pre), 5 min (Post5), and 60 min (Post60) after the cessation of exercise. Shear-mediated dilation was induced by 3 min of hypercapnia (target end tidal partial pressure of carbon dioxide +10 mmHg from an individual's baseline) and calculated

as the percent rise of the peak diameter from baseline diameter. Doppler ultrasound was employed to measure the carotid diameter, and blood velocity during exercise, and hypercapnia. Conductance and shear rate (SR) of the ICA at 25 min of exercise was calculated based on the Doppler variables and mean blood pressure.

RESULTS: Neither type of exercise altered the SR of the ICA (Interaction effect; $P = 0.93$, main effect of time; $P = 0.14$). Conductance decreased during high-intensity exercise (Pre to 25 min; 5.1 ± 1.3 to 3.2 ± 1.0 ml/min/mmHg, $P < 0.01$) but not during moderate-intensity exercise (5.0 ± 1.3 to 4.0 ± 0.8 ml/min/mmHg, $P = 0.11$). Shear-mediated dilation immediately declined after high-intensity exercise (Pre to Post5; 6.9 ± 1.7 to $4.0 \pm 1.4\%$, $P < 0.01$), but not after moderate-intensity exercise (7.2 ± 2.1 to $7.3 \pm 1.8\%$, $P = 1.00$). Shear-mediated dilation did not show significant changes at Post60 in either exercise intensity (Post 60; Moderate; 8.0 ± 3.1 , High; $6.4 \pm 2.9\%$). **CONCLUSIONS:** The acute decline of shear-mediated dilation in the ICA following high-intensity exercise may have been due to changes in the sympathetic activity and hemodynamics rather than in the SR. Current findings suggest that moderate-intensity exercise is more suitable for promoting cerebrovascular health than high-intensity exercise.

972 Board #98 May 27 2:30 PM - 4:00 PM
Concurrent Vibration During Muscle Contractions Acutely Reduces Following Central Arterial Stiffness

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(No relevant relationships reported)

Whole body vibration has been shown to elicit vasodilation after intervention. **PURPOSE:** To test the hypothesis that concurrent local vibration while muscle contraction would reduce the vasoconstrictive response induced by exhaustive resistance exercise. **METHODS:** A total of 18 apparently young healthy males (age=22±1 yrs; BMI=23 ± 1kg/m²) were recruited. Following the maximal isometric voluntary contraction determination (MVC), participants were randomly assigned to perform 2 trials of isotonic knee extensor exercise (40%MVC×3 sets, 8 reps for the first 2 sets, exercise to exhaustion in the 3rd set, 1 min rest interval) with (KE+V) and without (KE) concurrent vibration (26Hz, 2-4mm in magnitude) on the customized motor-driven knee extensor device. Brachial blood pressure measured by sphygmomanometer, central and peripheral pulse wave velocity determined by photoplethysmography, and heart rate variability (HRV) were measured before and 5 mins after exercise. **RESULTS:** Heart rate, brachial blood pressure parameters significantly increased from baseline during exercise, and there was no difference between treatments. KE+V trial significantly reduced central pulse wave velocity after exercise, whereas KE did not elicit any changes on pulse wave velocity measures compared with the baseline. HRV analysis showed KE significantly increase low to high frequency ratio (LF/HF) and reduced RMSSD after exercise, whereas no significant changes were observed in KE+V trial. **CONCLUSIONS:** Local concurrent vibration with muscle contraction also exerts vasodilatory responses after exercise, which may be associated with relatively higher parasympathetic dominance induced by vibration.

973 Board #99 May 27 2:30 PM - 4:00 PM
Distribution Of Passive Leg Movement-induced Hyperemia In Old And Impact Of Occluding The Lower Leg

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PURPOSE: With passive leg movement (PLM), a vascular function assessment, in the young, of the total blood flow (BF) that passes through the common femoral artery (CFA), ~70% is directed to the deep femoral artery (DFA), while only ~30% passes through the superficial femoral artery (SFA). With lower leg cuff-induced BF occlusion, a common practice with drug infusions during PLM, there is an attenuated response in the SFA, which is reflected by a fall in BF in the CFA, but not in the DFA. Interestingly, the proportion of blood passing through the DFA and SFA is unchanged. However, BF distribution during PLM, and the impact of cuffing the lower leg, with aging is unknown. **METHODS:** Therefore, PLM was performed with and without cuff-induced lower leg BF occlusion in 6 healthy old subjects, with BF assessed by Doppler ultrasound. **RESULTS:** In terms of BF distribution during PLM, like the young, of the 80±27 ml of blood that passed through the CFA, 69±22% was directed to the DFA, while only 31±22% passed through the SFA. However, unlike the young, the cuff resulted in the complete ablation of SFA BF and the fall in CFA BF did not achieve statistical significance. As with the young, DFA BF was unaltered by the cuff. **CONCLUSIONS:** Thus, in the old, as with young, the PLM-induced hyperemia

predominantly passes through the DFA. Cuffing appears to impact the SFA BF in the old to a greater extent than the young, but, again, in this population there is no effect on PLM-induced DFA BF.

974 Board #100 May 27 2:30 PM - 4:00 PM
Decreased Pulse Wave Reflections Associated With Isometric Handgrip Training Improves Cognitive Function In Older Adults

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to investigate whether the decrease in pulse wave reflection and central systolic blood pressure (SBP) as a result of isometric handgrip (IHG) training improves cognitive function in older adults.

METHODS: Twenty-two men and women (age 75±7 years, mean±standard deviation) who were not actively involved in regular resistance or endurance training were randomly assigned to either the group that performed IHG training (IHG group, n=11) or the sedentary control group (CON group, n=11). The IHG exercise comprised four unilateral 2-min isometric contractions at 30% of maximal voluntary contraction using a programmed handgrip dynamometer with 1-min rest periods for 5 days per week for 8 weeks. Carotid augmentation index (AIx), an index of the magnitude of pulse wave reflections, and carotid SBP were non-invasively measured after resting in the supine position for at least 5 min in both groups before (baseline) and after 8 weeks of training using an arterial applanation tonometry system. Trail making test (TMT) Part A, which measures processing speed, and Part B, which assesses task shifting, were used to determine processing speed and flexibility in task switching and cognition.

RESULTS: Carotid AIx and carotid SBP in the IHG group after training were significantly lower than baseline values, decreasing from 52±4 to 39±3 mmHg and from 148±5 to 137±5 mmHg, respectively ($p < 0.05$ for both). TMT-A and TMT-B in the IHG group after training were significantly lower than baseline values, decreasing from 34.73±3.04 to 26.41±2.33 and from 60.52±5.25 to 49.39±4.51 s, respectively ($p < 0.05$ for both). The carotid AIx, carotid SBP, TMT-A and TMT-B did not significantly change before and after training in the CON group. A significant positive correlation was observed between the amount of change in carotid AIx and the amount of change in TMT-A ($r = 0.603$, $p < 0.05$) and TMT-B ($r = 0.591$, $p < 0.05$). In addition, a significant positive correlation was observed between the amount of change in carotid SBP and the amount of change in TMT-A ($r = 0.736$, $p < 0.01$) and TMT-B ($r = 0.582$, $p < 0.05$).

CONCLUSIONS: These results demonstrate that isometric handgrip exercises reduce carotid AIx and carotid SBP, which is associated with improving cognitive function.

975 Board #101 May 27 2:30 PM - 4:00 PM
Abstract Withdrawn

976 Board #102 May 27 2:30 PM - 4:00 PM
Abstract Withdrawn

977 Board #103 May 27 2:30 PM - 4:00 PM
A Cross-sectional Comparison Of Vascular Health Between Physically Active Pre- And Post- Menopausal Women.

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Following menopause, the risk of developing cardiovascular diseases increases significantly in women. The hormonal changes observed during the menopause transition, including the cessation of estrogen production by the ovaries, seems to accelerate arterial aging by decreasing vasoreactivity and increasing arterial stiffness. Physical activity is considered the most effective strategy to maintain optimal vascular health. For older men, research has demonstrated a positive influence of physical activity on markers of vascular health. However, in older women, the benefits of physical activity on vascular health are still unclear. **PURPOSE:** To determine if physically active post-menopausal women demonstrate preserved vascular health compared to physically active pre-menopausal women. **METHODS:** Five pre- (49 ± 3 years) and five post- (54 ± 2 years) menopausal healthy and active women were recruited. Blood pressure (24-hour ambulatory blood pressure monitoring), physical activity levels (7-day accelerometry), vasoreactivity (brachial artery flow-mediated dilation) and central arterial stiffness (carotid-femoral pulse wave velocity) were compared between groups. **RESULTS:** Despite both groups being physically active

(post: 708 ± 235 vs. pre: 445 ± 302 min/week, P=0.16), post-menopausal women tend to have greater 24-hour systolic blood pressure (125 ± 9 vs. 115 ± 8 mmHg, P=0.14). In contrast, vasoreactivity (post: 3.35 ± 3.68 vs. pre: 4.58 ± 1.40 %, P=0.62) and central arterial stiffness appear similar between groups (post: 7.19 ± 2.11 vs. pre: 6.84 ± 1.40 m/s, P=0.78). **CONCLUSION:** Physically active post-menopausal women tend to have greater systolic blood pressure compared to physically active pre-menopausal women, despite similar values of endothelial function and arterial stiffness.

Grant fundings: Mirella and Lino Saputo Research Chair in Cardiovascular health and the prevention of cognitive decline; HABISAN (Handicap Biologie Santé) program, Regional council of Nouvelle Aquitaine

978 Board #104 May 27 2:30 PM - 4:00 PM
Sitting-induced Endothelial Dysfunction Is Prevented In Endurance-trained Individuals

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(No relevant relationships reported)

PURPOSE: Prolonged sitting impairs leg endothelial function, which seems to be mediated by a sustained reduction in blood flow-induced shear stress. However, whether regular endurance training is effective in preventing sitting-induced leg endothelial dysfunction remains largely unknown. Herein, we tested the hypothesis that sitting-induced leg endothelial dysfunction is prevented in high endurance-trained individuals.

METHODS: The endurance-trained group comprised 11 male collegiate cyclists (age, 19.7 ± 0.6 years; height, 168.4 ± 6.2 cm; weight, 62.7 ± 7.0 kg; body mass index, 22.1 ± 2.4 kg/m²), and the untrained group comprised 9 male with no regular endurance training (age, 21.1 ± 1.8 years; height, 170.1 ± 6.6 cm; weight, 72.2 ± 8.1 kg; body mass index, 24.8 ± 1.5 kg/m²). Peak oxygen uptake (VO_{2peak}) was initially determined in all participants using incremental exercise test (37.9 ± 4.7 mL/min/kg in the untrained group vs. 60.5 ± 3.6 mL/min/kg in the endurance-trained group). At second visit, the popliteal artery flow-mediated dilation (%FMD) was assessed before and after a 3-h sitting period. During the sitting period, the popliteal artery diameter and blood velocity were measured every hour.

RESULTS: The popliteal artery shear rate was significantly and similarly reduced during the sitting period in both groups (the untrained group and the endurance-trained group: 51.9 ± 19.2 sec⁻¹ vs. 58.3 ± 23.5 sec⁻¹ at pre-sit, 25.5 ± 10.9 sec⁻¹ vs. 25.5 ± 15.2 sec⁻¹ at 1h during sitting period, 19.4 ± 7.4 sec⁻¹ vs. 27.5 ± 12.3 sec⁻¹ at 2h during sitting period, 21.4 ± 8.1 sec⁻¹ vs. 20.8 ± 8.3 sec⁻¹ at 3h during sitting period, 29.4 ± 13.9 sec⁻¹ vs. 29.7 ± 15.8 sec⁻¹ at post-sit, P < 0.001). In a 3-h sitting, a significant impairment in popliteal artery %FMD was observed in the untrained group (4.5 ± 0.6 % vs. 1.6 ± 0.2 % P = 0.003), but it was prevented in the endurance-trained group (6.9 ± 0.7 % vs. 6.2 ± 1.3 %, P < 0.431).

CONCLUSIONS: In conclusion, the present study revealed that sitting-induced leg endothelial dysfunction is preventable in endurance-trained individuals.

B-69 Free Communication/Poster - ACL Injury

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

979 Board #105 May 27 1:30 PM - 3:00 PM
The Functional Movement Screen Is Not Associated With Self-reported Disability, Gait, Or Drop Vertical Jump In Individuals With ACL Reconstruction

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Purpose: To determine the associations between Functional Movement Screen (FMS) scores and the International Knee Documentation Committee (IKDC) questionnaire score, Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales scores, gait biomechanics, and drop vertical jump (DVJ) biomechanics in individuals with ACL reconstruction (ACLR).

Methods: 30 individuals with ACLR (53% female; 71.0±46.4 months post-ACLR; 22.6±1.8 years old; 11 patellar tendon graft, 12 hamstring tendon graft, 7 allograft) completed the IKDC and KOOS. Bilateral gait biomechanics were obtained from 5 trials on a 10m runway over 2 force plates. DVJ biomechanics were obtained using a 30cm box placed half their height from the force plates. FMS tasks were scored from 0-3 and summed for analysis. Bilateral gait biomechanics included the knee flexion

angle (KFA) at heel contact, peak KFA, and vertical ground reaction force (vGRF) in the first 50% of stance. Bilateral DVJ biomechanics included the peak knee abduction angle, KFA at heel contact, peak KFA, and peak vGRF. A limb symmetry index (LSI) was calculated for peak KFA and peak vGRF during gait and DVJ. Involved limb values and LSI from gait and DVJ were used for analysis. Separate stepwise linear regression examined the association between the FMS and the IKDC, KOOS subscales, and gait and DVJ biomechanics after accounting for sex and time since ACLR.

Results: No associations were found between FMS score (Mean: 15.0±1.8) and the IKDC (Mean: 84.3±10.6) and KOOS (Mean: 72.0 - 95.6±1.8 - 21.3) after accounting for sex and time since ACLR (ΔR²=0.01 - 0.05, Δp=0.23 - 0.95). No associations were found between FMS score and involved limb biomechanical variables or their LSI's for gait (ΔR²=0.01 - 0.07, Δp=0.17 - 0.79) and DVJ (ΔR²=0.01 - 0.11, Δp=0.08 - 0.99) after accounting for sex and time since ACLR.

Conclusion: The IKDC and KOOS indicated that participants reported some knee-related disability. Conversely, the average FMS score was above the clinical threshold for dysfunctional movement patterns. Therefore, the FMS may not identify knee-related disability in individuals with ACLR. Moreover, FMS score was not associated with gait or DVJ biomechanics, and thus the FMS may not identify hazardous knee movement patterns in individuals with ACLR.

980 Board #106 May 27 1:30 PM - 3:00 PM
The Relationship Between Hip And Thigh Muscle Strength After Acl-reconstruction

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(No relevant relationships reported)

Purpose: Weakness post ACL reconstruction (ACLR) of hip and thigh muscles are evaluated to track rehabilitation progress and/or inform decisions about return to sports. Lower extremity muscle adaptations are common mechanisms by patients coping with muscle weakness. Relationships among hip and thigh strength measures after reconstruction in ACLR patients may help identify potential coping mechanisms and targets for therapeutic intervention.

Methods: Thirty-four patients with primary unilateral ACLR (21.09±6.70yr, 18M, 170.82±11.95cm, 76.82±21.36kg, 7.97±5.22 mo post ACLR) performed maximum isometric contractions for hip abduction (AB) and adduction (AD) in a supine hook-lying position with the hips flexed to 45-degrees and knee flexed to 90-degrees and knee extension (EX) and flexion (FL) while seated with the hip and knee flexed to 90-degrees; average peak torque was recorded and normalized to body mass. We used Pearson correlation coefficients to determine associations among hip and knee muscle strength.

Results: There were statistically significant positive relationships between all hip and thigh strength values of both limbs (Table 1). Correlations between knee EX and hip AB of the ACLR limb were between 0.640 and 0; the contralateral limb was between 0.583 and 0.769. Correlations between knee FL and hip AB of the ACLR limb were between 0.600 and 0.615; the contralateral limb was between 0.583 and 0.606. Correlations between knee EX and hip AD of the ACLR limb were between 0.579 and 0.726; the contralateral limb was between 0.574 and 0.754. Correlations between knee FL and hip AD of the ACLR limb were between 0.681 and 0.702; the contralateral limb was between 0.642 and 0.700.

Conclusion: Statistically significant, moderate to strong, positive relationships among hip and thigh strength measures were found of both limbs about 7 months post ACLR. Relationships among hip and quadricep strength are all moderate to strong, appearing slightly weaker in the ACLR limb.

Table 1. Pearson Correlation Strength Values for Hip Abductor, Adductor, Quadriceps, and Hamstring of ACLR and Contralateral limbs (*P<0.05)

		Knee EXtension		Knee FLexion	
		ACLR Limb	Contralateral Limb	ACLR Limb	Contralateral Limb
Hip ABduction	ACLR Limb	0.640*	0.793*	0.600*	0.615*
	Contralateral Limb	0.583*	0.769*	0.585*	0.606*
Hip ADduction	ACLR Limb	0.579*	0.726*	0.681*	0.702*
	Contralateral Limb	0.574*	0.754*	0.642*	0.700*

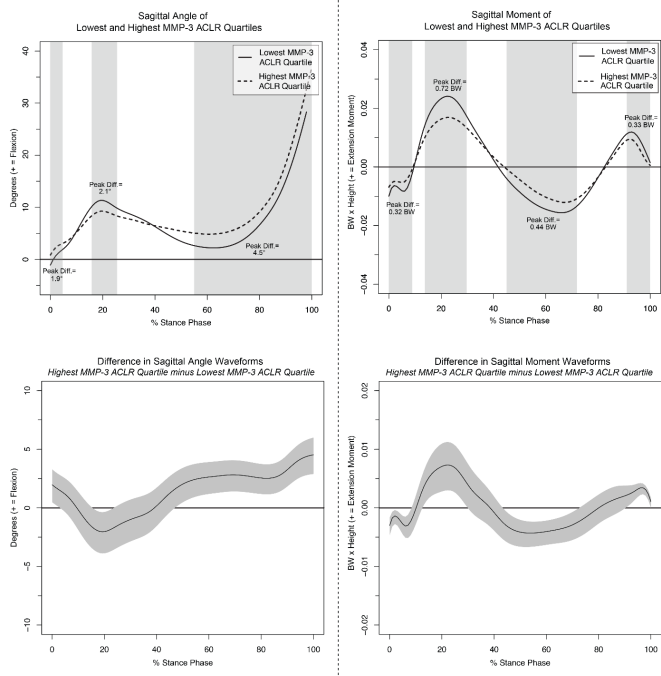
981 Board #107 May 27 1:30 PM - 3:00 PM

Greater Matrix Metalloproteinase-3 Concentrations Following ACL Injury Associate With Worse Gait Biomechanics 6-months Post-ACL Reconstruction

Alyssa Evans-Pickett, Hope C. Davis-Wilson, Lara Longobardi, Steven J. Pfeiffer, Jeffrey Spang, Alexander R. Creighton, Ganesh Kamath, Richard Loeser, Troy Blackburn, Brian Pietrosimone, FACSM. *University of North Carolina at Chapel Hill, Chapel Hill, NC.* (Sponsor: Brian Pietrosimone, FACSM) Email: alyssae@ad.unc.edu

(No relevant relationships reported)

Matrix metalloproteinase-3 (MMP-3) is a degenerative enzyme associated with joint tissue breakdown and has been shown to be a potential biomarker of osteoarthritis. It remains unknown if synovial fluid (SF) MMP-3 concentrations following ACL injury influence gait mechanics. **PURPOSE:** To compare knee flexion angle (KFA) and internal knee extension moment (KEM) during gait 6 months post-ACL in individuals with the highest concentrations of SF MMP-3 compared to those with the lowest concentrations of SF MMP-3 collected within the first 14 days of injury. **METHODS:** Thirty-seven individuals with ACL injury scheduled for primary patellar tendon autograft ACLR (57% females, 21±4 yrs, 23.7±2.8 BMI) participated. Individuals were grouped into highest (HQ; n=9) and lowest (LQ; n=10) quartiles based on MMP-3 knee joint SF concentrations sampled 6±4 days after ACL injury. At 6 months post-ACLR, biomechanics were collected using 3-dimensional motion capture during gait performed at a self-selected speed. Functional analyses of variance were conducted to compare KFA and KEM between HQ and LQ groups throughout stance. Groups were considered different at any percentage of stance where the 95% confidence intervals of the mean differences did not cross zero. Peak differences (PD) and corresponding effect sizes (Cohen's d) within portions of stance demonstrating differences were also calculated. **RESULTS:** HQ exhibited lesser knee flexion excursion; KFA was lower during 17-24% of stance (PD: 2.1°, d=0.44) and greater during 48-100% of stance (PD: 4.5°, d=0.93). HQ also exhibited lower KEM during 14-30% and 91-100% of stance (PD: 0.72 BW, d=0.67; PD: 0.33 BW, d=1.42) and greater KEM during 45-72% of stance (PD: 0.44, d=0.76) **CONCLUSION:** Compared to individuals in the lowest quartile of SF MMP-3, those in the highest exhibited a stiffened knee gait strategy. Pre-surgery levels of MMP-3 following ACL injury may serve as a biomarker predicting worse gait mechanics 6 months post-ACLR.



982 Board #108 May 27 1:30 PM - 3:00 PM

Knee Extensor Torque Complexity During A Maximal Voluntary Isometric Contraction Differs Between ACL-reconstructed And Healthy Individuals

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(No relevant relationships reported)

PURPOSE: Rehabilitation goals following anterior cruciate ligament reconstruction (ACLR) are structured around maximal force generating capabilities of the quadriceps. ACL injuries may occur through the inability to adapt motor output rapidly and accurately to external demands. Approximate Entropy (ApEn) can be used to describe the complexity of torque production to reflect the functional capacity of the neuromuscular system. The purpose of this study was to compare torque complexity of a maximal voluntary isometric contraction (MVIC) in ACLR limbs compared to the uninvolved limb and healthy controls. **METHODS:** A total of 215 individuals (120 ACLR [65 Female, 21.0±8.3 years, 5.96±48-mo. post-ACLR] 95 Healthy [50 Female, 21.5±2.9 years]) participated in the study. Participants completed a 30-second knee extensor MVIC which was stratified into three 10-second bins. The 3-seconds of lowest variation were used to calculate ApEn for the Early (ApEn₁), Middle (ApEn₂), and Late (ApEn₃) time bins. Torque complexity was compared across the trial, between limbs, and between groups using a repeated measures design. The dependent variable was torque complexity (ApEn) and the independent variables were group (ACLR, Healthy) and time bins (Early, Middle, Late). An *a priori* alpha was set at 0.05. **RESULTS:** There was a significant time main effect for torque complexity ($P < .001$). For all participants, ApEn₁ and ApEn₂ were significantly higher than ApEn₃ ($P < .001$, Figure 1). There was also a significant group by limb interaction ($P < .001$). The ACLR limb (.46±.12) demonstrated greater torque complexity than the uninvolved limb (.38±.12, $P < .001$) and of healthy individuals (.38±.10, $P < .001$, Figure 1). **CONCLUSIONS:** The ACLR limb demonstrated a greater torque complexity at the end of a 30-second MVIC compared to healthy controls and the contralateral limb. Force fluctuations during a sustained maximal task may draw clinical insight into the recovery of motor function following ACLR.

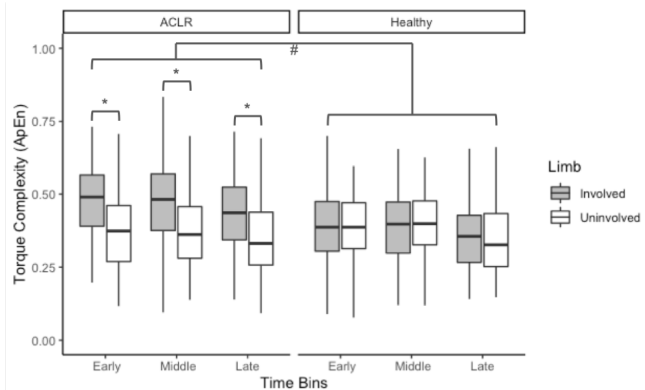


Figure 1: Torque complexity of knee extensor maximal contraction compared between limbs and groups. The involved limb of the ACLR individuals demonstrated significantly higher torque complexity compared to the uninvolved limb (denoted by *) and the healthy individual trials (denoted by #).

983 Board #109 May 27 1:30 PM - 3:00 PM

Influence Of Resistance Training On Strength And Gait Kinetics In Individuals With Acl Reconstruction

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Purpose: Individuals with anterior cruciate ligament reconstruction (ACLR) demonstrate reduced hip and knee extensor strength in their injured limb. Previous research suggests strength imbalances reduce an individuals' ability to propel themselves forward during gait as indicated by the impulse of the anterior ground reaction force (propulsive force; pGRF). As resistance training increases muscular strength, it may improve any propulsion deficits. Therefore, the purpose of this study was to compare hip and knee extensor strength as well as pGRF characteristics between individuals with ACLR who resistance train (RT) and ones who do not (NRT). **Methods:** Hip and knee extensor strength and gait were measured in 16 individuals (22.4±4.2 yr, 1.7±0.1 m, 73.8±15.1kg) with unilateral ACLR via isokinetic dynamometry and force platforms, respectively. The RT group had individuals who

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resistance trained according to the American College of Sports Medicine guidelines consistently after completion of physical therapy. The NRT group included individuals who did not resistance train at all. Independent samples T-tests were used to compare peak hip and knee extensor strength (Nm/kg⁻¹), peak pGRF (N/kg⁻¹), and pGRF impulse (N*s/kg⁻¹) between the RT and NRT groups. Bivariate correlations were used to identify if hip and knee extensor strength were related to pGRF and pGRF impulse. **Results:** The RT group had greater peak knee extensor torque at 60°/sec⁻¹ (KE60) and 180°/sec⁻¹ (KE180) compared to the NRT group. No differences were observed between groups in peak hip torque, pGRF, or pGRF impulse. There was a negative correlation between KE60 and pGRF during walking ($r = -0.531$, $p = 0.034$). No correlations were found between pGRF impulse and hip or knee torque. **Conclusion:** Results confirm our hypothesis that in ACLR, individuals in the RT group exhibited greater knee extensor torque than the NRT group. Additionally, greater KE60 was related to less pGRF during walking. An exploratory analysis found no differences in walking or running velocities, indicating the RT group accomplishes the same goal with less force. This may demonstrate greater movement efficiency resulting from resistance training above the improvements in strength alone.

984 Board #110 May 27 1:30 PM - 3:00 PM
Effects Of ACL Reconstruction On In Vivo Quadriceps Contractile Behavior During Weight Acceptance In Walking

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(No relevant relationships reported)

Appropriate knee loading during walking is essential for optimal health of mechanosensitive joint tissues and is largely governed by quadriceps muscle forces. However, individuals with anterior cruciate ligament reconstruction (ACLR) often exhibit quadriceps muscle dysfunction conventionally measured via reduced peak knee extensor moments (pKEM). Recent advances in ultrasound imaging provide a unique opportunity to determine if quadriceps dysfunction also manifests as altered contractile behavior between those with ACLR and uninjured controls. **PURPOSE:** Determine differences in quadriceps contractile behavior during weight acceptance in walking between ACLR, contralateral, and control limbs. **METHODS:** Six individuals to date with unilateral ACLR (4 females, 20±2 yrs, BMI: 25.3±1.8, months post-surgery: 7.1±0.7) and 11 uninjured controls (6 females; 24±3 yrs, BMI: 22.0±2.0) walked for 2 min on an instrumented treadmill. We collected motion capture and ground reaction force data and recorded cine B-mode ultrasound images of the vastus lateralis (VL). We quantified pKEM, knee flexion excursion (KFE), and VL fascicle length change during weight acceptance (i.e., heel-strike to the instant of pKEM). We report effect sizes (ES) for all comparisons. **RESULTS:** pKEM was 25% lower in the ACLR limb (0.18±0.18 Nm/kg) than the contralateral limb (0.24±0.11 Nm/kg, ES=0.40) and 75% lower than for uninjured controls (0.74±0.19 Nm/kg, ES=3.03). Similarly, the ACLR limb exhibited 21% less KFE (11.4±3.4°) than the contralateral limb (14.5±2.2°, ES=1.08) and 32% less KFE than in uninjured controls (16.8±3.5°, ES=1.57). In uninjured controls, VL fascicles shortened by 0.13±0.23 cm during weight acceptance despite 1.21±0.26 cm of muscle-tendon-unit lengthening, alluding to a predominant role of tendon elongation. VL fascicles in the contralateral limb of ACLR subjects also exhibited shortening during weight acceptance (0.07±0.33 cm). Conversely, we observed fundamentally different behavior in the ACLR limb, for which VL fascicles lengthened by 0.10±0.14 cm (vs controls, ES=1.21). **CONCLUSION:** ACLR alters quadriceps contractile behavior during weight acceptance in walking. Fascicle lengthening unique to the ACLR limb may be a functional consequence of quadriceps dysfunction relevant to altered knee loading.

985 Board #111 May 27 1:30 PM - 3:00 PM
Knee Extensor Torque Variability Correlates With Impaired Functional Knee Kinetics After ACLR In Collegiate Athletes

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(No relevant relationships reported)

Quadriceps neuromuscular dysfunction is universal following anterior cruciate ligament reconstruction (ACLR). Quadriceps performance is often characterized by peak strength, but the ability to generate consistent knee extensor (KE) torque is not captured by maximal strength assessments and may be functionally significant. Torque steadiness (TS) quantifies the capacity to produce smooth and consistent contractile forces, but is not well-defined post-ACLR.

PURPOSE: To evaluate KE TS in collegiate athletes 4, 6, and 12 months post-ACLR, and determine the associations between TS, strength, and knee joint kinetics during athletic tasks.

METHODS: 13 Division I athletes (age 20.5 ± 1.0, BMI 26.3 ± 4.7, 6 male) completed maximal voluntary isometric KE contractions (MVIC), countermovement jumps (CMJ), and treadmill running (2.68 m/s) while 3D kinematics and ground reaction forces were recorded 4.1 ± 0.6 (4), 6.3 ± 0.6 (6) and 11.9 ± 1.1 (12) months post-surgery. TS was defined as the mean difference between raw KE torque and a lowpass filtered signal (4th order butterworth filter, 2 Hz cutoff) within a 4 second torque plateau window. Sagittal plane KE impulses were computed from the stance phase of running (RUN) and the concentric (CON) and landing (LAND) CMJ phases. Wilcoxon Signed-Ranks tests assessed between-limb comparisons at each interval, and Spearman's correlation evaluated the associations between TS, MVIC, and KE impulses.

RESULTS: Involved limb TS was significantly reduced at 4 (limb symmetry index (LSI): 36.8%, $p = .002$), 6 (LSI: 75.3%, $p = .001$), and 12 months post-surgery (LSI: 84.7%, $p = .033$). TS was significantly associated with RUN at 4 and 6 months post-surgery ($r_s = .881$ and $.865$), CON at 4, 6, and 12 months ($r_s = .720$, $.587$, and $.708$), and LAND at 6 and 12 months ($r_s = .678$ and $.564$). MVIC was significantly correlated with RUN at 4 months ($r_s = .762$) and CON at 4, 6, and 12 months ($r_s = .787$, $.587$, and $.689$). TS and MVIC were not correlated at any interval ($r_s = -.335$, $-.346$, and $-.225$). **CONCLUSIONS:** KE TS is reduced 4-12 months post-ACLR in collegiate athletes, and asymmetrical TS is generally strongly associated with asymmetrical KE kinetics. KE TS and strength appear to be unique characterizations of quadriceps performance post-ACLR. Interventions to improve KE TS post-ACLR are recommended to restore knee function.

986 Board #112 May 27 1:30 PM - 3:00 PM
Similar Biomechanics During Change Of Direction In Adolescents With Contact Versus Non-contact Acl Injury

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(No relevant relationships reported)

Purpose: Patients who sustain non-contact (N-CON) anterior cruciate ligament (ACL) injuries may be predisposed to injury due to deficient biomechanics. In contrast, patients who sustain contact (CON) ACL injuries may be injured due to unlucky trauma rather than poor biomechanics. This study compared biomechanics during change of direction movements between patients with CON vs. N-CON ACL injury mechanisms. We hypothesized that patients with CON ACL injury would have better biomechanics (greater shock absorption and less dynamic limb valgus) than patients with N-CON ACL injury.

Methods: 15 patients age 10-18 years with CON ACL injury (4 female; mean age 15.5, SD 2.1) and 94 with N-CON ACL injury (11 female; mean age 15.6, SD 1.9) underwent motion analysis 6-12 months (mean 7.5, SD 1.3) after ACL reconstruction (ACLR). Subjects performed forward-backwards and lateral change of direction tasks. 3D kinematic and kinetic variables reflecting dynamic limb valgus (frontal and transverse plane) and shock absorption (sagittal plane) were compared between patients who had CON and N-CON injury mechanisms using 2-tailed t-tests.

Results: No significant differences were observed between the CON and N-CON groups (Table).

Conclusion: The CON injury group did not have better biomechanics than the N-CON group. This may be due to both groups engaging in similar rehabilitation programs. Alternatively, the CON injury group may have had similar pre-injury biomechanics to the N-CON group but happened to suffer a contact injury. These results suggest that all patients post-ACLR have potentially modifiable risk factors for re-injury and should have their biomechanics evaluated so any deficiencies can be rectified prior to return to sport regardless of injury mechanism.

Table: Comparison of kinematics and kinetics between contact and non-contact ACL injury groups

	Deceleration			Lateral Shuffle		
	Non-Contact	Contact	P-value	Non-Contact	Contact	P-value
SHOCK ABSORPTION						
Max hip flexion	75.3 (15.2)	76.9 (16.4)	0.72	68.4 (14.6)	71.9 (13.6)	0.39
Max knee flexion	65.2 (14.1)	68.8 (20.9)	0.39	61.4 (13.1)	65.2 (13.5)	0.31
Max ankle dorsiflexion	-5.5 (7.1)	-2.3 (2.2)	0.12	16.0 (7.5)	18.2 (8.9)	0.32
Max hip flexion moment	2.8 (1.5)	2.5 (0.9)	0.58	2.07 (0.52)	2.10 (0.63)	0.89
Max knee flexion moment	1.3 (0.5)	1.2 (0.7)	0.55	1.20 (0.50)	1.25 (0.45)	0.72
Max ankle dorsiflexion moment	0.84 (0.22)	0.82 (0.29)	0.80	1.07 (0.30)	1.14 (0.55)	0.52
Energy absorption at hip	0.66 (0.43)	0.56 (0.39)	0.39	0.50 (0.26)	0.45 (0.25)	0.50
Energy absorption at knee	0.50 (0.35)	0.44 (0.38)	0.52	0.38 (0.26)	0.38 (0.19)	0.96
Energy absorption at ankle	0.17 (0.11)	0.14 (0.06)	0.25	0.41 (0.19)	0.42 (0.25)	0.84
DYNAMIC LIMB VALGUS						
Max hip internal rotation	7.8 (7.4)	5.1 (7.8)	0.19	13.7 (8.8)	9.3 (7.5)	0.07
Max hip adduction	1.9 (6.4)	2.6 (4.5)	0.70	-18.3 (8.3)	-17.2 (7.0)	0.65
Min knee varus	-1.1 (4.8)	-3.8 (6.6)	0.05	-2.4 (5.1)	-3.5 (5.4)	0.44
Min knee varus moment	-0.34 (0.34)	-0.32 (0.32)	0.82	-0.85 (0.69)	-0.81 (0.93)	0.84

External moments are reported. Angles are expressed in degrees, moments in N/kg, energy absorption in J/kg.

987 Board #113 May 27 1:30 PM - 3:00 PM
Revisiting Central And Peripheral Contributions To Muscle Weakness After ACL-Reconstruction

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(No relevant relationships reported)

Purpose: Alterations in quadriceps muscle morphology (i.e. cross-sectional area [CSA]) and volitional activation (VA) contribute to muscle weakness following anterior cruciate ligament reconstruction (ACLR). Research on the relative contributions between each factor and quadriceps weakness remain inconclusive as few studies have concurrently evaluated VA and muscle morphology in the same cohort of ACLR patients. Further, the magnitude of contribution of morphology and activation may vary depending on whether data are considered for the ACLR limb alone or if data are reported as a limb symmetry index (LSI), taking into account the uninvolved leg. Thus, aims of this study were to determine the contributions of VA and CSA on quadriceps strength in ACLR patients and to determine if the contributions were similar when using the involved limb or the LSI. **Methods:** Sixteen individuals 6-12 months post-ACLR (time post ACLR: 40.3±8.2 wks, Age: 22.3±6.0yr, Height: 1.7±0.1m, Mass: 68.7±11.5 kg, Sex: 9F) were recruited for this study. Quadriceps isometric peak torque (PT) and VA, via the interpolated triplet technique, were assessed bilaterally at 90° of knee flexion on a dynamometer. Ultrasound images were acquired to assess vastus lateralis CSA in both legs. LSI's were calculated for all outcome variables by expressing values of the involved leg as a percent of the uninvolved leg. Paired t-tests were used to compare outcomes between legs (Bonferroni-adjusted $\alpha = 0.017$). Two separate stepwise linear regressions were performed to examine the contribution of VA and CSA on quadriceps PT where model 1 used LSI for all variables, and model 2 used variables from the involved leg (Bonferroni-adjusted α 's = 0.025). **Results:** Regression model 1 indicated PT LSI was significantly predicted by VA LSI ($R^2=0.45$, $P<0.01$), but not by VL CSA LSI ($R^2=0.01$, $P=0.87$). Model 2 indicated that involved leg PT was significantly predicted by VL CSA ($R^2=0.50$, $P<0.01$) but not quadriceps VA ($R^2=0.08$, $P=0.11$) of the involved leg. All dependent variables were smaller in the involved compared to uninvolved leg ($P<0.017$). **Conclusions:** The contributions of VA and CSA on

quadriceps PT differed greatly if LSI or involved leg outcomes were used. Evaluation of VA and CSA in unison may provide a more holistic understanding of the sources of muscle weakness after ACLR.

988 Board #114 May 27 1:30 PM - 3:00 PM
Preventing Acl Injuries With Martial Arts Break Falling Training

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PURPOSE: ACL injuries have remained prevalent despite numerous prevention attempts. Most prevention has focused on traditional approaches. We propose a novel approach to injury prevention by implementing martial arts falling techniques. This training uses proprioceptive and kinesthetic conditioning to reinforce the athlete's ability to mitigate at-risk postures. This study aims to evaluate the proprioceptive function and risk factors in soccer athletes that undergo fall training. **METHODS:** Members of a premier soccer club, ages 9 to 16, were recruited to. All subjects continued usual training. Subjects partook in the interventional training of martial arts fall training, taught by a 3rd degree black belt master in karate and aikido, twice weekly for ten weeks. Baseline and post-intervention, proprioceptive testing was performed using the Neurocom Balance Master. A linear mixed model was used to determine the effect of the intervention on variables of interest. The fixed effect was time point, used to compare pre to post intervention measures, and random effects included intercepts for subjects and trials within subjects. The level of significance was 0.05.

RESULTS: A significant increase in movement time from pre to post (Premean=1.14, Postmean=1.94, $p=0.032$), no significant change in turn time, turn sway, or sway energy. There was a non-significant decrease in impact index (Premean=46.3, Postmean=36.9, $p=0.206$). A significant decrease in the mean impact index for the right lower extremity. While not statistically significant, downward trends were observed in right lower extremity for mean turn time, mean turn sway, and mean sway energy. Additionally, increases noted for mean equilibrium and mean strategy.

CONCLUSIONS: Results of the mean impact index test highlight the efficacy of martial arts fall training in the dominant lower extremity. Furthermore, the trend of improvement in the dominant leg in a variety of proprioceptive metrics is noteworthy, suggesting the intervention reinforced the more honed neural pathways of the dominant side quicker than the non-dominant. Future research is needed to elucidate whether the non-dominant side can demonstrate the plasticity seen in the dominant side. Finally, the overall increase seen in mean equilibrium and mean strategy is promising.

989 Board #115 May 27 1:30 PM - 3:00 PM
Decreased Loading During Gait Alters Intralimb Coordination In Anterior Cruciate Ligament Reconstructed Individuals

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Aberrant lower extremity loading following anterior cruciate ligament reconstruction (ACLR) is theorized to play a role in posttraumatic osteoarthritis (PTOA) development. Cueing an increase or decrease in loading could potentially optimize gait biomechanics and slow progression to PTOA. Stable coordination is fundamental for functional gait as a mediating process for the distribution of joint loads. Accordingly, examining how joint loading impacts coordination during gait may elucidate compensatory movement strategies following ACLR. **PURPOSE:** Determine the effect of cueing an increase or decrease in lower extremity loading on intralimb coordination between the knee-hip joints in ACLR participants. **METHODS:** Coordination was assessed in 10 individuals (age: 21±4 years; 9±1 months post-surgery; 4F) with unilateral ACLR during three separate loading conditions. Loading was manipulated via real-time feedback using a force measuring treadmill that cued a change in peak vertical ground reaction force (vGRF). Three conditions were conducted on separate days in a random order: 1) preferred (no feedback), 2) overload (cue 5% body weight [BW] increase in vGRF), and 3) underload (cue 5% BW decrease in vGRF). The intralimb coordination between sagittal plane knee-hip angles was assessed via measures of coordination dynamics (mean [M] and standard deviation [SD] of relative phase [RP] and percent determinism [%DET] from cross-recurrence quantification analysis) for each condition. One-way repeated-measures analyses of variance were used to determine differences among conditions. **RESULTS:** A main effect of loading was observed for M RP ($F_{2,26}=6.9$, $p<0.05$) and SD RP ($F_{2,26}=9.5$, $p<0.05$). The underloaded condition exhibited significantly different coordination stability (lower M and higher SD of RP) compared to the preferred and overloaded conditions ($p<0.05$).

A significant effect of loading on %DET ($F_{2,26}=2.7$ $p<.05$) was also observed; the underloaded condition led to tighter coupling than the preferred condition. ($p<.05$).
CONCLUSIONS: Overall, underloading changed the pattern and multi-scale stability of knee-hip coordination. These findings indicate manipulations in joint loading result in altered movement strategies that concern the development of PTOA.

990 Board #116 May 27 1:30 PM - 3:00 PM
Changes In Gait Biomechanics Between Level And Downhill Walking Do Not Differ Between Those With Anterior Cruciate Ligament Reconstruction And Controls

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Conflicting evidence exists regarding the presence of aberrant gait biomechanics after the first year post-anterior cruciate ligament reconstruction. Overground walking may not elucidate differences in those further removed from surgery due to the unexact nature of the task. Deleterious gait biomechanics following ACLR are partly attributable to quadriceps dysfunction. Downhill walking may exacerbate aberrant gait biomechanics, as this task places greater demands on the quadriceps compared to level walking.

PURPOSE: To compare gait biomechanics between individuals with ACLR and healthy controls during level and downhill walking conditions.

METHODS: 24 individuals more than 1 year removed from primary ACLR (83% female, age= 21 ± 3 yr, time since ACLR 44 ± 26 mo, BMI= 23 ± 3 kg/m²) and 24 healthy controls (79% female, age= 21 ± 1 yr, BMI= 24 ± 3 kg/m²) completed both level and downhill (10° grade) gait biomechanics assessments on an instrumented split-belt treadmill at their preferred walking speed. Peak variables were evaluated over the first 50% of stance including the vertical ground reaction force (vGRF), internal knee abduction moment, internal knee extension moment, knee flexion angle, and knee abduction angle. Moments were normalized to %body weight*height (%BW*Ht) and vGRF was normalized to %body weight. Dependent variables were compared across groups and conditions via two-way repeated measures ANCOVA controlling for gait speed.

RESULTS: There were no significant condition*group interaction effects nor group main effects for any outcomes. However, there were significant condition main effects for peak internal knee extension moment ($p = 0.020$, level to downhill mean increase of 0.042 %BW*Ht) and peak knee flexion angle ($p = 0.018$, level to downhill mean increase of 13.2°).

CONCLUSIONS: Downhill walking necessitates a larger internal extension moment and knee flexion angle compared to level gait. Our results suggest that changes in gait biomechanics between level and downhill conditions do not differ between individuals with ACLR > 1 year post reconstruction and controls. These results suggest that aberrant gait biomechanics may be mitigated over time in those with ACLR.

991 Board #117 May 27 1:30 PM - 3:00 PM
Fewer Steps Per Day Associates With Greater Cartilage Breakdown Biomarkers Post Anterior Cruciate Ligament Reconstruction

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PURPOSE: Individuals with anterior cruciate ligament reconstruction (ACLR) engage in fewer steps per day (steps/day) compared to uninjured controls. While regular physical activity can improve outcomes of idiopathic knee osteoarthritis such as disability, it is unknown if physical activity influences post-traumatic knee osteoarthritis outcomes following ACLR. Cartilage oligomeric matrix protein (COMP) is a biomarker outcome associated with cartilage breakdown, and it is responsive to mechanical loading during walking. Therefore, the purpose was to determine the association between steps/day and change in COMP (ΔCOMP) following walking in individuals with an ACLR. **METHODS:** Steps/day was assessed over 7 days using ActiGraph accelerometers worn on the right hip in 31 participants (age=22±4years, body mass index=23.9±2.9kg/m², 52±37 months post-ACLR, 55% females) with primary unilateral ACLR ≥ 6 months at the time of testing. Subjects walked at a preferred speed for 3000 steps (~30 minutes) on a treadmill to introduce cartilage loading. Blood samples were collected immediately pre- and post-walking, and serum COMP concentrations were analyzed with ELISA kits. ΔCOMP was calculated with post-walking concentrations expressed as a percentage of pre-walking levels. Greater

ΔCOMP was interpreted as greater cartilage breakdown during the walking protocol. A univariate linear regression was conducted to determine the association of steps/day with ΔCOMP.

RESULTS: Fewer steps/day (mean±SD: 9,626±2,452) associated with greater ΔCOMP (+11.5±16.4%; $R^2=0.152$, $\beta=-0.003$, $p=0.030$).

CONCLUSIONS: Individuals after ACLR who habitually engage in fewer steps/day demonstrated greater ΔCOMP during a walking protocol. We postulate fewer steps/day in individuals with a history of ACLR may result in deleterious changes in cartilage homeostasis due to inadequate mechanical stimulation of joint tissues. Future studies should determine if increasing steps/day improves knee cartilage outcomes following ACLR.

992 Board #118 May 27 1:30 PM - 3:00 PM
Does Lower Limb Dominance Change After An Anterior Cruciate Ligament Reconstruction?

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 (No relevant relationships reported)

Changes in limb dominance, the limb to kick a ball or recover a fall, after an anterior cruciate ligament reconstruction (ACLR) could occur if the limb has not fully recovered. Due to the impact of an ACLR on the quadriceps, a poor quadriceps limb symmetry index (Q-LSI) could influence changed limb dominance. The difference in the leg used during a quick regain of balance (step-limb) from the subjects' self-reported limb dominance, could identify poor motor planning required to use the limb.

PURPOSE: Evaluate if patients reporting tearing their dominant, defined as the leg to kick a ball, (DOM group) or non-dominant (N-DOM group) limb is the same as the step-limb used during a reactive balance test. For the DOM group, Q-LSI was compared between subjects who switched dominance and those that did not.

METHODS: 36 ACLR (15M, 18±5 years) reported their dominant leg 6-months after ACLR. A reactive balance test was performed where subjects were passively leaned forward 10 degrees. In 5 out of 10 trials they were released and had to step to regain their balance. The most frequently used (3 out of the 5 trials) step-limb was recorded. Q-LSI were calculated through the maximum voluntary isometric contractions at 90 degrees of knee flexion. A Fisher's exact evaluated if the step-limb was similar to the reported dominant limb, comparing the DOM and N-DOM groups. For the DOM group, a Student's t-test compared the differences in Q-LSI between switchers and non-switchers.

RESULTS: 75% (27 DOM: 9 N-DOM) of the subjects tore their DOM limb. When a loss of balance occurred, 48% of the DOM group (13:14) switched dominance. This was significantly greater than the N-DOM group (11%, 1:8, $p=0.02$). The DOM group who did not switch limbs had higher Q-LSI (switchers: 57% Q-LSI, non-switchers: 78% Q-LSI, $p=0.04$).

CONCLUSIONS: Almost half of the subjects who tore their dominant limb stepped with their uninjured/non-dominant limb 6-months after an ACLR and had a lower Q-LSI than those who stepped with their dominant limb. These results suggest that with lower Q-LSI, subjects' preplanning of initial movements is altered. Switching limb dominance to the non-dominant/uninjured limb may affect performance during tasks that require quick movements. Future studies should evaluate the effects of changes in limb dominance on subsequent injuries after ACLR.

993 Board #119 May 27 1:30 PM - 3:00 PM
Altered Corticospinal Tract Structure And Excitability In Patients With Anterior Cruciate Ligament Reconstruction

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Underlying neural factors contribute to poor outcomes following anterior cruciate ligament reconstruction (ACLR). Neurophysiological adaptations have been identified in motor cortex activation and corticospinal tract excitability, however limited evidence exists on neurostructural changes that may influence motor recovery in ACLR patients.

PURPOSE: To 1) quantify hemispheric differences in structural properties of the corticospinal tract in patients with a history of ACLR, and 2) assess the relationship between excitability and corticospinal tract structure. **METHODS:** Ten ACLR participants (age: 22.6 ± 1.9 yrs; height: 166.3 ± 7.5 cm; mass: 65.4 ± 12.6 kg, months from surgery: 70.0 ± 23.6) volunteered for this cross-sectional study. Corticospinal tract structure (volume; fractional anisotropy [FA]; axial diffusivity [AD]; radial diffusivity [RD]; mean diffusivity [MD]) was assessed using diffusion tensor imaging, and excitability was assessed using transcranial magnetic stimulation (motor evoked potentials [MEP]) for each hemisphere. Hemispheric differences were evaluated using paired samples t-tests. Pearson product moment correlational analyses were conducted on structural and excitability outcomes. Alpha level was set at $p \leq 0.05$. **RESULTS:**

The hemisphere of the ACLR injured limb demonstrated lower volume (567.1 ± 75.3 voxels; $p = 0.005$), lower FA (0.49 ± 0.01 ; $p = 0.02$), higher MD ($7.58 \times 10^{-4} \pm 0.35 \times 10^{-4}$; $p = 0.01$), and smaller MEPs (0.013 ± 0.007 ; $p = 0.04$) compared to the hemisphere of the non-injured limb (659.7 ± 64.3 voxels; 0.53 ± 0.02 ; $7.23 \times 10^{-4} \pm 0.10 \times 10^{-4}$; 0.028 ± 0.010), indicating disrupted white matter structure and a reduction in excitability of the corticospinal tract. Correlation analyses revealed a strong, positive correlation between corticospinal tract volume and MEP of the ACLR injured limb ($r = -0.890$; $p = 0.001$). **CONCLUSIONS:** ACLR patients demonstrated asymmetry in structural properties of the corticospinal tract that may influence the recovery of motor function following surgical reconstruction. More research is warranted to establish the influence of neurostructural measures on patient outcomes and response to treatment in ACLR populations.

994 Board #120 May 27 1:30 PM - 3:00 PM
Gait Biomechanics Linked To Post-traumatic Osteoarthritis Following Anterior Cruciate Ligament Reconstruction Are Improved With Vibration

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PURPOSE: Anterior cruciate ligament reconstruction (ACLR) incurs a high risk of post-traumatic knee osteoarthritis (PTOA). Aberrant gait biomechanics contribute to PTOA and are attributable in part to quadriceps dysfunction. Vibration improves quadriceps function following ACLR, but its effects on gait biomechanics are unknown. The purpose of this study was to evaluate the effects of whole body vibration (WBV) and local muscle vibration (LMV) on gait biomechanics in individuals with ACLR. **METHODS:** 75 volunteers with primary unilateral ACLR (72% females; age 21 ± 3 yr; time since ACLR 27 ± 16 mo) were randomized to WBV, LMV, or Control interventions. WBV and LMV were applied 6×1 minute (30Hz, 2g). Walking biomechanics were assessed prior to and following the interventions. Outcomes included the peak vertical ground reaction force (vGRF) and its loading rate, peak internal knee extension and valgus moments, and peak knee flexion and varus angles during the first 50% of stance. vGRF magnitude and rate were normalized to body weight (BW) and moments were normalized as % body weight*height (%BW*Ht). ACLR limb change scores (post-pre) for each outcome were compared across groups via one-way ANCOVA controlling for gait speed, time since ACLR, and baseline values. **RESULTS:** Change scores did not differ across groups for peak knee flexion ($p = 0.374$) or varus ($p = 0.801$) angles, vGRF ($p = 0.656$), or internal valgus moment ($p = 0.866$). However, changes in vGRF loading rate differed across groups ($p = 0.024$), with a significant decrease in the LMV group (-3.6 BW/s) that was greater than the changes in the WBV (-0.3 BW/s; $p = 0.035$) and Control (0.5 BW/s; $p = 0.010$) groups. Additionally, the change in peak internal extension moment differed across groups ($p = 0.016$), with a significant increase in the WBV group (0.27 %BW*Ht) that was greater than the change in the Control group (-0.17 %BW*Ht; $p = 0.005$) but not the LMV group (0.01 %BW*Ht; $p = 0.101$). **CONCLUSIONS:** Lower knee extension moments and greater loading rates during gait have been linked to declines in joint health following ACLR. WBV acutely increased the peak knee extension moment and LMV decreased loading rates. These data suggest that vibration has the potential to mitigate aberrant gait biomechanics, and may represent an effective approach for mitigating PTOA risk following ACLR.

995 Board #121 May 27 1:30 PM - 3:00 PM
Can Increased Gait Speed Improve Knee Loading Mechanics Following Anterior Cruciate Ligament Reconstruction?

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Knee extensor moments (KEM) deficits during gait persist long term following anterior cruciate ligament reconstruction (ACLR) and are attributed to progression of osteoarthritis. KEM are reduced in surgical limb through modulation of heel rocker mechanics (HRM): reduced knee flexion excursion (KFE), shank anterior angular velocity (SAV) and posterior ground reaction force (pGRF). Improved KEM are more therapeutically desirable if accomplished by improving underlying HRM. Increased gait speed increases knee loading in healthy individuals but it is not known if those with long term deficits post-ACLR respond to gait speed with improved KEM or if these improvements are accomplished by improving underlying HRM

PURPOSE: To determine if individuals with long term KEM deficits post-ACLR respond to increase treadmill gait speed with increase KEM and HRM and if improved KEM is related to improved HRM

METHODS: Individuals > 1 year post-ACLR with KEM deficits >10% are recruited; data collection on-going. Participants (N=4, 61.4±29.8 months post-ACLR) walked on a treadmill at self-selected (SS) and 50% faster than SS (FAST) speeds (3 minutes/ speed). 3D kinematics (Qualisys) and kinetics (Bertec) were collected in last 30 seconds (6 steps/limb). KEM (inverse dynamics), SAV, pGRF and KFE during loading response (surgical limb) were compared between speeds; strength of difference indicated by effect size (ES). Pearson correlations used to determine association between percent increase (SS to FAST speed) in peak KEM and increase in HRM (peak SAV, peak pGRF and KFE)

RESULTS: KEM ($97.1 \pm 74.8\%$, $ES = 1.1$), SAV ($44.9 \pm 4.4\%$, $ES = 1.5$), pGRF ($62.9 \pm 3.5\%$, $ES = 1.6$) and KFE (4 ± 1.9 degrees, $ES = 1.3$) increased with speed. Increased KEM correlated with increases in KFE ($r = .92$, $p = .08$), and SAV ($r = .99$, $p = .01$) but not pGRF ($r = -.18$, $p = .82$)

CONCLUSIONS: This preliminary analyses suggest that increased gait speed improves KEM and all features of HRM. A 97% increase in KEM was strongly related to improvements in KFE and SAV. Sample size calculations suggests these results will hold up in our full study sample (expected for May presentation). If results hold, it will suggest that increasing treadmill gait speed may be an effective stimulus for retraining kinematic features of HRM and KEM in those who have persistent KEM deficits during gait following ACLR

996 Board #122 May 27 1:30 PM - 3:00 PM
Bilateral Changes In Running Biomechanics Observed From Pre-injury To 6-months Post Anterior Cruciate Ligament Reconstruction

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Reduced knee function during running has been observed in anterior cruciate ligament reconstructed (ACLR) knees, persisting up to 5 years after surgery. Current evidence is limited to cross-sectional design and often utilizes the contralateral limb for comparison with questionable appropriateness. Pre-injury running biomechanics, although difficult to obtain, can be used to assess post-surgical changes in both the involved and uninvolved limbs. Through pre-season injury screening, we obtained running mechanics on collegiate athletes. This study utilizes this pre-injury data for evaluation of bilateral changes in those athletes who sustained an ACL injury and then underwent ACLR. **PURPOSE:** To assess changes in knee joint mechanics during running from pre-injury to 6-months post-ACLR in Division 1 collegiate athletes. **METHODS:** Whole body kinematics and ground reaction forces (GRF) were collected during treadmill running for 9 athletes (5 females) prior to a primary ACL injury (PRE) and 6.1±0.3 months post-ACLR (6M). Athletes ran at a maximally comfortable speed at 6M (3.8 ± 0.5 m/s) and speed-matched PRE data was reviewed. Knee joint mechanics and GRF variables were compared between PRE and 6M within the involved (INV) and uninvolved (UNI) limb using Wilcoxon Signed-Rank Tests. Results are presented as within-limb percent change (kinetics, GRF) or median difference (kinematics) between PRE and 6M.

RESULTS: Knee joint metrics decreased from PRE to 6M in the INV limb: knee flexion excursion during stance (5.4° , $p < 0.01$), knee extensor impulse (59.1% , $p < 0.01$), rate of knee extensor moment (37.0% , $p < 0.01$). No change in knee joint mechanics were observed in the UNI limb ($< 5\%$, $p > 0.1$). Furthermore, INV limb demonstrated reduced vertical GRF impulse (2.8% , $p < 0.01$) and braking impulse (13.6% , $p = 0.01$), while both metrics increased in the UNI limb (vertical, 5.7% , $p = 0.01$; braking, 23.8% , $p = 0.01$).

CONCLUSIONS: This is the first study to assess changes in running biomechanics following ACLR relative to the pre-injury state. Consistent with cross-sectional studies, INV knee kinematics and kinetics did not return to pre-injury state by 6 months post-ACLR. Additionally, the UNI limb appears to be a valid comparator for the INV limb for knee joint specific running mechanics at 6M, but not for GRF variables. NIH award TL1TR002375

997 Board #123 May 27 1:30 PM - 3:00 PM
Gait Variability Of Younger Children Is More Altered By Footwear Type Compared To Older Children

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The role footwear plays on the development of children's gait and gait variability is not often considered. Many factors contribute to the development of children's gait, including growth, coordination, and motor control, but little attention is paid to the

added constraint of footwear and its role in guiding the development of children's gait. **Purpose:** To determine the affect different footwear types have on children's gait variability at different stages in development. **Methods:** 28 healthy children were divided into four groups by ages 2-3, 4-5, 6-7, and 8-10 years old respectively. Gait variability (coefficient of variation (CV)) measures of stride length (SL) and stride time (ST) parameters were collected for three minutes of treadmill walking in barefoot (BF), moccasin (MO), athletic (AT), and rigid shoes (RS) conditions. A mixed factorial ANOVA (4 age x 4 shoe) was performed to determine significant differences. Tukey post-hoc tests were conducted where applicable. **Results:** There was a significant age x shoe interaction for ST CV ($p=.003$). Specifically, MO decreased from youngest to oldest while BF, AT, and RS increased from 2-3 to 4-5 before decreasing to 6-7 and 8-10. There was a significant age x shoe interaction for SL CV ($p=.007$). There was linear decrease for the MO condition from youngest group to oldest group for SL CV while SL CV increased from 2-3 to 4-5 old before decreasing for the 6-7 and decreasing again for the 8-10 for the BF, AT, and RS conditions. **Conclusion:** Younger children were more sensitive to the varying types of footwear conditions than older children. Concerning footwear, MO most closely resembles BF gait compared to AT and RS. It is important to note the increased sensitivity to footwear differences for younger children. The results of this study raised the concern of what types of footwear should be most appropriate for a developing child, recommending moccasin type shoes and not typical athletic or rigid shoes.

CV Spatiotemporal

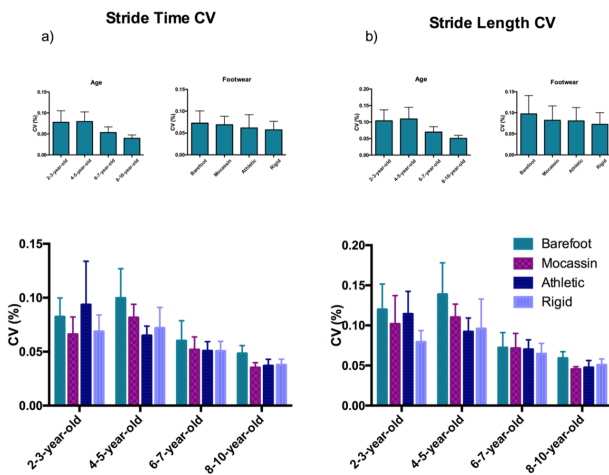


Figure: Bar charts showing the mean and standard deviation for CV Stride time and CV stride length spatiotemporal time series. Data are reported for main effect of age group and footwear condition as well as pairwise comparisons.

AG: -2.9%) angle showing the more leveled foot angle control. There was a greater reduction of foot elevation at mid-swing in CG than AG ($p=0.007$; CG: -11.1%; AG: 8.6%). Lower lateral step variability ($p=0.021$; CG: 5.2%; AG: 34.5%) and greater reduction of lumbar motion in transverse plane ($p=0.030$; CG: -27.7%; AG: -9.4%) were also exhibited in CG. **CONCLUSION:** The study highlights that to attain a comparable secondary task performance with adults, children group adopted more cautious gait patterns when walking and texting. The observed changes, therefore, may suggest that a greater compromise in motor-domain seems necessary in younger age smartphone users under dual-tasking conditions.

999 Board #125 May 27 1:30 PM - 3:00 PM
Sex And Height Differences Associated With High Impact Physical Activities In Children
 Carlos Santillan, Illinois State University, Bloomington, IL.
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 (No relevant relationships reported)

INTRODUCTION: During childhood mechanical loading is important for developing a resilient skeleton. High impact activity interventions cause improvements in bone mineral density in youth and can promote long term bone health. When designing interventions, it is important to know if sex and height play a role in loading magnitudes experienced during various jumping activities. **PURPOSE:** Examine if sex and height impact the magnitude of peak ground reaction forces (pGRF) during different jump tasks. **METHODS:** Four males (Age: 9±1 years; Height: 1.36 ± 11 m; Mass: 31 ± 5 kg) and four females (Age: 11±1 years; Height: 1.46±0.05 m; Mass: 36±6 kg) performed five trials for each jump condition. Each subject performed a broad jump (BJ), countermovement jump (CMJ), jumping jack (JJ), leap jump (LJ), and a drop jump (DJ). Data were collected on a force plate (1000 Hz), and pGRF in units of body weight (BW) was determined during the landing phase. A mixed ANOVA was employed to assess sex differences across conditions. Correlation analysis assessed the relationship between height and pGRF for each condition. **RESULTS:** No differences in pGRF were observed between males (m) and females (f) across conditions [BJ (m: 2.14± 0.09, f: 2.33± 0.18 BW), CMJ (m: 2.42±0.2, f: 2.44±0.25 BW), JJ (m: 2.55±0.16, f: 2.53±0.25 BW), LJ (m: 1.98±0.02, f: 2.02±0.15 BW), and DJ (m: 2.88±0.31, f: 3.25±0.48 BW)]. There was a moderate correlation between height and pGRF for DJ ($r = 0.59$). **CONCLUSION:** Larger pGRF exhibited with taller subjects during the DJ condition can be explained by considering a higher center of mass contains more gravitational potential energy converted to kinetic energy during the DJ, and thus requires a larger pGRF to slow the participant's center of mass during landing. Height differences should be considered when designing interventions involving drop jumps to elicit bone adaptations in youth.

B-70 Free Communication/Poster - Functional Biomechanics in Young People
 Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

998 Board #124 May 27 1:30 PM - 3:00 PM
Comparison Of Gait Characteristics Between Children And Adults During Walking And Texting
 Eun Hye Kwon, Jongil Lim, Henry Martinez, Ian Martinez.
 Texas A&M University San Antonio, San Antonio, TX.
 (No relevant relationships reported)

Average age for a child getting their first smartphone is getting younger. While well-established negative impacts of using smartphone on walking characteristics were generally found for the adult population, its age-related differences are not clear. **PURPOSE:** To examine age-related differences in gait characteristics during walking and texting. **METHODS:** A total of 24 participants were recruited in this study: 12 children (CG; age = 11.7±1.0 years; 1.15 ± 0.11 m; 50.5 ± 13.8 kg) and 12 adult participants (AG; age = 24.8±2.5 years; 1.61 ± 6.3 m; 65.4 ± 18.6 kg). Two conditions were employed (No-texting and Texting). In each condition, subject performed two 60 sec walking trials at their preferred speed along a rectangular walkway (8 x 12 m). Participants were asked to walk while matching a preferred foot strike to the beat of an auditory metronome corresponding to a preferred step frequency measured in baseline. Gait parameters including spatial and temporal step characteristics were measured from wireless inertial sensor system. Dual-task cost (DTC) was calculated as the percentage change between single-task (No-Texting) and dual-task (Texting) conditions. Two-way repeated measures ANOVA's were performed for all dependent variables, with texting condition as a within-subjects variable and group as a between-subjects variable. **RESULTS:** No significant group differences in DTC were observed for texting speed and accuracy. DTC for the gait speed was not significantly different between groups (CG: -14.1%; AG: -11.3%). CG exhibited greater DTCs of foot strike ($p=0.008$; CG: -12.9%; AG: -7.9%) as well as toe-off ($p=0.023$; CG: -6.0%;

1000 Board #126 May 27 1:30 PM - 3:00 PM
Loading Profiles Associated With High Impact Physical Activities In Children
 Zach L. Fassett, Adam E. Jagodinsky, Carlos Santillan, David Q. Thomas, FACSM, Skip M. Williams, Illinois State University, Normal, IL.
 (No relevant relationships reported)

INTRODUCTION: Physical activities that involve impact loading are important for improving bone strength and bone mineral density in children. However, there is little research quantifying the impact loads associated with various high impact activities. **PURPOSE:** Examine the magnitude of peak ground reaction forces (pGRF) of a variety of jumping tasks. **METHODS:** Eight adolescents, within the ages of 8-12 years (age: 9.63±1.49 years; height: 1.42±0.08 m; mass 33.69±4.81 kg), performed five trials for each jump condition. Each subject performed a broad jump (BJ), countermovement jump (CMJ), jumping jack (JJ), leap jump (LJ), and a drop jump (DJ). All jumps were performed on a force plate (1000Hz). pGRF was determined during the landing phase of each jump condition, and expressed in units of body weight (BW). A repeated measures ANOVA was employed to assess differences in pGRF across conditions. **RESULTS:** DJ exhibited significantly greater pGRF (3.09±0.46 BW) in comparison to the BJ (2.25± 0.2 BW; $P=.003$), and LJ (2.01±0.1 BW; $P=.002$). LJ exhibited significantly less pGRF compared to the CMJ (2.45±0.22 BW; $P=.001$), JJ (2.56±0.21 BW; $P<.001$), and DJ ($P=.002$). **CONCLUSION:** Vertical jumping tasks (CMJ, JJ, DJ) elicited greater vertical impact loads compared to horizontal tasks (BJ and LJ) due to the nature of landing. Previous studies indicated loads between 3-9 BW are sufficient for stimulating increases in bone mineral density in pre and early pubertal

children. All conditions except DJ exhibited loading below three BW, suggesting these activities may not sufficiently stimulate bone remodeling to influence bone mineral density.

- 1001** Board #127 May 27 1:30 PM - 3:00 PM
Strength And Power As Indicators Of Differences In Fiber Type Contributions In Children And Adolescents
 Zachary M. Gillen, Marni E. Shoemaker, Nicholas A. Bohannon, Nicholas A. Bohannon, Joel T. Cramer, FACSM. *University of Nebraska-Lincoln, Lincoln, NE.*
 (No relevant relationships reported)

PURPOSE: Examine individual patterns of peak torque (PT) and mean power (MP) across a range of angular velocities in children and adolescents and how these patterns relate to measurements of growth. **METHODS:** Seventeen children (age = 11 ± 0.4 years) and 22 adolescents (age = 14 ± 0.6 years) performed maximal voluntary isometric contractions, isokinetic leg extensions at 60, 120, 180, 240, and $300^\circ \cdot s^{-1}$, and 50 consecutive maximal isokinetic leg extensions at $180^\circ \cdot s^{-1}$. Patterns of responses for PT and MP across angular velocity were fit with quadratic equations for each subject with r^2 values ranging from 0.803-0.934 for PT and 0.908-0.996 for MP, respectively. Derivatives of each quadratic formula quantified velocity-related changes in PT and MP. Each quadratic formula predicted the peak velocity at which torque could be generated (V_{PT}) or the velocity at which the greatest MP would occur (V_{MP}). The percent of fast-twitch fibers (FT%) was estimated from the fatigue index of the 50-repetition test. Measurements of growth included age, maturity offset, height, body mass, fat-free mass, and quadriceps femoris muscle cross-sectional area. **RESULTS:** All measurements of growth, PT, and MP were greater for adolescents than children ($p \leq 0.003$). As expected, PT decreased quadratically ($p < 0.001$), while MP increased quadratically to $180\text{--}240^\circ \cdot s^{-1}$ ($p < 0.001$) and plateaued ($p = 0.056$) or decreased ($p < 0.001$) to $300^\circ \cdot s^{-1}$. V_{PT} was 352 ± 18 Nm for children and 527 ± 34 Nm for adolescents ($p < 0.001$), while V_{MP} was 216 ± 11 W for children and 268 ± 11 W for adolescents ($p < 0.001$). FT% was $39 \pm 4\%$ for children and $46 \pm 4\%$ for adolescents ($p < 0.001$). Derivatives indicated that PT decreased while MP increased across velocity more rapidly in adolescents than children ($p \leq 0.016$). Derivatives of PT vs. velocity exhibited a high relationship with body mass for adolescents ($r = -0.727$), while derivatives of MP vs. velocity exhibited high relationships with body mass and fat-free mass in children ($r = 0.714\text{--}0.795$). V_{TO} and V_{MP} exhibited high relationships with age for adolescents ($r = 0.884$). **CONCLUSION:** Isometric and isokinetic muscle actions in children and adolescents indirectly demonstrate growth-related increases in fast-twitch fiber contributions to maximal, voluntary muscle strength and power across the velocity spectrum.

- 1002** Board #128 May 27 1:30 PM - 3:00 PM
Relationship Between Core Stability And Running Mechanics In Adolescent Runners
 Allison Hoffee, Scott Monfort, James Becker. *Montana State University, Bozeman, MT.*
 Email: james.becker4@montana.edu
 (No relevant relationships reported)

Stability of the lumbopelvic "core" is essential for the control and movement of the lower extremity and for absorption and transfer of force. In adult runners, poor core stability is related to increased running injury risk and decreasing core stability results in negative effects on mechanical variables associated with running injuries. It is currently unknown if relationships between core stability and running mechanics exist in adolescent populations. **PURPOSE:** Evaluate the relationship between core stability and mechanical variables associated with running injuries in adolescent runners. **METHODS:** 20 adolescent runners (11 M/9 F; age: 12.38 ± 0.79 years; easy training run pace: 3.24 ± 0.17 m/s) participated in this study. Kinematics and kinetics were recorded using a motion capture system as participants ran on an instrumented treadmill. Core stability was assessed using a novel method which evaluates center of pressure movement over 30 seconds while participants sit still on an unstable surface. Core stability was calculated as total center of pressure excursion (CoPEX) during the test, and Pearson's product-moment correlations were used to determine relationship between CoPEX and running mechanics. **RESULTS:** Mean CoPEX was 1.39 ± 0.41 m, and mean values for running mechanical variables are shown in Table 1. CoPEX was not correlated with any of the mechanical variables. **CONCLUSIONS:** In contrast to what has been reported in adult runners, core stability was not related to running mechanics in this sample of adolescent runners. Without fully developed motor control, adolescent runners may have more overall variability in their running gait, leading to minimal relationships between running mechanics and core stability. Further research is needed to reveal whether reducing core stability influences injury risk factors, as has been shown in novice adult runners, or whether relationships between core stability and running mechanics change as adolescents mature.

Table 1. Mean, standard deviation (SD), p-value, and correlation coefficient (r) for eight injury risk-related mechanics; VALR: vertical average loading rate; BW: body weight

Variable	Mean	SD	p-value	r
Peak hip abductor moment (Nm/kg)	1.81	0.37	0.95	0.01
Hip abductor impulse (Nm/kg*s)	0.18	0.04	0.96	0.01
Peak knee extensor moment (Nm/kg)	1.82	0.50	0.65	-0.11
Knee extensor impulse (Nm/kg*s)	0.13	0.07	0.75	-0.07
Peak knee abductor moment (Nm/kg)	0.67	0.29	0.15	0.34
Knee abductor impulse (Nm/kg*s)	0.03	0.04	0.44	0.18
Peak impact force (BW)	1.85	0.42	0.74	0.08
VALR (BW/s)	72.12	16.80	0.85	0.05

- 1003** Board #129 May 27 1:30 PM - 3:00 PM
Movement Screening For Adolescent Runners: Relationship Between Single Limb Step Down Performance And Running Mechanics
 James Becker, Allison Hoffee, Scott Monfort. *Montana State University, Bozeman, MT.*
 Email: james.becker4@montana.edu
 (No relevant relationships reported)

The single limb step down (SLSD) is a movement screen commonly used to assess neuromuscular control of the lower extremity. In adult runners, performance on the SLSD is predictive of running mechanics. However, it is unknown whether this is also the case for adolescent populations. If so, the SLSD could be a useful tool for injury risk screening in adolescent athletes. **PURPOSE:** Determine whether performance on the SLSD predicts running mechanics in adolescent runners. **METHODS:** 21 runners participated in this study (12 M/9 F; age: 12.38 ± 0.79 years; weekly mileage: 23.2 ± 6.4 miles; easy training run pace: 3.25 ± 0.17 m/s). Participants ran for five minutes on an instrumented treadmill after which 10 SLSD trials were performed bilaterally from a 15 cm box. Running and SLSD kinematics were recorded using motion capture. Peak frontal plane hip, knee, and ankle, and transverse plane hip and knee angles were calculated during both SLSD and running. The sum of the frontal plane angles was calculated to indicate total medial collapse (TMC). Five additional kinetic variables previous linked to running injuries were calculated for the running trials. Linear regressions were used to determine whether performance on the SLSD predicted kinematics or kinetics during running, with left and right limbs analyzed separately. **RESULTS:** Kinematics on the SLSD predicted kinematics during running (Figure 1). However, TMC during SLSD did not predict vertical loading rates ($R^2 = .008, p = .568$), peak hip adductor moments ($R^2 = .021, p = .363$) or impulses ($R^2 = .007, p = .602$), or peak knee abductor moments ($R^2 = .014, p = .446$) or impulses ($R^2 = .039, p = .209$) during running. **CONCLUSIONS:** The SLSD can predict kinematics during running in adolescent runners. However, performance on the SLSD does not provide information regarding kinetic factors associated with running injuries. Additional research is required to confirm the suitability of the SLSD for identifying adolescent runners at risk of injury.

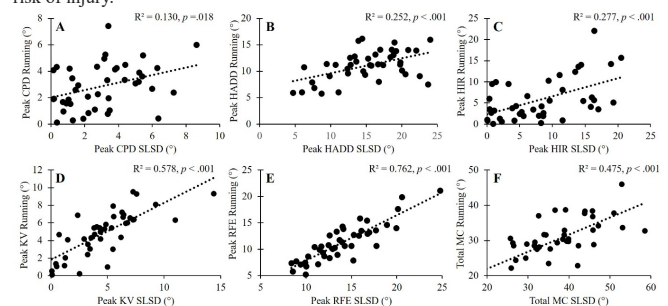


Figure 1. Plots of kinematics on the single limb step down (SLSD) versus kinematics during running for peak contralateral pelvic drop (CPD; A), peak hip adduction (HADD; B), peak hip internal rotation (HIR; C), peak knee valgus (KV; D), peak rearfoot eversion (RFE; E), and total medial collapse (MC; F).

- 1004** Board #130 May 27 1:30 PM - 3:00 PM
Effects Of Rehabilitation Exercise On Muscle Group Working Characteristics Of Adolescent Patients With Scoliosis
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 (No relevant relationships reported)

PURPOSE: At present, most studies using surface electromyography (sEMG) to diagnose muscle working characteristics of scoliosis patients were limited to static status. The purpose of the study was to explore the acute effects of corrective exercise

for adolescent scoliosis. METHODS: Adolescent scoliosis patients with Cobb angle between 10-40° were screened. Patients with other predisposing spinal and neurological abnormalities were excluded. 19 girls (age 14.18 ± 2.58) were recruited into experimental group, including 9 patients with thoracic right protrusion (TRP), 7 patients with lumbar left protrusion (LLP) and 3 patients with S-shaped curvature of spine (SSC). 20 healthy subjects (age 14.91 ± 1.23) were randomly selected. The experimental group was given rehabilitation exercises of 60 minutes for twice. sEMG was used to test the muscles at T2, T7, T10 and L4 level. Basic movements were tested in relax mode (RM) and spine correction mode (SCM). RESULTS: 1. For patients with TRP, when sitting, iEMG of muscle groups at T2 level (left -4.53±3.58, p<0.05; right -2.59±0.96, p<0.01), T7 (left -3.19±1.94, p<0.05; right -1.27±1.16, p<0.05) and right muscle group at T10 level (-3.78±2.19, p<0.01) were lower in SCM than in RM; when walking, iEMG of left muscle group at T7 level (-2.07±1.61, p<0.05) was lower in SCM than in RM. Compared to control group, for SCM of this sub-group, when sitting, activation of the left muscle group at T2 level was increased (2.32±1.58, p<0.05). 2. For patients with LLP, compared to control group, when sitting, activation level of right muscle group at L4 level was increased (0.33±0.69, p<0.05). 3. For patients with SSC, when sitting, the iEMG of right muscle group of T2 level was lower in SCM than that in RM (-1.39±0.45, p<0.05). In SCM of standing with balanced legs, compared to control group, this sub-group has higher activation level of the L4 right muscle group (2.71±1.20, p<0.05). CONCLUSION: 1. The asymmetry between convex and concave sides of paraspinal muscles in adolescents with scoliosis was not obvious. 2. The muscle activation of the thoracic spine-related muscle group was more important for the adjustment of adolescent scoliosis. 3. Posture corrective exercises for adolescent scoliosis had good acute rehabilitation effects and contributed to the maintenance of good postures in daily life.

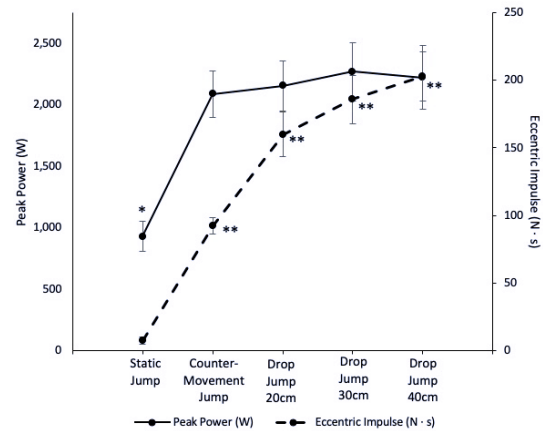


Figure 1. Increases in peak power (PP, left axis) with increases in eccentric pre-loading (ECC, right axis) across vertical jump techniques. * PP for SJ < CMJ, DJ20, DJ30, DJ40; ** ECC for SJ < CMJ < DJ20 < DJ30 < DJ40.

1005 Board #131 May 27 1:30 PM - 3:00 PM

Effects Of Eccentric Pre-loading On Vertical Jump Performance In 9-17-year-old Female Athletes

Nicholas A. Bohannon, Zachary M. Gillen, Marni E. Shoemaker, Sydney M. Gibson, Joel T. Cramer, FACSM. *University of Nebraska-Lincoln, Lincoln, NE.* (Sponsor: Joel Cramer, FACSM)
(No relevant relationships reported)

PURPOSE: Examine peak force (PF), rate of force development (RFD), peak power (PP), eccentric impulse (ECC), concentric impulse (CON), and jump height (JH) during static (SJ), counter-movement (CMJ), and drop (DJ) jumps in young female athletes.

METHODS: Twenty females ranging from 9-17-years old performed SJs, CMJs, and DJs from drop heights of 20, 30, and 40 cm (DJ20, DJ30, and DJ40, respectively) in random order. Measurements included PF, RFD, PP, ECC, CON, and JH for each vertical jump condition. Measurements of growth included age, maturity offset, height, body mass, fat-free mass (FFM), and thigh muscle cross-sectional area (CSA).

RESULTS: As an indicator of eccentric pre-loading, ECC increased systematically from SJ to CMJ to DJ20 to DJ30 to DJ40 (p < 0.001-0.038) (Figure 1); however, CON was not different across vertical jump conditions (p = 1.0). PF and RFD increased from SJ to CMJ (p = 0.009) and from CMJ to DJ20 (p < 0.001), but did not change from DJ20 to DJ30 (p = 1.0) or DJ30 to DJ40 (p = 1.0). PP increased from SJ to CMJ (p < 0.001), but remained constant from CMJ to DJ40 (p = 0.486-1.0) (Figure 1). JH during the CMJ was greater than all other vertical jumps (p ≤ 0.001). The change in PP from SJ to CMJ was moderately to highly correlated with growth measures (r = 0.558-0.815, p ≤ 0.010), except thigh CSA (r = 0.416, p = 0.068).

CONCLUSIONS: These findings were consistent with previous evidence in young male athletes indicating that eccentric pre-loading beyond the CMJ does not result in greater vertical jump power in young female athletes. In contrast to previous evidence in young males, thigh CSA was less related to the increase in vertical jump power from SJ to CMJ than other measures of growth (age, maturity offset, height, body mass, and fat-free mass). In young females, compared to young males, factors other than muscle size contribute more to vertical jump power production. It is unclear how landing mechanics may have influenced the DJ performance measures.

1006 Board #132 May 27 1:30 PM - 3:00 PM

Baseline Assessment High School Athlete: Normative Functional Movement Values

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(No relevant relationships reported)

A significant amount of research has aimed to understand ACL injuries, a common injury in high school athletes. It has yet to be determined how to best evaluate athletes' injury risk. To accomplish this, we need functional movement and injury data for a cohort of athletes across time. **Purpose:** To determine functional movement quality in high school athletes and explore the impact of age, gender, single-sport participation on movement quality and changes over time. **Methods:** 121 male (15.83±1.14 yo, 1.77±0.38m, 75.68±16.8kg) and 70 (15.95±1.19 yo, 1.63±0.08m, 59.04±8.78kg) female high school athletes were recruited to complete a Functional Movement Screen (FMS), a Landing Error Scoring (LESS) test, and a hop series including a single limb hop (SH), triple hop (TH), crossover hop (CH) and a 6m timed hop. For the hop series, a limb symmetry index was calculated by: (Right/Left)*100%. SPSS was then used to determine if differences exist between the youngest 25% of athletes tested and the oldest 25%, sexes, or athletes of a single sport and athletes who participated in multiple high school sports using a t-test (α=0.05). Additionally, 42 athletes were re-tested 9.53±3.5 months after the first visit. A 2x2 repeated measures ANOVA (Gender: Male (n=25), Female (n=17); Time: Visit 1, Visit 2) to identify differences in the population over time (α=0.05). **Results:** The males had higher symmetry on the single limb hop compared to the females. Additionally, the older students performed better on the LESS, SH, and CH. Between visits there was a significant increase in limb symmetry on the SH. **Conclusion:** Several differences exist between age groups, while only SH symmetry varied between genders and over time. This work provides a basic understanding of how high school athletes move and provides a data set to investigate injury risk.

WEDNESDAY, MAY 27, 2020

	Visit 1						Between Visits			
	Male	Female	Young	Old	Single	Multi	Visit 1		Visit 2	
	n=121	n=70	n=48	n=48	n=73	n=118	Male	Female	Male	Female
FMS p-value	14.71 (2.73)	15.10 (2.10)	14.46 (2.79)	15.46 (2.32)	14.84 (2.50)	14.86 (2.55)	15.08 (2.06)	14.71 (1.99)	14.84 (2.98)	15.00 (2.34)
	0.272		0.059		0.939		I: 0.599 S: 0.852, V: 0.957			
LESS p-value	5.76 (2.67)	6.02 (2.55)	7.07 (2.75)	5.41 (2.39)	6.15 (2.16)	5.67 (2.86)	6.86 (2.78)	6.89 (1.76)	6.43 (1.86)	7.78 (3.23)
	0.542		0.002*		0.211		I: 0.258, S: 0.386, V: 0.690			
SH p-value	94.59 (4.54)	92.87 (5.85)	92.60 (6.69)	95.39 (4.12)	93.59 (4.96)	94.25 (5.17)	94.24 (5.30)	93.02 (6.13)	94.74 (4.61)	97.94 (1.41)
	0.031*		0.015*		0.404		I: 0.061, S: 0.52, V: 0.023*			
TH p-value	94.15 (5.20)	93.43 (5.06)	93.89 (3.97)	94.35 (4.63)	93.89 (4.49)	93.91 (5.55)	94.50 (4.24)	94.34 (5.16)	94.41 (3.37)	96.47 (2.67)
	0.379		0.571		0.987		I: 0.281, S: 0.419, V: 0.317			
CH p-value	93.87 (4.36)	93.28 (6.07)	91.70 (5.95)	94.18 (4.80)	93.76 (4.81)	93.61 (5.15)	93.84 (4.93)	93.80 (6.33)	92.15 (6.74)	95.26 (2.73)
	0.498		0.027*		0.844		I: 0.278, S: 0.376, V: 0.937			
6m p-value	93.23 (5.59)	93.01 (5.31)	92.64 (6.42)	94.08 (4.29)	92.84 (5.86)	93.36 (5.24)	92.28 (6.35)	93.62 (5.02)	93.84 (3.89)	92.46 (3.86)
	0.798		0.181		0.531		I: 0.276, S: 0.988, V: 0.873			

Single (SH), triple (TH), crossover (CH), interaction (I), sex (S), and visit (V) *p-value < 0.05.

This study was funded by the National Federation of High School Sports.

B-71 Free Communication/Poster - Musculoskeletal Modeling

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

1007 Board #133 May 27 1:30 PM - 3:00 PM
Effects Of Step Length And Speed On Lower Extremity Individual Muscle Force During Forward Lunge

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 (No relevant relationships reported)

Lunge technique variations can affect the biomechanics of lower extremity. However, only a few studies have examined the muscle forces during the forward lunges.
PURPOSE: The purpose of this study was to compare the force of individual muscles of the lower limb during the forward lunges with the change of step length and speed.
METHODS: Three healthy adults performed (1 male, 2 females 35 ± 8 years) forward lunges with different step lengths and speeds. The step lengths were set at 70% and 100% of the leg length (from the greater trochanter to the lateral malleolus); the speeds were set to slow, normal, and fast (30, 40 and 50 lunges/min, respectively). Kinematic and kinetic data were sampled using a three-dimensional motion analysis system and force plate, respectively. Individual muscles of the lower extremities including four muscles of the quadriceps (rectus femoris, vastus medialis, vastus intermedius, vastus lateralis) and four muscles of the hamstrings (semitendinosus, semimembranosus, biceps femoris long head, and biceps femoris short head) were analyzed. Total forces (active+passive force) were calculated using the musculoskeletal modeling technique (Seth et al., 2018). Two-way repeated measure ANOVAs were used to find the effects of the step and speed on the forces of hamstring and quadriceps muscles.
RESULTS: The total forces of the four hamstring muscles were similar between two-length conditions (3.16±2.90 vs. 3.34±3.53 N/kg; 70% vs. 100%; all muscle forces of each speed conditions were pooled, p-values > 0.05) and three-speed conditions (4.26±4.08 vs. 2.60±2.36 vs. 2.89±2.81 N/kg; Slow vs. Normal vs. Fast; all muscle forces of each length conditions were pooled, p-values > 0.05). The total forces of the four quadriceps muscles were similar between two-length conditions (2.23±0.81 vs. 2.29±1.15 N/kg; all muscle forces of each speed conditions were pooled, p-values > 0.05) and three-speed conditions (2.71±1.10 vs. 1.89±0.71 vs. 2.18±0.96 N/kg; all muscle forces of each length conditions were pooled, p-values > 0.05).

CONCLUSIONS: Our preliminary results suggest that the changes in the step length and the speed used in this study did not affect the kinetics of hamstring and quadriceps muscles. This might be due to the limited number of subjects. Further studies are needed.

1008 Board #134 May 27 1:30 PM - 3:00 PM
Knee Medial Compartment Joint Loads In Stationary Cycling With Increased Q-factor

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 (No relevant relationships reported)

As Q-Factor (QF: inter-pedal width) is increased, the knee abduction moment also increases. Though the knee abduction moment has been associated with knee medial compartment joint load, it is not a direct measure of joint contact forces. In the absence of *in vivo* measurement using an instrumented knee implant, musculoskeletal modeling simulations may provide a viable option for estimation of knee joint contact forces.

PURPOSE: To estimate the total knee joint compressive force (TCF) and knee medial compartment joint compressive force (MCF) in stationary cycling with increasing QF using musculoskeletal simulation.

METHODS: Five recreationally active males cycled on a stationary ergometer at a workrate of 80 Watts and a cadence of 80 rotations per minute at two QF: original QF (150mm), and wide QF (276mm). Wide QF was increased using pedal extenders. Three-dimensional kinematic data (240 Hz, Vicon) and pedal reaction forces using two custom instrumented bike pedals (1200 Hz, Kistler) were collected. A modified gait2392 model with a knee that includes hinge joints for the medial and lateral compartments was used to estimate muscle forces with static optimization and TCF and MCF with joint reaction analysis (3.3 OpenSim, SimTK, Stanford University). Paired samples t-test and Cohen's d were used to detect differences between conditions.

RESULTS: Peak TCF increased from original to wide QF (960.2 ± 258.2 N to 1117.3 ± 202.1 N; p = 0.299; d = 0.54) and MCF increased from original to wide QF (792.2 ± 98.4 N to 1029.2 ± 315.5 N; p = 0.116; d = 0.89).

CONCLUSION: Large standard deviations and small sample size may account for the lack of statistical significance, yet medium and large effect sizes may allude TCF and MCF increases with greater QF (Figure 1). It appears the majority of TCF is born by the medial compartment; TCF and MCF ranged from 1.46 and 1.14 BW for original and 1.75 to 1.42 BW for wide QF, respectively. These loads are much smaller than 2.0-2.5 BW found in walking and 4.0 BW in jogging.

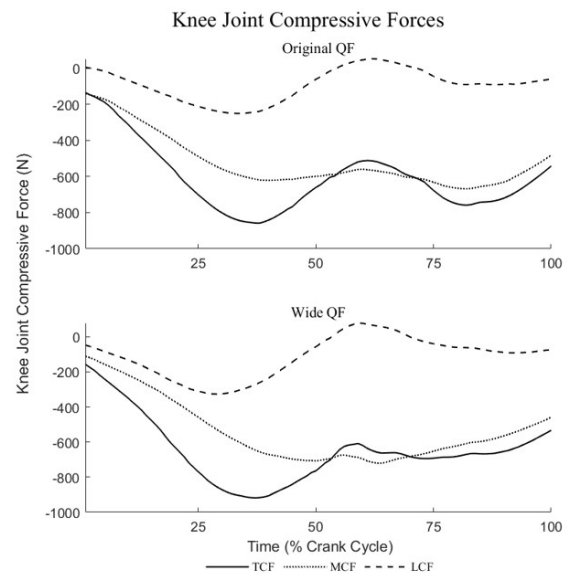


Figure 1: Ensemble curves of the total knee contact force (TCF), medial compartment compressive force (MCF), and lateral compartment compressive force (LCF) during stationary cycling.

1009 Board #135 May 27 1:30 PM - 3:00 PM
The Influence Of The Asymmetry Of Myodynamia On Bilateral Lower Limbs On Kinetics And Kinematics Performance

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(No relevant relationships reported)

PURPOSE: The experiment aims to research the kinetics and kinematics differences between bilateral lower limbs of athletes who have the asymmetry of myodynamia on bilateral lower limbs and provide some basis for avoiding sports injury.

METHODS: The experiment test subjects' Peak Torque of their extensor kinematic chain of bilateral lower limbs. Define subjects whose difference value of peak torque is great than 10% as the experimental group, the rest is the control group. Each group has 10 subjects. Two groups will finish 3 kinematics tests items including running with full power, triple jump by left leg and triple jump by right leg. And also every subject will finish 4 kinetics test items including drop jump, vertical jump by two legs, vertical jump by left leg and vertical jump by right leg on the force platform.

RESULTS: In the intra-group testing, the peak force and impulse in the takeoff phase of vertical jump by two legs (the dominant side peak force is 1000.814±194.59N, the non-dominant side peak force is 852.346±198.23N; the dominant side impulse is 315.887±70.87N*s, the non-dominant side impulse is 255.821±72.00 N*s), the impulse in the takeoff phase of vertical jump by single leg (the dominant side impulse is 611.121±82.10 N*s, the non-dominant side impulse is 430.946±106.76 N*s) and the peak force in the takeoff phase of drop jump (the dominant side peak force is 916.301±272.47N, the non-dominant side peak force is 772.171±159.04N), these four indexes of dominant-side is much higher than the opposite side in the experimental group (p<0.05). But there is no significant difference in control group. There was neither significant difference in the two groups of dominant side nor in the two groups of non-dominant side.

CONCLUSIONS: There are no significant influence on the sports performance of running, vertical jumping and drop-jumping caused by asymmetry of myodynamia of bilateral lower limbs when the Peak Torque of their extensor kinematic chain of bilateral lower limbs is lower than 27% , but it will have a great significant influence on sports performance and sports ability of some relative movements like long jump with single leg and vertical jump with single leg.

1010 Board #136 May 27 1:30 PM - 3:00 PM
M-mode Ultrasound Detects Changes In Lumbopelvic-hip Muscle Activity Using Body Mass Normalization Technique

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(No relevant relationships reported)

M-mode or motion mode allows for non-invasive assessment of contractile tissue movement from echogenicity changes. This method has been used in muscles surrounding the lumbopelvic-hip complex, including the gluteals, however this measurement has not been explored to our knowledge in the rectus abdominis, external oblique, or erector spinae. A normalization technique has not been utilized for M-mode to ensure proper comparison within and between groups as normalization strategies have been applied with other musculoskeletal ultrasound techniques, such as B-mode imaging.

PURPOSE: To determine activity ratio and timing of rectus abdominis (RA), external oblique (EO), erector spinae (ES), gluteus maximus (Gmax), and gluteus medius (Gmed) with a body mass normalization technique. **METHODS:** Ten healthy, physically active individuals with no history of low back or lower extremity injury (21.1±0.7yrs, 67.1±14.8kg, 168.1±6.9cm, 5F) participated in this study. B-mode ultrasound images were collected at rest and during contraction: supine, hook-lying for RA and EO; prone for ES; and side-lying for Gmax and Gmed. Thickness from B- and M-mode images were normalized to body mass (kg) and timing of M-mode was measured in seconds (s). Contracted muscle thickness was divided by rested muscle thickness to calculate activity ratios from B-mode images. Paired *t*-tests were used to compare activity ratios and contraction timing (cm-s/kg) between muscles. **RESULTS:** There were no significant differences (p>.05) between activity ratios, although the EO had the largest activity (1.66±0.72). The RA followed with the second highest activity ratio (1.48±0.38), then ES (1.34±0.43), Gmed (1.30±0.51), and finally Gmax (1.06±0.27). ES exhibited the greatest output from the M-mode normalization technique (0.019± 0.004cm-s/kg) and EO had the least at 0.0053±0.002cm-s/kg (p<.001). **CONCLUSIONS:** The anterior musculature assessed, EO and RA, generated the largest activity ratios, while ES and EO had the greatest disparity detected during motion. The balance of activity between anterior and posterior muscles of the lumbopelvic-hip complex should be noted especially with M-mode activity with this body mass normalization application as the variance in size of muscle plays a major role in how ultrasound data may be interpreted.

1011 Board #137 May 27 1:30 PM - 3:00 PM
Patellofemoral Joint Loading Performing The Forward And Side Lunge With Step Height Variations

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(No relevant relationships reported)

PURPOSE: Forward and side lunge exercises are frequently employed during patellofemoral joint syndrome rehabilitation. The purpose was to compare patellofemoral joint force and stress while performing the forward and side-lunge at ground level and up to a 10 cm platform. **METHODS:** Sixteen participants performed a forward and side lunge at ground level and up to a 10 cm platform. Electromyography, ground-reaction-force, and kinematic variables were collected and input into a biomechanical optimization model, and patellofemoral joint force and stress were calculated as a function of knee angle during the lunge descent and ascent and assessed with a repeated-measures 2-way analysis of variance (p<0.05). **RESULTS:** Collapsed across step-height, at 10° (p=0.003) knee angle during lunge descent and 10° and 30° (p<0.001) knee-angles during lunge ascent patellofemoral joint force and stress were greater in forward lunge than side lunge. At 40°(p=0.005), 50°(p=0.002), 60°(p<0.001), 70°(p=0.006), 80°(p=0.005), 90°(p=0.002), and 100°(p<0.001) knee angles during lunge descent and 50°(p=0.002), 60°(p<0.001), 70°(p<0.001), 80°(p<0.001), and 90°(p<0.001) knee angles during lunge ascent patellofemoral joint force and stress were greater in side lunge than forward lunge. Collapsed across lunge type, at 60° (p=0.009) knee angle during lunge descent and 40°(p=0.008), 50°(p=0.009), and 60°(p=0.007) knee angles during lunge ascent patellofemoral joint force and stress were greater lunging at ground level than up to 10 cm platform. No interactions occurred between lunge type and step height. **CONCLUSIONS:** Patellofemoral joint loading changed according to lunge type, step height, and knee angle. When the goal is to initially minimize and then gradually progress patellofemoral joint loading, the following may be a prudent lunging progression: 1) forward lunge at lower knee angles(0°-30°) at ground level or up to 10 cm platform; 2) forward lunge at middle knee angles(0°-60°) up to 10 cm platform and progressed to ground-level; 3) side lunge at middle knee angle(0°-60°) up to 10 cm platform and progressed to ground level; 4) forward lunge at higher knee angles(0°-100°) up to 10 cm platform and progressed to ground level; and 5) side lunge at higher-knee angle(0°-100°) up to 10 cm platform and progressed to ground level.

1012 Board #138 May 27 1:30 PM - 3:00 PM
Interpreting Knee Valgus: Orthogonal Distance Vs Cardan/Euler Angles

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(No relevant relationships reported)

Cardan/Euler angles (EAs) are commonly used to quantify knee valgus. Although EAs precisely describe the orientation of segments, their geometrical interpretation may not relate well to the underlying joint *kinetics* and can be difficult for practitioners to interpret. Having a metric that is both better related to the knee joint kinetics (e.g. knee abduction moment (KAM) and tibial external rotation moment (TRM)) and easier to interpret would be advantageous for researchers and practitioners. **PURPOSE:** Assess the relationship between (1) EAs and a novel kinematic descriptor of knee valgus - the orthogonal distance of the knee joint center from the hip-foot plane (OD), and (2) EAs and OD with KAM and TRM. **METHODS:** Two datasets were used; in the first, 26 varsity athletes performed 10 bodyweight squats and 10 jump squats. In the second, 13 participants performed 4-5 drop vertical jumps. EAs were used to decompose orientation matrices between the shank and thigh. OD was computed by first creating a plane using the midpoint between the 1st and 5th metatarsals, the ankle joint center, and the hip joint center. Then, the scalar projection of the knee joint center and a vector normal to this plane was computed. Newton-Euler equations of motion were used to compute net joint moments at the knee. Repeated-measures correlation (*r*) and percent agreement (%AG) scores were used to compare continuous and binary (i.e. valgus vs no valgus) metrics at initial contact (Purpose 1), peak knee flexion (Purpose 1 & 2), and the instant when KAM was highest (Purpose 1 & 2). **RESULTS:** EA and OD demonstrated poor correlations (*r*= -0.28 – 0.43) and low agreement when categorizing valgus vs not valgus (%AG= 17.69 – 56.45%). The OD showed stronger links to KAM and TRM in comparison to EAs (Table 1). **CONCLUSION:** Although both kinematic measures were poorly correlated with KAM and TRM, OD was better able to categorize knee valgus kinetics. OD may also be easier to visually observe.

Table 1.

	KAM		TRM	
	r	%AG	r	%AG
OD	-0.39 - -0.13	67.74 - 95.16%	0.21 - 0.51	48.39 - 96.77%
EA	-0.71 - -0.28	24.19 - 38.71%	-0.48 - 0.10	33.87 - 70.78%

1013 Board #139 May 27 1:30 PM - 3:00 PM

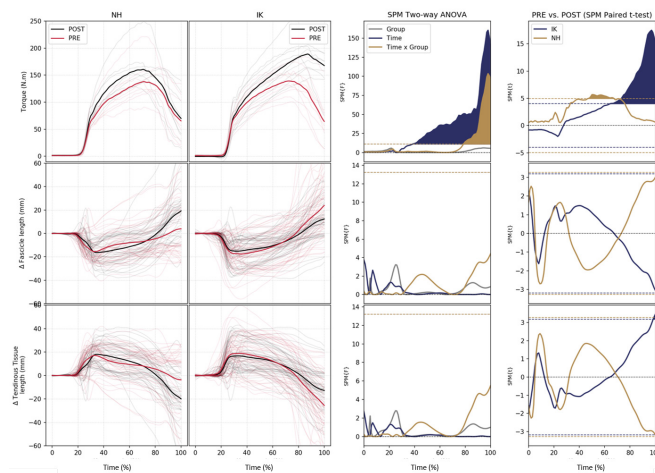
Effects Of An 8-week Nordic Hamstring Vs. Isokinetic Eccentric Training Intervention On Biceps Femoris Muscle-tendon Interactions

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(No relevant relationships reported)

Resistance eccentric training triggers adaptations in both active and passive elements of the muscle tendon unit (MTU). Previous research highlight the buffering role that tendinous tissues may play to mitigate muscle strain and to optimize operating fascicle lengths. However, the effects of eccentric training on the muscle-tendon interactions of the *biceps femoris* remain unexplored. **PURPOSE:** To evaluate the effects of eccentric training on torque and muscle-tendon interactions of the *biceps femoris* muscle during lengthening contractions. **METHODS:** Eighteen participants completed an 8-wk standardized eccentric training intervention comprising 15 sessions of Nordic Hamstring (NH) or isokinetic leg curl (IK; n=10) exercise. Pre and post training, torque and fascicle, tendinous tissue and MTU length of the *biceps femoris* muscle were measured during maximal 70° lengthening knee extensions at 60°.s⁻¹. One sample t-test statistical parametric mapping (SPM) analyses were performed to evaluate fascicle and tendon behaviour during the contractions. Training effects were evaluated with two-way repeated measures ANOVA and paired t-test SPM. **RESULTS:** Both groups increased torque from 38% to 100% of the contraction duration, with greater improvements in IK from 78.5 to 100% (p < 0.001). The contribution of tendinous tissue to MTU length changes slightly increased only in IK at the last 2% of the contraction (p = 0.04). Despite opposite trend changes in NH, no training effects on fascicle or tendon behavior occurred. The tendinous tissues contribution to MTU lengthening was greater than fascicles up to 75% of the contraction. The fascicles contribution progressively augmented at the end of the contraction (p < 0.05). **CONCLUSION:** We provide novel findings on the muscle-tendon interactions of the *biceps femoris* muscle during lengthening contractions. A 15-session eccentric training program comprising NH or IK exercise does not seem to affect muscle-tendon interactions.



1014 Board #140 May 27 1:30 PM - 3:00 PM
Relationships Between Body Mass Normalized Abdominal Wall Thickness And Self-reported Activity And Global Health

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(No relevant relationships reported)

The anterolateral abdominal wall, rectus abdominis (RA), external oblique (EO), and internal oblique (IO), contributes to lumbopelvic-hip strength; and its role in injured populations such as low back pain has been well explored. However, it is important to establish the association between a body mass normalized measure of muscle size with overall physical activity in a healthy population due to their utility as a frequently used control group and for the potential of this measurement technique in aging, resistance training, and abdominal fat assessment.

PURPOSE: To determine relationships between muscle thickness (at rest and during contraction) of RA, EO, IO and patient-reported outcome measures on physical activity and health. **METHODS:** Eight active participants with no history of low back or lower extremity injury (23.1±5.4yrs, 171.1±11.3cm, 70.6±15.1kg, 4F) completed a single imaging session of RA, EO, and IO. Before imaging, participants completed the PROMIS Global Health (GH), PROMIS Physical Function (PF), and International Physical Activity Questionnaire Short Form (IPAQ). Ultrasound images were collected at rest while supine, hook-lying and during contraction with participants instructed to perform an abdominal crunch for RA, and crunches toward either knee for EO and IO. Thickness measures were normalized to body mass (kg). Pearson's r correlation coefficients were used to determine relationships. **RESULTS:** Six of the 8 participants scored high on the IPAQ (≥3000 METmin/week) and the rest were moderate (≥600 METmin/week). The average hrs/day participants spent sitting was 4.6±2.3hrs. The PROMIS GH (37.5±4.7) and PROMIS PF (98.9±2.4) both confirmed overall health and activity levels. Right side EO at rest (r=.74, p=.04) and during contraction (r=.84, p=.01) were strongly related to hours spent sitting per day. **CONCLUSIONS:** Normalized EO muscle thickness was found to increase, at rest and during contraction, as healthy, active individuals sat longer. Although this was the only significant correlation, this controversial finding may be explained due to the relative 17.4% decrease in EO activity on the right side, compared to the left. The connection between the abdominal wall and self-reported physical activity is important to distinguish, especially with a body mass normalization technique.

1015 Board #141 May 27 1:30 PM - 3:00 PM

Kinematic Analysis Of Single-leg Hopping In Adults With And Without Autism Spectrum Disorder

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(No relevant relationships reported)

Purpose: Adults with Autism Spectrum Disorder (ASD) may be predisposed to deficient biomechanics or neuromuscular control. This study compared the biomechanics of adults with and without ASD completing a single-leg hopping task. We hypothesized that adults with ASD would demonstrate deficient biomechanics (i.e., decreased pelvic control and greater dynamic limb valgus) compared to adults without ASD.

Methods: 10 participants with ASD (8 male; mean age 23.3, SD ± 3.8) and 10 without ASD (8 male; mean age 21.5, SD ± 2.5) were included in this analysis. 3D motion capture data were collected while participants performed five consecutive single-leg hops. Two of the middle hops were analyzed and kinematic values were averaged across hops. Dynamic limb valgus and frontal plane pelvis range of motion were compared between groups using independent samples t-tests.

Results: No statistically significant differences were observed between the individuals with and without ASD (Table).

Conclusion: Our hypothesis was not supported. Individuals with ASD did not demonstrate deficient biomechanics during the single-leg hopping task when compared to individuals without ASD. The high-level of function of the adults with ASD in the present study may be related to their proficient hop performance. It is also possible other biomechanical variables not presently measured may highlight differences in performance between populations. The present results suggest adults with ASD have similar biomechanics as adults without ASD, though further study is needed.

Table: Comparison of Kinematic Variables Between Groups

	ASD (n=10)*	Non-ASD (n=10)*	Between-Group Differences	p-value
Pelvis ROM	-8.3±2.81	-6.7±2.35	-1.6	0.194
Hip flexion	45.7±8.69	45.9±11.03	0.2	0.965
Hip adduction	8.1±3.99	4.4±4.81	-3.7	0.077
Hip internal rotation	6.6±6.16	9.3±5.6	2.7	0.321
Knee abduction	7.1±4.81	3.6±3.94	3.5	0.100
Knee flexion	50.1±8.77	49.9±5.78	0.2	0.888
Ankle dorsiflexion	24.4±2.98	22.01±6.52	2.4	0.4
Abbreviations: ASD=Autism Spectrum Disorder, ROM = range of motion				
*Values are mean±SD degrees				

1016 Board #142 May 27 1:30 PM - 3:00 PM
Abstract Withdrawn

B-72 Free Communication/Poster - Pitching, Throwing, and Hitting
 Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

1017 Board #143 May 27 1:30 PM - 3:00 PM
The Relationship Of The Kinematic Sequence And Shoulder Compression Forces During Fastpitch Softball
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Reported Relationships: D.M. Scarborough: Salary; FIGUR8, Inc. Ownership/interest/stock; future stock options.

INTRODUCTION: The Kinematic Sequence (KS) refers to the order of peak angular velocities of connected body segments during a specific movement. There are many possible KS patterns. The proximal-to-distal sequence (PDS) KS ordered: pelvis->trunk-> arm-> forearm-> hand is reported as the most efficient pattern for overhead throwing. Simulation studies report that the PDS KS results in reduced torques across the joints of the overhead throwing limb, potentially reducing risk of injury. Another KS is the PDS Variant which has a similar PDS pattern of pelvis-> trunk-> arm->, but with simultaneous forearm & hand peak velocities. A third KS pattern, Delayed CORE, demonstrates delayed peak velocity of the trunk: pelvis-> hand -> trunk-> simultaneous arm & forearm. While the PDS KS concept is instructed in fastpitch softball pitching, KS studies have not been published. The study purpose was to investigate the KS in a group of fastpitch softball pitchers.
METHODS: 3D biomechanical analyses using high-speed motion capture cameras (240Hz) were performed on 140 fastball pitches from 21 softball pitchers (16 high school, 5 collegiate, mean age 16.15 ± 2.31 y). For each fastball pitch, Visual 3D v6 biomechanical analysis software calculated the peak angular velocity of the pelvis, trunk, arm, forearm and hand after the time of stride which allowed KS identification. Shoulder compression forces and stride length was also calculated for each of 3 primary groups of fastball pitches PDS n=12, PDS Variant n= 28 and the Delayed CORE n= 27. ANOVA and T-test comparisons were performed.
RESULTS: There were no significant differences in stride length between the 3 KS patterns, p = 0.14. The Delayed CORE KS pattern demonstrated statistically significantly greater shoulder compressive force than the other groups, mean= 8.23 ± 1.04 (F(2,64)= 23.45, p< 0.01). There were no differences in shoulder compression forces between the PDS (6.89BW ± 0.5) and the PDS Variant (6.74BW ± 0.73) group, p= 0.524.
CONCLUSION: This foundational study is the first to apply a KS classification system to the fastball softball pitch. Use of the PDS or PDS Variant KS promoted less shoulder compression force than the Delayed CORE group. The KS classification system could potentially guide underhand pitching instruction for injury prevention.

1018 Board #144 May 27 1:30 PM - 3:00 PM
A Comparison Of Pitch Velocity And Elbow Valgus Torque Between Collegiate Baseball Pitchers Trained With And Without Weighted-ball Exercises
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(No relevant relationships reported)

Several training strategies have been suggested and evaluated for their effects on baseball pitching performance and injury risk. There is some data in the current literature which indicates that plyometric based weighted-ball training is effective at altering the kinematics and kinetics of the throwing motion. However, it is unclear whether weighted-ball trained pitchers throw faster with lower joint kinetics than those trained otherwise. **PURPOSE:** To compare throwing velocity and maximum elbow valgus torque (MEV) between collegiate male baseball pitchers trained with weighted-ball exercises and those without. It was hypothesized that weighted-ball trained pitchers exhibit higher throwing velocity and MEV than pitchers trained without weighted-ball exercises. **METHODS:** Twenty-one collegiate baseball pitchers participated in this study, 13 of whom trained using weighted baseballs and 9 of whom trained without weighted baseballs as part of their in-season training regimen. After providing written informed consent, each participant threw 15 fastballs while ball speed and MEV were measured using a radar gun and a wearable inertial measuring unit (IMU), respectively. **RESULTS:** There was no significant difference in ball speed between weighted-ball trained pitchers (36 ± 1 m/s) and non-weighted-ball trained pitchers (35 ± 3 m/s, p = .108). Conversely, weighted-ball pitchers threw with greater MEV (110 ± 28 N-m) than non-weighted-ball trained pitchers (52 ± 6 N-m, p < 0.001). **CONCLUSION:** These findings suggest that pitchers who train using weighted-ball exercises throw at ball speeds comparable to those who do not but may do so at a higher risk of a pitching-related elbow injury.

1019 Board #145 May 27 1:30 PM - 3:00 PM
The Relationship Of Stride Length And Joint Stresses Among Adolescent Female Fastpitch Softball Pitchers
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(No relevant relationships reported)

PURPOSE: During the softball windmill pitch delivery, power is generated from the lower extremities and transferred up through the kinetic chain out to the throwing hand. At time of stride, the lead lower extremity incurs significant momentum breaking forces that could contribute to injury risk. Joint angle positions at the time of stride may vary based on stride length and extreme ranges of stride length may correlate with biomechanics that are associated with vulnerability to injury. This study investigates the relationship between stride length and 1) joint angles of the lead lower extremity at time of stride and 2) peak joint torques of the lead hip and throwing shoulder during the softball windmill pitch.
METHODS: 17 pitchers (mean age= 15.4 ± 1.4 y) underwent 3D biomechanical analysis of 80 fastballs using a 20 motion capture camera system (Vicon Motion Systems Ltd UK) at 240 hz. A 15-segment whole-body model for each pitcher was created. Ankle, knee, hip, and pelvis angles of the lead lower extremity and peak hip and shoulder torques at time of stride were calculated within a biomechanical analysis software (Visual 3D v6, C-Motion). Analyses included 2-tailed Pearson correlations. **RESULTS:** Stride length correlated positively with peak shoulder external rotation torque (r= 0.245, p= 0.029), lead ankle eversion/inversion, and hip flexion/extension angle at time of stride. Stride length negatively correlated with lead knee valgus/varus, hip abduction/adduction, hip rotation, and pelvis flexion/extension angle at the time of stride (Table 1). No other correlations were observed.
CONCLUSION: The most prevalent reported injuries among softball pitchers occur at the shoulder, hip, and low back. Study findings suggest that pitch instruction on lead leg joint position at time of stride as well as stride length may be important for injury prevention during fast pitch softball pitching.

Table 1: Correlation of Joint Angles to Stride Length

Joint	Angle	Average (°) ± SD	Correlation Coefficient	P value
Ankle	Eversion (+)/ inversion (-)	-22.71 ± 10.29	.265	0.018*
Knee	Valgus (+)/ Varus (-)	10.08 ± 5.00	-.320	0.004*
Hip	Flexion (+) / Extension (-)	40.90 ± 11.21	.499	<0.001*
	Abduction (+) / Adduction (-)	17.99 ± 8.74	-.262	0.019*
	External Rotation (+) / Internal Rotation (-)	6.20 ± 8.47	-.228	0.042*
Pelvis	Flexion (+) / Extension (-)	-9.44 ± 9.78	-.401	<0.001*

* reached established level of significance p<0.05

1020 Board #146 May 27 1:30 PM - 3:00 PM

Effects Of A 6 Week Balance Training Program On Throwing Velocity And Joint Kinetics In Collegiate Baseball Pitchers

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(No relevant relationships reported)

It is known that high elbow valgus torque in the pitching motion can contribute to the occurrence of elbow injury. Lately, studies have shown pitchers with UCL tears had significantly lower balance measures than healthy players when tested after injury occurred. There is a paucity of research on the effect of balance-specific training on the joint loading of the elbow and player performance in baseball pitching.

PURPOSE To investigate the effect of a balance training intervention on the biomechanical factors that can contribute to a pitcher's increased risk of elbow injury. **METHODS** Thirteen collegiate baseball pitchers were randomly assigned to a training group: control or intervention. The control group did only the team training and the intervention group did the team training and a specific balance training program. The intervention was performed 3 times a week for 6 weeks. Measurements of balance (Y-Balance), limits of stability (center of pressure excursion), ball speed, and joint kinematics and kinetics, specifically maximum elbow valgus torque (MEV), through motion capture were collected before and after the 6-week training program. **RESULTS** None of the outcome measures showed a significant difference between training type (Y-Balance $p=.405$; COP excursion $p=.537$, ball speed $p=.150$; MEV $p=.945$). Three outcome measures, COP excursion ($p=.007$), ball speed ($p=.003$), and MEV ($p<.001$) showed significant decreases over time regardless of training type. A Pearson Correlation was run for the entire study population ($n=13$) between ball speed and MEV for initial ($p=.409$) and final ($p=.300$) testing and showed no significant correlation between the variables. **CONCLUSION** The balance training program had no observable effect on a pitchers' pitching performance or elbow kinetics. There was no significant difference between groups in pre or post measures, therefore, any change in balance measures can be attributed to normal in-season training strength development.

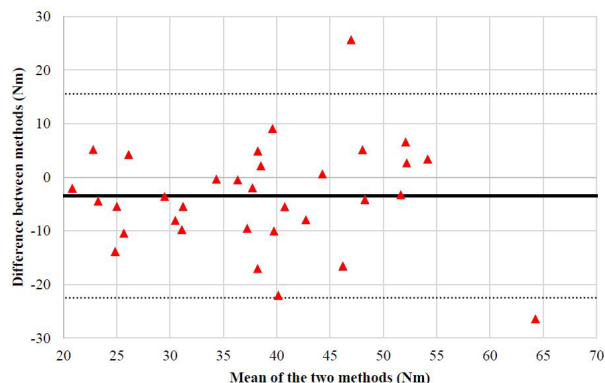
	Pre-Intervention	Post-Intervention
<i>Y-Balance</i>		
Control	123.1 ± 9.7 cm	124.5 ± 11.9 cm
Intervention	119.0 ± 7.7 cm	122.0 ± 9.6 cm
<i>COP Excursion</i>		
Control	160.5 ± 33.9 cm	129.4 ± 4.3 cm
Intervention	152.4 ± 24.7 cm	131.1 ± 13.0 cm
<i>Ball Speed</i>		
Control	81.2 ± 3.2 mph	77.9 ± 3.8 mph
Intervention	81.1 ± 2.6 mph	73.5 ± 3.4 mph
<i>Maximum Elbow Valgus</i>		
Control	103.6 ± 28.6 Nm	64.5 ± 8.7 Nm
Intervention	117.0 ± 27.2 Nm	77.0 ± 13.7 Nm

1021 Board #147 May 27 1:30 PM - 3:00 PM

Validation Of A Wearable Sensor In The Estimation Of Elbow Valgus Torque During Baseball Pitching

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(No relevant relationships reported)

Because of its relationship to pitching-related elbow injuries, the valgus torque at the elbow during baseball pitching has been a measure of interest that has clinical implications for the assessment and treatment of ulnar collateral ligament (UCL) injuries in pitchers. However, there currently is no feasible method to quantify elbow valgus torque in game-like settings. **PURPOSE:** To estimate the concurrent validity of a wearable sensor in measuring valgus torque at the throwing elbow during the pitching motion. **METHODS:** After providing informed consents, thirty-four adolescent pitchers threw 10 fastballs from a regulated mound while the joint kinematics and kinetics were simultaneously being measured with a 3D motion capture system and an inertial measurement unit (IMU) sensor, which was used to specifically estimate elbow valgus torque during baseball pitching. The Pearson correlation and Bland-Altman charts were used to estimate the concurrent validity and degree of accuracy of the IMU using the 3D motion capture system as the criterion method. **RESULTS:** The concurrent validity of the IMU in measuring elbow valgus torque was moderate ($r = 0.686$, $p < 0.01$) with a mean error of -3.48 N·m (Fig. 1). **CONCLUSION:** The wearable sensor was found to have moderate concurrent validity in estimating elbow valgus torque, the magnitude of which was underestimated by the sensor.



1022 Board #148 May 27 1:30 PM - 3:00 PM

Relationship Between Kinematics, Strength, And Throwing Velocity Of Adolescent Softball Players During Overhand Throwing

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The kinematics of overhand throws by adolescent softball players is currently under-reported. Identifying the relationship between kinematics, strength and velocity can help guide further research and promote better understanding of the sport. Current research has investigated the differences between softball and baseball but has not looked at how kinematics and strength correlate with throwing velocity in softball. **Purpose:** To identify the relationship between kinematics, strength, and velocity of an overhand throw in adolescent softball players. **Methods:** 25 adolescent softball players performed 3 maximum effort overhand throws. The throws were filmed using a 2-D video analysis system consisting of 3 cameras set up in the frontal and sagittal planes. The velocity of the throws were recorded using a speed gun. Key positions were identified in six throwing phases and angles were measured using software on a tablet. Bilateral hip and shoulder strength of each player were measured using standardized methods via handheld dynamometer. Correlation coefficients were determined. **Results:** A moderate and significant correlation was found between the velocity of overhand throw and the stride knee flexion angle during the arm cocking phase ($r = .55$, $p = .004$), the stance knee flexion angle during stride phase ($r = .49$, $p = .015$), and the elbow flexion angle during arm acceleration phase ($r = -.45$, $p = .024$). A moderate and significant correlation was found between trunk flexion angle during follow through phase and hip internal rotation ($r = -.45$, $p = .04$) as well as hip external rotation ($r = -.53$, $p = .013$) strength. **Conclusion:** Increases in velocity were influenced by lower extremity variables including increases in stride knee flexion angle during the arm cocking phase and increased stance knee flexion during stride phase. Upper extremity

variables that related to higher velocity included decreased elbow flexion at the end of acceleration phase. Strength parameters including hip internal and external rotation strength were found to be related to higher velocities. These findings highlight the potential influence of lower extremity kinematic variables and strength on performance as measured by velocity. These results can benefit players or coaches who are teaching or learning how to do the overhand throw.

1023 Board #149 May 27 1:30 PM - 3:00 PM

Effects Of Weighted Baseball Throwing On Youth Glenohumeral Joint Reaction Force

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(No relevant relationships reported)

INTRODUCTION: Weighted baseball throwing programs are often used to increase pitch velocity. However, increased injury risk has been reported and questions regarding possible mechanism of injury exist. Kinematics and kinetics have been investigated with inverse dynamics approach, but the effects of individual muscle forces have rarely been taken into account by these models and in consideration of pitch mechanics. Analysis of shoulder joint reaction force with a musculoskeletal model including individual muscle forces may provide new insight on injury mechanism.

PURPOSE: To compare the effects of varied weighted baseballs on glenohumeral (GH) joint reaction forces during youth pitching.

METHODS: 7 baseball pitchers (Age 15.7 ± 2.4) participated in the study. Participants performed 5 pitches for strikes with 5oz, 7oz, and 9oz baseballs. Full body, 3D segment position data were collected using a motion capture system (200 Hz) and ball velocities were measured via radar gun. Highest velocities of 3 pitches were selected and 3D marker trajectories input into a 19 DOF musculoskeletal model utilizing a standard inverse dynamics and static optimization routine to produce individual muscle forces to yield GH joint reaction forces. Mean distraction force, anterior shear force, and superior shear force on GH joint were calculated and compared with RMANOVA (alpha = .05) during the acceleration phase of the pitch with Bonferroni post-hocs.

RESULTS: Differences were noted between the ball weights on ball velocity (5oz 66.9 ± 8.8mph, 7oz 61.6 ± 7.8 mph, 9 oz 56.9 ± 6.1 mph, p<0.001). Also, throwing heavier baseballs exhibited increased distraction forces (5oz 1987±472.5N, 7oz 2386±544.1N, 9oz 2414±601.1N, p = 0.007); while anterior shear force and superior shear force did not present distinct differences.

CONCLUSIONS: Distraction force pulls humeral head out of the glenoid fossa, and weighted baseball throwing program may cause more stresses on biceps brachii, rotator cuff, and surrounding structures by the increased distraction force.

1024 Board #150 May 27 1:30 PM - 3:00 PM

The Kinematic Sequence Of The Baseball Bat Swing And Associated Upper Extremity Torques

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(No relevant relationships reported)

PURPOSE: The Kinematic Sequence (KS) is the timing of peak angular velocities generated across connected body segments during a movement pattern. The most efficient KS reported in sport is when the timing occurs in a proximal-to-distal (PDS) pattern. This 'ideal' KS follows the order of pelvis, trunk, arm, forearm, and hand. Based on simulated models of the golf swing, the PDS KS results in greater ball distance and decreased joint stresses. Despite similarities to the golf swing, there is limited research on the KS during batting. Study aims: 1) Identify KSs during the baseball swing and 2) compare the leading upper extremity torques across the 3 primary KSs.

METHODS: 23 baseball players (professional=2, collegiate=11, high school=10) underwent 3D biomechanical swing analysis, totaling 47 trials. A 15-segment model was constructed using a 20 Vicon™ camera motion capture system (240 hz). Body segment and bat velocities as well as peak shoulder and elbow torques were calculated using Visual 3D™ biomechanical software. Time of peak angular velocity of the pelvis, trunk, arm, forearm, and hand was recorded. The torques were compared across the two most performed KS patterns as well as the KS representing the closest to a PDS pattern. The KS patterns were labeled by the first body segment that disrupted the PDS pattern: proximal (PUE) and distal (DUE) upper extremity. Analyses included an ANCOVA using bat velocity as a covariant.

RESULTS: 11 unique KS patterns were identified. The most commonly performed KSs were DUE (n=23) then PUE (n=13). No batter displayed the exact PDS KS. Therefore, 5 trials that most closely represent the PDS, those with forearm and hand velocities peaking simultaneously, were grouped as PDS. Peak elbow extension torque

differed significantly between the 3 KS groups ($F(2,37)=4.95$, $\eta^2=0.21$, $p=0.012$) with lower values for PDS (PDS: 17.94 ± 12.83 Nm, PUE: 51.09 ± 25.19 Nm, DUE: 43.01 ± 22.26 Nm, $p=0.012$).

CONCLUSIONS: This foundational study is the first to apply a KS classification system to the baseball swing. Lower elbow extension torques for the PDS group are consistent with the idea that a PDS KS may result in decreased joint stress. KS analyses could potentially guide clinicians and hitting instruction to minimize biomechanical risk factors during batting.

B-73 Free Communication/Poster - Sports Biomechanics

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

1025 Board #151 May 27 1:30 PM - 3:00 PM

The Measurement Of Thrust In Competitive Swimming: The Association Between Different Thrust Variables

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Swimming acceleration and velocity are the net balance between Drag Force and Thrust. It is a standard procedure to do the decomposition of the Thrust-Time curve, assessing the swimmer's thrust. However, there is not a convention or standard procedure on the variables to be selected. Researchers report on regular basis either the Peak Thrust, Mean Thrust or Thrust-Time Integral. It is yet unclear to which extend these variables can be used, reported and interpreted interchangeably. **PURPOSE:** To analyze the association between different thrust variables performing arm-pulls in competitive swimming. **METHODS:** 671 front-crawl arm-pull cycles of 14 competitive swimmers were analyzed. Thrust was collected by an in-house built system composed by differential pressure sensors and underwater camera (Aquanex, Swimming Technologies, USA). A customised software (LabVIEW®, v.2017) was used to acquire ($f=50$ Hz) and streaming time-series and video signal. Data was transferred to interface by a 14-bit resolution acquisition card (NI-6001, National Instruments, Austin, USA). Then, it was imported into a signal processing software (AcqKnowledge v.3.9.1, Biopac Systems, USA). It was extracted the Peak Thrust, Mean Thrust and Thrust-Time Integral of each arm-pull. Coefficients of Determination were computed between the three thrust variables. **RESULTS:** All Coefficients of Determination were significant ($P<0.001$). Peak Thrust vs. Mean Thrust was $R^2=0.49$, Peak Thrust vs. Force-time Integral $R^2=0.51$, and Force-time Integral vs. Peak Thrust $R^2=0.61$. Interception on Y-axis at the origin of the pairwise variables noted in the same SI unit (i.e. Newton) were very close to zero (-1.6948<c<4.5029) and standard error of estimate acceptable (6.54<S<12.14). **CONCLUSIONS:** There is a strong association between different thrust variables, even though the proportion of the variance is about 50-60%. Supported by: NIE AcRF Grant (RI 6/17 TB); Portuguese Foundation for Science and Technology (UID/DTP/04045/2019); European Fund for regional development (FEDER)-COMPETE 2020 (POCI-01-0145-FEDER-006969).

1026 Board #152 May 27 1:30 PM - 3:00 PM

Power Parameters Appear Less Important To Water Polo Success Than Motor Control

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(No relevant relationships reported)

Conditioning programs for water polo players typically focus on muscular power to enhance the wrestling and shooting components of play. While improvements in strength training are easily quantifiable, the relationship between upper limb power and in-game performance has yet to be established. **PURPOSE:** To test the effect of upper limb force parameters on offensive performance in women's water polo players. **METHODS:** We conducted biomechanical testing on 12 D1 women's water polo players using Proteus (Proteus Motion, USA). After completing a familiarization and warm-up protocol, subjects performed a single set of 10 repetitions at 3lb of magnetic resistance in 3 different exercises: shoulder adduction, internal rotation of the shoulder while in horizontal abduction, and a throw motion. Proteus calculated peak power (PP), peak force development rate (PFDR), and consistency (accuracy of movement

replication in 3D space during successive repetitions). The corresponding season statistics (2018-2019) were tabulated for assists, goals scored, and shooting percentage. Descriptive statistics characterized the sample; linear regressions tested the effect of PP, PFDR, and consistency on in-game performance. **RESULTS:** During the test season, players scored 23.1 ± 19.9 goals, had a shooting percentage of $41.6 \pm 12.1\%$, and accomplished 10.5 ± 10.9 assists. In the throw motion, Proteus calculated a PP of 59.2 ± 15.5 watts, PFDR of 104.3 ± 33.0 watts/sec, and consistency of $81.0 \pm 8.7\%$. PFDR exhibited negative relationships with goals scored ($p=0.021$) and shooting percentage ($p=0.049$), and a non-significant negative relationship with assists ($p=0.111$). Similar relationships were found with throw PP as well as PP and PFDR in shoulder adduction and internal rotation; all corresponded to worse performance in every performance metric. Consistency in all motions had a positive, non-significant relationship with all performance metrics; statistical trends were reached with horizontal shoulder adduction in which consistency predicted 7.1% more goals ($p=0.062$) and 8.8% more assists ($p=0.050$). **CONCLUSIONS:** These data provide preliminary evidence that skill-based fine motor coordination may be more valuable than power development in offensive performance in women's water polo.

1027 Board #153 May 27 1:30 PM - 3:00 PM
Core Temperature While Swimming In A Wetsuit During 1000-m Race Pace Swim

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(No relevant relationships reported)

Majority of fatalities that occur in the sport of triathlon happen during the swim portion of the race (Harris et al., 2010, JAMA). The potential risk of death while swimming has raised safety concerns. The governing body, USA Triathlon (USAT), has implemented guidelines related to water temperatures and the use of wetsuits. The varying water temperatures allow for a wide selection of wetsuits. Using a wetsuit while swimming in warm water may increase body heat storage which could increase core temperature. Currently, there are only limited data on the influence of triathlon wetsuits on core temperature when swimming in warm water while swimming a short distance at a somewhat hard swim pace (Aura et al., 2019, MSSE). **PURPOSE:** The purpose of this study was to examine core temperature while swimming a long distance (1000 m) at a fast pace in warm water (25.5°C) while wearing a wetsuit. **METHODS:** Two experienced triathletes (mean \pm standard deviation (SD), age 38.5 ± 23.3 years, height 1.83 ± 0.03 m, weight 80.1 ± 1.1 kg) participated in the study. At least 8 hours prior to attending the test session, participants swallowed an ingestible core temperature pill (BodyCap). Before beginning data collection, core temperature (T_c) data were transferred to a computer and sample rate was set to 0.1 Hz (1 sample every 10 s). Testing consisted of a self-directed warm up of 250-m followed by a 1000-m swim in an indoor pool (set to 25-m length) for each condition: no wetsuit (NW) and full sleeve wetsuit (FS). Participants swam at a self-selected pace at a "race pace" intensity (Borg Rating of Perceived Exertion = 16). Participants were required to rest until core temperature was within 0.5°C of baseline before starting the next condition. Core temperature data were transferred to a computer after each swim. Average T_c of each swim was computed for analysis. **RESULTS:** The average core temperatures of NW and FS were $37.75 \pm 0.11^\circ\text{C}$ and $37.74 \pm 0.46^\circ\text{C}$, respectively. The total swim time for the NW and FS conditions were $14:04 \pm 1:43$ and $13:05 \pm 1:06$ minutes. Mean stroke rate calculated for NW and FS were 30.12 ± 0.17 and 30.68 ± 0.45 strokes per minutes. Average swim speeds for NW and FS were 1.19 ± 0.15 and 1.28 ± 0.11 meters per second. **CONCLUSIONS:** Based upon the analysis of the results, the use of a wetsuit while swimming in warm water does not influence core temperature.

1028 Board #154 May 27 1:30 PM - 3:00 PM
Is There An Optimal Vertical Ground Reaction Force Profile For Maximizing Jump Height In A Countermovement Jump?

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PURPOSE: The vertical ground reaction force (VGRF) during a countermovement jump (CMJ) is classically described with a single peak force occurring at the low position of the countermovement. However, in practice, jumpers display a variety of CMJ VGRF profiles, including single and double peaks, and jumps where the peak force occurs at, or after, low position. The purpose of this study was to identify the optimal CMJ VGRF profile for maximizing jump height.

METHODS: The top 100 CMJs (based on jump height) from a database of over 2000 jumps, from 211 division one college athletes were analyzed. The 100 athletes (21 \pm 3 yr, 96 men) were from several different sports teams (hockey n=33, lacrosse n=25, soccer n=14, basketball n=14, other n=14). All jumps were performed with the hands

on the hips. Jumps were categorized as having a single or a double peak in VGRF and whether the peak GRF occurred at, after, or before low position. Jump heights were categorized as above average (1SD=mean), average (within 1SD of mean), or below average (1SD<mean). The association between jump metrics and VGRF profiles was examined using chi square analyses and independent t-tests.

RESULTS: Of the 100 CMJs 22 had a single peak VGRF, of which 14 occurred at low position and 8 occurred after low position. Of the 78 CMJs with a double peak, the 1st peak was higher in 47 jumps (30 at low position, 13 after low position, 4 before low position), the peaks were equal in 20 jumps (10 at low position, 10 after low position), and the 2nd peak was higher in 11 (all after low position). Peak GRF occurred at the low point of the countermovement for 82% (14 of 17) of the above average jumps versus 52% (33 of 64) of the average jumps and only 37% (7 of 19) of the below average jumps ($P=0.007$). For the 78 jumps with two distinct VGRF peaks the 1st peak was greater than the 2nd for 77% (10 of 13) of above average jumps, 61% (30 of 49) of average jumps and only 44% (7 of 16) of below average jumps ($P=0.033$).

CONCLUSIONS: The optimal VGRF profile appeared to be peak force occurring at low position regardless of whether there was a single or double peak. The worst VGRF profile appeared to be jumps with two peaks where the 2nd peak was greater than the 1st peak, or the 1st and 2nd peaks were equal, but the 1st peak occurred after low position. In conclusion, achieving peak VGRF at the low position of a CMJ appears to be optimal.

1029 Board #155 May 27 1:30 PM - 3:00 PM
Effect Of Countermovement Depth On The Neuromechanics Of A Vertical Jump

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PURPOSE: The purpose of this study was to examine kinematic, kinetic and muscle activation metrics during countermovement jumps (CMJs) with varying countermovement depths. The hypothesis was that a shallow countermovement depth would compromise jump height by disrupting neuromechanical control.

METHODS: Ten healthy men (age 26 ± 8 yr, height 1.81 ± 0.08 m, mass 83.5 ± 9.0 kg) performed maximal CMJs at self-selected countermovement depth (self-selected CMJ), at reduced countermovement depth (shallow CMJ) and at increased countermovement depth (deep CMJ). Three jumps were performed in each condition on force plates with ankle, knee and hip motion recorded and electromyograms (EMG) recorded from the gluteus maximus (GM), vastus lateralis (VL) and medial gastrocnemius (MG) muscles. During CMJs knee flexion angle was recorded with an electrogoniometer. Jumpers were instructed to flex 15% less (shallow CMJ) and 15% more (deep CMJ) than the self-selected CMJs. Kinematic, kinetic and EMG metrics were compared between the different CMJ depths using repeated measures ANOVA.

RESULTS: Compared with self-selected CMJs, shallow CMJs had 26% less countermovement depth (9.5 cm less, $P<0.001$) and the deep CMJs had 28% greater countermovement depth (10.2 cm more, $P<0.001$). Jump height was 8% less for the shallow vs. self-selected CMJs (0.344 m vs. 0.373 m, diff 2.9 ± 2.5 cm, $P=0.007$) but not different between self-selected and deep CMJs (0.373 m vs. 0.378 m, diff 0.05 ± 0.19 cm, $P=0.254$). Shallow CMJs differed from self-selected CMJs at the initiation of the countermovement (unweighting phase). For self-selected CMJs force dropped to 43% of body weight during unweighting but only to 58% for shallow CMJs ($P=0.015$). During unweighting VL EMG averaged 5.5% of MVC during self-selected CMJs versus 8.1% for shallow CMJs ($P=0.014$). Percent decline in jump height with shallow versus self-selected CMJs was correlated with the difference in VL EMG during unweighting between shallow and self-selected CMJs ($r=0.651$, $P=0.041$). **CONCLUSIONS:** Failure to deactivate the quadriceps during the unweighting phase of shallow CMJs compromised unweighting and resulted in a reduced jump height. These findings highlight the importance of unweighting at the initiation of the countermovement in dictating subsequent jump performance.

1030 Board #156 May 27 1:30 PM - 3:00 PM
Task Intensity Alters How Anterior Knee Pain Influences Frontal-plane Hip Biomechanics During Landing And Jumping

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Anterior knee pain (AKP) often affects individuals participating in activities involving high-intensity landing and jumping. Task intensity may alter the influence of AKP on lower-extremity landing and jumping biomechanics. **PURPOSE:** Determine whether

task intensity affects the influences of AKP on frontal-plane hip biomechanics during landing and jumping. **METHODS:** 13 healthy adults (6 females, 7 males; 70 ± 15 kg; 1.7 ± 0.1 m; 22 ± 2 years) performed three land and jump trials under three conditions: pre-pain, pain (1-ml hypertonic saline (5% NaCl) injection into the right infrapatellar fat pad), and post-pain. Subjects jumped over an obstacle, landed on a force plate, then jumped over a second obstacle. Obstacle heights of 80 and 50% of maximal vertical jump height defined high and low task intensities. Frontal plane hip angles and internal moments were calculated for the right leg. A functional analysis ($\alpha=.01$) was used to evaluate differences between conditions for each intensity, across the duration of foot contact with the force platform (ground contact). **RESULTS:** For the high intensity task, AKP resulted in increased hip adduction angle, as much as 2° between 1-20% and 75-95% of ground contact, and increased hip abduction moment, up to 6 Nm between 10-30% of ground contact (Figures 1E-F). For the low intensity task, AKP resulted in decreased hip adduction angle, as much as 1.3° between 25-75% of ground contact, and decreased in hip abduction moment, as much as 15 Nm between 25-60% of ground contact (Figure 1G-H). Changes due to AKP persisted after pain abatement (Figures 1I-L). **CONCLUSIONS:** Experimental AKP effects frontal plane hip biomechanics and these effects differ between task intensity. Especially during the high-intensity task, the AKP resulted in increased hip adduction angle and internal abduction moment. More data are needed to determine how/if the present changes influence the risk of chronic knee injury/disease.

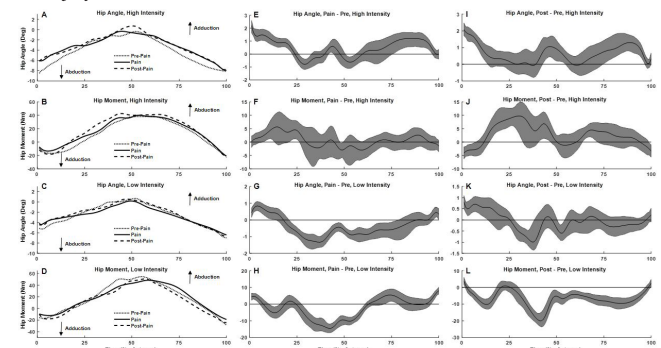


Figure 1. Grand ensembles for each condition and each intensity (A-D). Results of condition comparisons, pain minus pre-pain (E-G) and post-pain minus pre-pain (H-K). For plots E-K, mean differences and corresponding 95% confidence intervals are plotted as a function of time. When shaded area does not cross the zero line, condition differences exist ($p<.05$).

1031 Board #157 May 27 1:30 PM - 3:00 PM
Breast Support Alters Knee Joint Biomechanics During A Landing Task.

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Females have a greater rate of traumatic knee injuries than male athletes. Trunk position has been shown to affect knee joint biomechanics during a landing task. Given the position of breast tissue, insufficiently supported breasts may also alter knee joint biomechanics. However, no previous research has investigated the effect of breast tissue or support on knee joint biomechanics during landing. **PURPOSE:** to determine the effect of breast support on knee and hip joint kinetics during a landing task. **METHODS:** Fifteen female athletes performed five step-off landings from a height of 40 cm in each of three bra support conditions: control (CON), low support (LOW) and high support (HIGH). 3D kinematics and ground reaction forces (GRFs) were simultaneously recorded using a 9-camera motion capture system (240 Hz.) and pair of force platforms (1200 Hz.) was used to calculate knee and hip joint angles and moments. Custom software (was used to determine peak joint angles and moments. Repeated measures ANOVAs with Tukey's post-hoc analyses were used to compare mean knee and hip joint kinetics. **RESULTS:** No differences in peak knee abduction moments were observed, though peak knee external rotation moments were smaller in the LOW compared to CON ($p = 0.007$) and HIGH conditions ($p = 0.013$). No differences were observed between CON and HIGH ($p = 0.423$). No differences were observed in peak hip abduction moment or peak hip external rotation moment. **CONCLUSIONS:** These findings indicate that knee joint biomechanics during a landing task are affected by breast support. The current study did not address the role of trunk orientation or differences in breast size amongst participants. Future research should address the role of breast motion on trunk kinematics and kinetics. Table 1. Mean knee and hip joint moments in the CON, LOW and HIGH support conditions.

Variable (Moments)	CON	LOW	HIGH	p-value
Knee Abduction	0.44 (0.35)	0.44 (0.30)	0.42 (0.21)	0.422
Knee External Rotation	-0.32 (0.21)	-0.24 (0.25)	-0.32 (0.22)	0.029
Hip Abduction	-0.62 (0.22)	-0.66 (0.26)	-0.57 (0.27)	0.216
Hip External Rotation	-0.57 (0.18)	-0.60 (0.16)	-0.58 (0.19)	0.353

1032 Board #158 May 27 1:30 PM - 3:00 PM
The Effects Of Whole-body Vibration And Fatigue On Vertical Jump Performance

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Whole Body Vibration (WBV) is the exposure of oscillating vibration to the body, which may result in an increase of the rate of motor unit activation. Fatigue of knee extensor muscles has been shown to hinder vertical jump (VJ) performance. **PURPOSE:** The purpose of this study is to investigate the effects of WBV and fatigue on vertical jump (VJ) performance.

METHODS: Sixteen active males and females (age, 23.19 ± 2.56 ; weight, 79.05 ± 16.97 ; height, 174.36 ± 12.11) volunteered for five-day study. On day 1 familiarization, after completing an IRB approved informed consent and health screening questionnaire participants were prepped on testing protocols. Following a dynamic warm up, testing sessions 2-5 will include one of four conditions: No WBV and No Fatigue (C1), WBV and Fatigue (C2), WBV and No Fatigue (C3), and No WBV and Fatigue (C4). WBV was performed using a frequency of 50Hz and a low amplitude while performing quarter squats for a total of 4min with a 30s rest or work ratio. Lower-body fatigue induced using Bosco fatigue test, performing 60s of jump squats. VJ was performed using an AMTI force plate and peak force, velocity, and power were calculated and a Vertec was used to measure vertical jump height (VJH). VJ data was collected pre and post conditions each day. Percent change scores (% Δ) were calculated between pre and post conditions and used for analysis. SPSS was used to perform a Repeated Measures ANOVA.

RESULTS: There was significant differences between C1 and C2 ($p = 0.005$; $C1 = -1.21 \pm 5.91$; $C2 = -7.83 \pm 6.17$ % Δ), C1 and C4 ($p = 0.002$; $C1 = -1.21 \pm 5.91$; $C4 = -8.94 \pm 6.90$ % Δ), C2 and C3 ($p < .001$; $C2 = -7.83 \pm 6.17$; $C3 = 0.97 \pm 4.63$ % Δ), C3 and C4 ($p < 0.001$; $C3 = 0.97 \pm 4.63$; $C4 = -8.94 \pm 6.90$ % Δ) in VJH. There were significant differences between C1 and C4 ($p = 0.011$) and between C3 and C4 ($p = 0.017$) in peak force. There were significant differences between C1 and C2 ($p = 0.01$), C1 and C4 ($p = 0.02$), C2 and C3 ($p < 0.001$), and C3 and C4 ($p = 0.001$) in peak velocity. There were significant differences between was between C1 and C2 ($p = 0.03$), C1 and C4 ($p = 0.03$), C2 and C3 ($p = 0.004$), and C3 and C4 ($p = 0.008$) in peak power. There were no significant ($p > 0.05$) differences between other variables.

CONCLUSIONS: WBV did not show to change the detrimental effects of lower-body fatigue, however this study did show lower-body fatigue decreases vertical jump performance.

1033 Board #159 May 27 1:30 PM - 3:00 PM
Effects Of w' Depletion On The Torque Velocity Relationship In Cycling

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The torque-velocity (T-v) curve has been used to study the effects of energy expenditure on contractile muscles at various workloads related to VO_{2max} . **PURPOSE:** The purpose of this study was to further quantify changes to the T-v curve, but based on anaerobic energy (W') expenditure at powers above Critical Power (CP6). **METHODS:** A group of 10 subjects (37.8 ± 11.6 yrs, 72.8 ± 16.2 kg, $1.75 \pm .11$ m) performed a Time to Exhaustion Test (TTE) interspersed with 6-second sprints to generate their T-v curve at 3 stages of W' expenditure: after initial warmup (FRESH), fatigued (after 2 minutes at CP6, 2MIN), and at TTE. **RESULTS:** ANOVA results indicated a statistically significant decrease in normalized Maximal Power (P_{max}) from FRESH to 2MIN (16.89%, $p < .0005$), 2MIN to TTE (24.71%, $p = .004$), and from FRESH to TTE (41.6% $p = .04$). Statistically significant decreases in normalized Maximal Velocity (v_{max}) were seen from FRESH to 2MIN (14.1%, $p < .0005$), from 2MIN to TTE (11.8%, $p = .001$), and FRESH to TTE (25.9%, $p < .0005$). No significant changes occurred in Maximal Torque (T_{max}). Linear regression

models were run using W' expended to explain variations in P_{\max} , v_o , and T_o . There were significant negative correlations for T_o ($P = 0.020$) and significant strong negative correlations for P_{\max} ($P < 0.005$), and v_o ($P < 0.005$).

CONCLUSIONS: This suggests that W' expenditure can be used to predict the performance parameters Torque (T_o), Shortening velocity (v_o), and Maximal Power (P_{\max}) during continuous cycling above Critical Power.

1034 Board #160 May 27 1:30 PM - 3:00 PM
Effects Of Bicycle Crank Length On Hip And Knee Joint Kinematics And Compressive Forces

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PURPOSE: Crank length (CL) on a bicycle may affect knee and hip joint compressive forces and range of motion (ROM). The relationship between knee/hip joint forces, moments, and ROM can have an influence on hip and knee joint health (i.e. osteoarthritis, patellofemoral disorder, ligament damage, etc.). The purpose of this study was to examine the effects of four different CL (155, 165, 175, and 185 mm) on ROM and resultant compressive forces on the hip and knee. **METHODS:** 12 non-cyclists (4M, 8F, aged 18-55) participated in a single blind randomized cross-over experiment with four CL. An Enhanced Helen Hayes marker protocol was used to place 32 retroreflective markers on anatomical landmarks to track kinematic data using a 12-camera 3D motion analysis system with Cortex software (Motion Analysis Corp., CA, USA). Kinetic data were collected using a stationary bike (SRM IndoorTrainer, Germany) retrofitted with custom pedals containing 6-axis load cells (AMTI, MA, USA). A 3 minute warm-up for each CL was performed at 1.5 W/kg and 70 rpm. 4x1 minute trials were conducted at 2 W/kg. The first two trials were at a constant cadence of 70 rpm and the second two trials were at a constant pedal speed (PS) of 1.47 m/s. There were 10 seconds of rest between trials and 5 minutes of recovery between each condition. Kinematic data was processed using Cortex software and filtered (4th order Butterworth, cutoff 6 Hz). Kinetic data was filtered using MATLAB (MathWorks, MA, USA). All data was averaged from 30 seconds of each trial. **RESULTS:** During submax cycling, the 155 mm CL had a significantly smaller hip ROM (42 deg vs. 49 deg; $p < 0.05$) and a significantly smaller knee ROM compared to the 185 mm CL (72 deg vs. 80 deg, $p < 0.05$). No significant differences were found at a cadence of 70 rpm: 155 mm CL peak hip compressive force (1.3 N/kg) vs. 185 mm CL (0.9 N/kg); 155 mm CL peak knee compressive force (2.8 N/kg) vs. 185 mm CL (2.6 N/kg). No significant differences were found at a PS of 1.47 m/s: 155 mm CL peak hip compressive force (0.6 N/kg) vs. 185 mm CL (0.7 N/kg); 155 mm CL peak knee compressive force (2.3 N/kg) vs. 185 mm CL (2.5 N/kg). **CONCLUSION:** Hip and knee ROM was significantly greater with a longer CL. There are no significant differences in hip or knee peak compressive forces. Implementation of a shorter CL at a PS of 1.47 m/s may minimize peak hip and knee joint compressive forces.

1035 Board #161 May 27 1:30 PM - 3:00 PM
Effects Of Workrate And Seat Position On Knee Biomechanics In Recumbent Cycling

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Cycling is one of the most popular rehabilitation tools for knee osteoarthritis (OA) patients. In recent years, recumbent bicycle has become a popular trend over upright bikes in exercise and rehabilitation. Previous literature has largely focused on upright cycling with few examining knee biomechanics in recumbent biking in the sagittal plane. Little is known on the effects of workrate and seat position on knee biomechanics in recumbent bike. **PURPOSE:** To examine the effects of different workrates and seat positions on knee biomechanics during stationary recumbent cycling. **METHODS:** Fifteen healthy participants (55.5±3.7 years, 1.75±0.09 m, 84.3±15.7 kg) cycled on a recumbent ergometer in six test conditions of three seat positions at two workrates. Seat positions were "far" (20-30° of peak knee flexion angle), "medium" (30-40°) and "close" (40-50°), and the workrates were set at 60 and 100 Watts (W). A 3D motion analysis system (240 Hz, Vicon) and a pair of custom-made instrumented pedals were used to collect kinematic and kinetic data in each condition. A 3x2 (seat position x workrate) repeated measures ANOVA was used to determine if differences existed between conditions ($p < 0.05$). **RESULTS:** Peak knee extension moment, peak knee abduction moment (KAbM), peak knee extension angle and peak knee extension ROM were significantly higher at 100 W compared to 60W (all $p \leq 0.008$). There was a significant main effect of seat position for peak

knee flexion moment. Pairwise comparisons showed that peak knee flexion moment was significantly higher in the far seat position (-18.9±6.3 Nm) compared to medium (-13.1±6.5 Nm) and close seat position (7.28±7.33 Nm). In addition, the peak flexion moment was significantly higher in the medium seat position (-13.1±6.5 Nm) than close position (-7.28±7.33 Nm). **CONCLUSION:** Increased workrates significantly increased peak KAbM and knee extension moment. Different seat positions did not change either peak KAbM or knee extension moment. For patients with knee OA, a low workrate may be considered in recumbent cycling exercises, while the seat position could be chosen based on personal preferences.

1036 Board #162 May 27 1:30 PM - 3:00 PM
Preoperative And Postoperative Cycling Biomechanics Following Cam Femoroacetabular Impingement Corrective Surgery: A Pilot Study

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 (No relevant relationships reported)

PURPOSE: Cycling is commonly prescribed following femoroacetabular impingement (FAI) corrective surgery. This surgery alters gait mechanics in the postoperative period, but alterations in cycling mechanics have not been reported. In this case study, we sought to determine if cam FAI corrective surgery altered cycling biomechanics postoperatively in a highly active female subject. **METHODS:** Bilateral cycling biomechanics were collected preoperatively when the subject was asymptomatic and again 11-weeks postoperatively. During each visit, pedal forces and limb kinematics were collected and used to determine joint-specific work. The subject was instructed to target a power output of 240 W during isokinetic cycling at 80 RPM. Limb symmetry index (LSI) was calculated to compare power production at the pedal. Normalized joint-specific work was compared both inter- and intralimb, as well as pre- vs. postoperatively. **RESULTS:** LSI decreased from 96% to 84% postoperatively. Summed joint extension work increased in the surgical limb from 90% to 97% postoperatively. This increase was the result of a 67% decrease in hip extension work (30% to 10%, Figure 1) and a compensatory 28% increase in knee extension (50% to 64%, Figure 1) and 70% increase in ankle extension (10% to 17%, Figure 1) work within the surgical limb. In the nonsurgical limb, there was a 333% increase in knee flexion work postoperatively (3% to 13%, Figure 1). **CONCLUSION:** Cycling mechanics following FAI corrective surgery exhibited significant changes suggesting the development of compensatory patterns. The results of this pilot study combined with the prevalence of cycling in FAI surgery rehabilitation warrant further studies on the development and persistence of compensatory patterns and to possibly identify early intervention strategies.

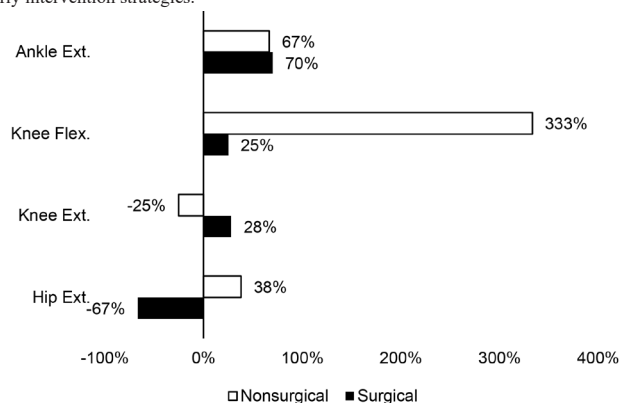


Figure 1. Pre- to postoperative changes in joint-specific work for the surgical and nonsurgical limbs.

1037 Board #163 May 27 1:30 PM - 3:00 PM

Biomechanics Metrics Associated With Golfing Prowess

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PURPOSE: The biomechanics of the golf swing have been studied extensively but specific metrics related to golfing proficiency have not been identified. The purpose of this study was to compare golf swing biomechanics between proficient and average golfers and thereby identify specific metrics associated with golfing proficiency.

METHODS: Twenty-two male golfers were categorized as proficient (golf index <6, n=10) or average (golf index 10-24, n=12). Three-dimensional kinematics and ground reaction forces (GRF) were recorded as subjects hit standard golf balls into a net using a driver. Angular velocities of the pelvis, trunk, lead arm and golf club, as well as X-factor, were calculated from the kinematic data. GRF under the lead and back legs are expressed as a % of bodyweight. The effect of golf proficiency on golf swing biomechanics was assessed using independent samples t-tests.

RESULTS: Proficient golfers were younger (26±6 yr vs. 48±16 yr, P=0.001) but did not differ in height (P=0.114) or weight (P=0.330). Peak pelvis and trunk velocities were higher (P=0.004) in proficient golfers (525.1±91.6 deg/s and 621.8±89.4 deg/s, respectively) versus average golfers (414.3±67.7 deg/s and 521.3±75.5 deg/s, respectively) but peak club velocity was not different (2509.8±226.1 deg/s vs. 2446.6±420.3 deg/s; P=0.675). Proficient golfers had greater X-factor at the top of the backswing (56.0±6.0 degrees vs. 44.1±11.4 degrees, P=0.008), greater peak X-factor (61.4±5.7 degrees vs. 49.3±11.8 degrees, P=0.008) and greater X-factor at ball impact (34.2±5.8 degrees vs. 22.5±6.5 degrees, P=0.001). Proficient golfers had a higher peak GRF on the lead leg compared with average golfers (142±17 %BW vs. 122±18 %BW, P=0.018), while paradoxically having a lower lead leg GRF at ball impact (56±18 %BW vs. 89±17 %BW, P<0.001).

CONCLUSIONS: The higher X-factor in proficient golfers is indicative of a more effective use of elastic energy in the trunk that is sustained through ball impact. The GRF data indicate that proficient golfers more effectively loaded the lead leg during the initiation of the downswing and more effectively unloaded the lead leg prior to ball impact. In conclusion, golf swing proficiency appears to be a function of a more effective transfer of power from the ground and a more effective use of elastic energy in the trunk.

1038 Board #164 May 27 1:30 PM - 3:00 PM

Biomechanical Comparison Of The Half To Full Golf Swing - Clinical Implications

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PURPOSE: Golf is popular, with many middle-aged participants. A concern for healthcare workers is how to advise those wishing to return to golf after a lower extremity (LE) injury or surgery. A common recommendation is to use a half swing, however, it is not known whether this reduces the motion or muscular torque for the LE. The purpose of this study was to examine the peak torques and positions of the hip during a half swing versus a full golf. **METHODS:** 11 healthy amateur male golfers with handicaps ≤ 21 participated in this study. All participants completed 20 golf swings (10 full swings, 10 half swings). A 10-camera motion analysis system, with force plates, were used to record swing data. Data was reduced using a 3-D modeling program and standard inverse dynamics were used to determine internal net joint torques. Peak torques (Nm; normalized by %BWHT) and movement positions (degrees) were analyzed in SPSS (Version 24) Differences and correlations considered significant if at the .05 level of probability. A repeated measures ANCOVA (club-head velocity in mph, as the covariate) was used to compare half to full swing for each movement. **RESULTS:** Subjects had an average age of 44±16 years and an average handicap of 13±6. Club-head speed ranged from 69 to 113mph, with an average of 91±12mph. The highest torques in both full (12.02±1.97 Nm/%BWHT) and half swings (12.04±2.07 Nm/%BWHT) occurred in trail hip extension. This was followed by lead hip flexion and hip abduction, and trail hip abduction in both swing styles. (6.58±2.46, 6.04±2.07 and 5.75±1.11 Nm/%BWHT, respectively). The highest peak positions were in the trail leg for flexion and abduction. There was a significant correlation between each half and full swing position ranging from r=.85 to r=.98. Repeated measures ANCOVAs found no significant differences between half and full golf swings.

CONCLUSIONS: Contrary to a pilot study, our data show that using a half swing did not reduce the amount of internal torque around the hip, as compared to a full swing. All torques were similar to a published study in which it was noted that the torques

were much higher than reported hip torques for walking and activities of daily living. These findings suggest that clinicians should use caution in recommending a half vs a full swing for those returning to golf following an injury or surgery.

1039 Board #165 May 27 1:30 PM - 3:00 PM

Correlation Of Lumbopelvic-hip Complex Stability To Pain In NCAA Division III Golfers

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Lumbopelvic-hip complex (LPHC) stability is known to be a major contributor in injury prevention of ballistic movement. However, the literature primarily focuses on the kinematics of the hips and trunk relative to swinging sports, specifically in professional golfers. Data is sparse regarding isometric strength (ISO) and muscular endurance (ME) of the LPHC relative to pain in male and female collegiate golfers.

PURPOSE: Therefore, the purpose of this study was to determine the relationship of LPHC isometric strength and muscular endurance to upper extremity, lower extremity, and back pain in NCAA Division III golfers. **METHODS:** Thirty-two NCAA Division III golfers (19.8 ± 1.3 yrs.; 70.0 ± 11.1 kg.; 173.4 ± 11.1 cm) volunteered to participate. Thirteen were female, and nineteen were male. A health history questionnaire was used to establish current pain or stiffness within each athlete. Bilateral internal and external rotation ISO, as well as adduction and abduction ISO, was measured using a handheld dynamometer. Two trials were conducted for each variable, and the mean was used for statistical analysis. Additionally, ME of the anterior and posterior trunk was measured using the trunk flexor endurance and trunk extensor endurance tests of the standardized McGill's Torso Muscular Endurance Test Battery. A Pearson product-moment correlation was run to determine relationships between ISO and ME to current pain. **RESULTS:** A statistically significant, negative correlation was found between lead hip internal rotation ISO, relative to the golf stance, and current pain (r = -.369, n = 32, p = .038). Of the 14 reported cases of pain, 11 instances were localized to the back and hips. No other statistically significant correlations were established between current pain and ME or ISO of bilateral external rotation, abduction, adduction, and internal rotation of the back hip. **CONCLUSION:** Deficient internal rotation isometric strength of the lead hip could be considered a risk factor for hip and back pain in collegiate golfers.

1040 Board #166 May 27 1:30 PM - 3:00 PM

Balance And Kinematic Swing Sequence In Older Female Golfers

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Female golfers account for approximately 25% of the entire golfing population in the United States and 16% of female golfers are over the age of 60. While balance and golf swing kinematic sequence are frequently cited as important performance determinants, literature involving the older female golfer is limited.

PURPOSE: To examine the balance profile (during specific dynamic tasks) and kinematic golf-swing pattern displayed in older female golfers. **METHODS:** Thirteen female golfers using a right-handed swing strategy (mean age ± SD, 67.5 ± 5.5) completed the Modified Clinical Test of Sensory Integration of Balance and the Rhythmic Weight Shift (RWS) protocols in order to collect balance data. A golf-swing kinematic assessment was also performed. Three recorded drives were used to analyze the swing and establish a dominant sequence. Balance outcome data were examined with reference to established age-matched normal values. Golf-swing kinematic sequence patterns were compared between those participants within (N=7; mean age ± SD, 66.1 ± 5.2) and outside of (N=6; mean age ± SD, 69 ± 5.9) normal Forward-Backward Directional Control (FBDC).

RESULTS: All participants displayed normal directional velocity values for the RWS assessment but only half demonstrated normal FBDC. The kinematic sequence analysis revealed that 53.8% of all participants optimally initiated the downswing by leading with the pelvis. Golfers with normal FBDC (mean % time on axis ± SD, 79.1 ± 5.5), were more likely (71.4%) to initiate a normal kinematic swing sequence compared to 33.3% of those with abnormal FBDC (mean % time on axis ± SD, 64 ± 7).

CONCLUSIONS: The results of this study suggest that this population of golfers may need to consider exercise or training programs designed to improve forward/backward dynamic balance control as a means to assist in optimizing the kinematic sequence and overall golf-swing performance.

1041 Board #167 May 27 1:30 PM - 3:00 PM

Crosse Use Effects On Running And Drop Jump Mechanics In Male And Female Lacrosse PlayersHeather K. Vincent, FACSM, Michelle L. Bruner, Cong Chen, Sharareh Sharififar, Kevin R. Vincent, FACSM. *University of Florida, Gainesville, FL.*

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(No relevant relationships reported)

PURPOSE: A unique feature of lacrosse is the use of a crosse to move the ball during complex running and jumping movements. It is unclear whether there is a differential biomechanical effect of holding the crosse during key sport-specific motions in female and male youth and high-school/collegiate players. The purpose of the study was to determine the motion differences of running and drop jumps when holding a short stick or a defensive pole in youth (11.8±1.4 yrs; 21% female) and high-school/collegiate players (18.4±1.9 yrs; 35% female).

METHODS: Players (N=70) performed drop jumps and running at near sprint speed. Drop jumps were completed under three conditions: bare hands, short stick and defensive long pole. Running was performed under three conditions: bare hands, and dominant side one-handed and two-handed holds while cradling. A 3D motion tracking system and floor embedded force plates captured motion about the ankle, knee, hip, pelvic and trunk during three trials of each condition for each motion. Sex and age group differences were tested using univariate analyses of variance.

RESULTS: For drop jumps, foot landings (heel, mid or toe) differed more often when holding a crosse versus bare hands for all players (31.4%-34.2% vs 27.1%). Irrespective of age, female players demonstrated more ankle 7°-9° dorsiflexion than males in all conditions (p<.05). Youth demonstrated 28% more knee adduction in all jump conditions than high-school/collegiate players (p<.05). Compared to males, females had 5.2°-6.5° less anterior trunk flexion at initial ground contact when holding a short or long stick and 9.8%-20% less anterior flexion after landing versus bare hands (p<.05). During running, females had 12.7% more hip adduction and 43% more trunk lateral lean than males with one or two-hand holds compared to bare hands irrespective of age (p<.05). A two-handed hold produced greater trunk transverse rotation than other conditions compared to males and across conditions (p=.001).

CONCLUSIONS: Holding a crosse differentially affects biomechanics in female and male players but not by age group. Preseason conditioning with movements while holding the crosse may provide help reduce excessive motion at affected joints. Funded by US Lacrosse.

1042 Board #168 May 27 1:30 PM - 3:00 PM

Relationships Between Accelerometer-derived Training Loads And Rpe In Collegiate Women'S Volleyball PlayersNatalie Kupperman, Jay Hertel, FACSM. *University of Virginia, Charlottesville, VA.**(No relevant relationships reported)*

Purpose: The relationship between ratings of perceived exertion (RPE) and objective training load metrics in women's volleyball players is unknown. This study examined relationships between RPE and accelerometer-derived variables in practices and games in this population.

Methods: External training loads were measured with triaxial accelerometry during team practices and games along with subjective RPE collected on the Borg CR-10 scale. Data from 12 athletes over a 7-week in-season period (13 games, 19 practices) were collected from an NCAA Division I women's volleyball team. The accelerometer-derived variables were: total playerload (PL), total change of direction (COD), total jumps, total accelerations, total decelerations, and total repeated high-intensity events (RHIE). Relationships between RPE and the accelerometry variables in practices and games were analyzed using Pearson correlations (r) and least ordinal squares regression.

Results: Correlations with RPE during games and practices were: PL (0.79, 0.57), COD (0.57, 0.23), jumps (0.68, 0.46), accelerations (0.55, 0.30), decelerations (0.76, 0.61), and RHIE (0.52, 0.52). Regression models for games revealed that accelerometry measures explained 70% of variance in RPE (PL, jumps, decelerations, $p < 0.05$; COD, accelerations, RHIE, $p > 0.05$). For practices, accelerometry variables explained 44% of variance in RPE (PL, decelerations, RHIE, $p < 0.05$; COD, jumps, accelerations, $p > 0.05$). PL alone explained 62% and 33% of the variance in RPE for games and practices, respectively ($p < 0.001$).

Conclusions: Accelerometer-derived variables informed the understanding of athlete-reported RPE in collegiate women's volleyball players. The selected volume-based accelerometer-derived variables had a stronger relationship with RPE for games than practices. The calculation of PL includes aspects of the other accelerometry variables assessed which may explain why PL was the strongest single predictor of RPE.

1043 Board #169 May 27 1:30 PM - 3:00 PM

Effects Of Hip Thrust And Resistance Training On Shuttle Run, Hand Grip Strength And Countermovement Jump In Colombian Elite Male Volleyball PlayersCristian Yanez, Cesar Lovera, Luis Cardozo, Jhonatan Peña, Felipe Martin, Frank Rincon, Angela Perdomo. *Area Andina Foundation University, Bogota, Colombia.*

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PURPOSE: This study aimed to determine whether a hip thrust and resistance training could improve performance on shuttle run, hand grip strength and countermovement jump in elite volleyball athletes.

METHODS: eleven elite male volleyball players (23,09 ± 2,87 years), body weight (84.91 ± 10.15 kg), average weight lean muscle (40,18 ± 3.07%), body fat (18.16 ± 5.45%) completed 2 training sessions per weeks, which included hip thrust exercise and upper resistance training. Over the 10 week season, the athletes performed 3-4 sets of 6-10 repetitions for resistance exercises during each training session. All sessions were supervised by one of the investigators as well as by the Colombian team coach. Shuttle run, hand grip strength and countermovement jump were assessed before and after the 10 week training program. A total of 12 variables was analyzed through CMJ: (peak flight time (PFT), peak contact time (PCT), Peak eccentric duration (PDE), peak concentric duration (PDC), Peak eccentric work (PWE), Peak Concentric work (PWC), Peak jump height (PMH), Peak maximum velocity (PMV), Peak maximum power (PMP), Peak maximum force (PMF), Peak rate of force development (PRFD) and Peak time to maximum force (PTFM) were simultaneously quantified with the Gyko inertial sensor system (Microgate, Bolzano, Italy).

RESULTS: Non parametric data were analysed by Wilcoxon and Spearman test. Significant correlations (r) were found next to the p value and the effect size (ES) of shuttle run, hand grip strength and those of countermovement jump respectively. Shuttle run (SR, $p=0,000$, $r=0,96$, $ES=0,23$), Right hand grip strength (HGS R, $p=0,000$, $r=0,90$, $ES=0,18$), Left hand grip strength (HGS L, $p=0,000$, $r=0,91$, $ES=0,22$). CMJ performance variables: Peak concentric duration (PDC, $p=0,000$, $r=0,68$, $ES=0,44$), Peak Jump Height (PMH, $p=2,0$, $r=0,88$, $ES=1,1$), Peak maximum velocity (PMV, $p=0,000$, $r=0,63$, $ES=0,61$).

CONCLUSIONS: The findings suggest that elite male volleyball players can improve speed, agility, hand grip strength and vertical jump performance during the pre competition season by implementing a well designed training program that includes both hip thrust and resistance training exercises.

1044 Board #170 May 27 1:30 PM - 3:00 PM

Examination Of Landing Error Scoring System Scores For Division 1 Basketball PlayersJessica Smith, Timothy G. Coffey. *Longwood University, Farmville, VA.**(No relevant relationships reported)*

The injuring of the anterior cruciate ligament (ACL) is one of the most prevalent sports related knee injuries to occur in athletics, specifically female athletes. **PURPOSE:**

To examine differences in LESS (Landing Error Scoring System) scores between frontcourt and backcourt, male and female NCAA Division 1 basketball players and to measure any changes in LESS scores between the beginning and end of the season.

METHODS: Participants were 24 Division 1 basketball athletes (10 females, 14 males). Participation for the initial LESS screen prior to the season was 24 participants, but only 15 completed the postseason LESS screen (12 males, 3 females). These losses in participants were due to team departures, injuries, and NCAA restrictions on team activities post season. They completed a LESS screen (three consecutive jumps per screen) while being filmed in the frontal and sagittal plane and these videos were analyzed using a visual analysis computer system (Darfish). The clinician examined the torso, feet, knees, and hips in the frontal and sagittal plane and assigned the athlete a score based on the landing performance. Athletes who scored above five points indicated an increased risk for an ACL injury. These screens were scored by a researcher using the LESS scoring sheet determined by Padua and then analyzed using an ANOVA 2x2 repeated measures test in SPSS to test for statistical significance. Statistical results were considered significant if they had a p-value ≤ .05.

RESULTS: There were no statistically significant difference in LESS scores between position ($p=0.650$) or gender ($p=0.904$), but there was a significant decrease in preseason LESS scores versus postseason LESS scores for men and women ($p \leq 0.001$). Preseason men LESS scores averaged 6.30 ± 1.31 and women averaged 6.38 ± 1.63 . Postseason LESS scores for men averaged 5.47 ± 1.09 and women averaged 6.44 ± 0.84 .

CONCLUSIONS: This sample of Division 1 basketball athletes' LESS scores did not seem to differ based on gender or position which could conclude that the athletes training regimens may be similar to each other and not determined by ACL risk, gender, or positions. The significant decrease in preseason LESS scores to postseason LESS scores could be attributed to the similar training regimens.

1045 Board #171 May 27 1:30 PM - 3:00 PM
Lower Extremity Joint Work During Braking Phase Of The Triple Hop For Distance
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The triple hop for distance (THD) involves three consecutive single leg hops for maximal horizontal displacement. This task imposes variable mechanical demands challenging balance, coordination and leg strength. While THD is common during late-stage rehabilitation, these demands may also qualify THD as appropriate for healthy athletes. While research shows that energy absorption strategies vary between landing styles, genders and heights, a limitation is the use of a single contact for analysis or training. As a result, changes in landing strategy over repeated landings are not well understood. **PURPOSE:** To determine changes in sagittal plane joint energetic landing strategy during each contact of THD. **METHODS:** Nine female college soccer players performed THD on the dominant limb. Ground reaction forces and lower extremity kinematics were measured using a force platform (1200Hz) and 9-camera motion capture system (240Hz). Three trials were collected of each contact in the THD sequence. Negative joint work was calculated as negative joint power integrated with respect to time. Total negative joint work (TJW) is the sum of eccentric work done on the hip, knee, and ankle, and the proportion of TJW done on each joint was defined as relative negative joint work (RJW). **RESULTS:** TJW increased from the first (-80.5 ± 26.3J) to the second (-95.5 ± 33.7J), and third (-145.2 ± 42.5J) landings. From the first to second contacts, RJW done on the ankle (33.5% vs 34.7%, $d = 0.10$), knee (53.9% vs 52.1%, $d = 0.20$), and hip (12.6% vs 13.1%, $d = 0.08$) was unchanged. From the second to third contacts, RJW done on the ankle was substantially decreased (34.7% vs 18.4%, $d = 1.67$), while RJW done on the hip was substantially increased (13.1% vs 25.4%, $d = 1.68$). RJW done on the knee was modestly greater (52.1% vs 56.3%, $d = 0.54$) in the second compared to third contacts in THD sequence. **CONCLUSION:** The serial nature of THD requires athletes to adapt to different demands in each ground contact. This includes progressively greater braking forces and landing strategy modulation during each contact. This represents a task which exposes athletes to variable demands of both ground reaction forces and joint work in a controlled manner. THD may therefore address multiple athletic performance qualities during performance enhancement and rehabilitation.

1046 Board #172 May 27 1:30 PM - 3:00 PM
Kinematic And Kinetic Differences During A Conventional Deadlift With And Without Shoes
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Despite the popularity of deadlifting without shoes, little research has examined the kinematic and kinetic differences during a conventional deadlift when performing the exercise barefoot. Excess joint torque in the frontal plane can be indicative of injury. **PURPOSE:** To examine the differences in frontal plane mechanics of the lower extremity and force development during a conventional deadlift with and without shoes. **METHODS:** Thirty participants with a mean height and weight of 1.75±0.10 meters and 81.12±16.05 kg. Participants recruited had consistently performed the conventional deadlift for six or more months and strength training at least two days per week. During the participant's first visit, a one repetition maximum (1RM) using NSCA guidelines was determined. A second visit occurred at least 72 hours or more after the 1RM testing. Kinematic and kinetic data were collected using a 15-camera Qualisys Oqus system (240Hz) and two Bertec force plates (1200Hz). Participants performed five consecutive reps at 70% of their 1RM in random order (shoes and barefoot). Visual 3D was used to process raw marker and force data and to calculate frontal plane joint moments at the hip, knee, and ankle during the concentric phase. A one-way MANOVA ($p < 0.05$) was used to investigate the different footwear conditions. **RESULTS:** There was a statistically significant difference between shoes (-0.28 ± 0.11 Nm/kg) and no shoes (-0.38 ± 0.14 Nm/kg) for internal ankle eversion moments ($p = 0.018$). No significant differences were detected for knee and hip abduction moments. Peak vertical ground reaction force in the barefoot condition (1035.2±281.4 N) was not significantly different than the shoe condition (1044.9±286.5 N). **CONCLUSION:** The absence of shoes created an increase in frontal plane ankle moments, but there was no change in the vertical force characteristics. An increased internal eversion moment did not affect the joint moments further up the kinetic chain despite undergoing similar loading patterns.

1047 Board #173 May 27 1:30 PM - 3:00 PM
The Effects Of Whole-body Vibration And Fatigue On Isometric Mid-thigh Pull
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Musculature exposed to continuous stress overtime will begin to decrease performance as a result of fatigue. However, past research has shown that Whole Body Vibration (WBV) can have a positive effect on performance by increasing motor unit recruitment.

PURPOSE: The purpose of this study is to analyze the effects of WBV and Fatigue on Isometric Mid-Thigh Pull (IMTP).

METHODS: Sixteen active males and females (age: 23.19 ± 2.56yr, weight: 79.05 ± 16.97kg, height: 174.36 ± 12.11cm) volunteered to participate in a 5-day study. Day 1 consisted of familiarization where participants completed an IRB approved informed consent, Health History Questionnaire, and a PARQ. Following anthropometrics measurements, participants were familiarized with all the testing protocols and interventions. Day 2-5 testing sessions consisted of a dynamic warm-up followed by pre-testing of IMTP's. Post-tests for IMTP were taken following the completion of one of 4 conditions, each performed on separate days. Conditions consisted of C1 (No WBV-No Fatigue), C2 (WBV-Fatigue), C3 (WBV-No Fatigue), and C4 (No WBV-Fatigue) in a randomized order. Peak Force for the IMTP was measured using an AMTI Portable Force Plate. WBV was administered while performing quarter squats at a frequency of 50Hz and low amplitude on for a total of 4min with a work to rest ratio of 30s/30s. The Bosco fatigue protocol was administered to induced lower-body fatigue by having participants perform 60s of jump squats. Percent change scores were calculated between pre- and post-tests for each condition and analyzed for statistical differences between conditions. SPSS was used to run a Repeated Measures ANOVA to compare condition differences of percent change scores (%Δ). An alpha level was set at $p < 0.05$ to determine significance.

RESULTS: There were no significant ($p = 0.84$) differences found between conditions (C1 1.25 ± 9.98 %Δ; C2= -0.79 ± 7.77 %Δ; C3= 1.53 ± 5.95 %Δ; C4= 1.32 ± 10.69 %Δ) for peak force.

CONCLUSIONS: Although no significant differences were found for peak force between pre- and post-tests for IMTP, further studies need to investigate alternative ways to evaluate the effects WBV on lower-body muscular performance.

1048 Board #174 May 27 1:30 PM - 3:00 PM
NEUROMUSCULAR FATIGUE ASSESMENT IN HAMSTRING MUSCLES IN ELITE ULTIMATE FRISBEE PLAYERS
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Ultimate Frisbee (UF) is a new team-sport, with more than 1.5 million practitioners worldwide. It is characterized by changes of direction, accelerations / decelerations, jumps and landings. It has been found that the incidence and prevalence of lower body injuries is 68% of total injuries and 73% are hamstring injuries.

PURPOSE: To determine hamstring neuromuscular fatigue in UF players.

METHODS: A descriptive observational study with analytical component was performed in 18 elite male UF players (age: 26 ± 5 years, weight: 67.5 ± 7kg, height: 1.73 ± 0.05m, BMI: 22 +/- 2), who participated and won the Colombian Interclubes National Tournament 2019. The strength of the hamstrings was evaluated using force platforms with isometric hamstring test, each player performed a maximum isometric contraction in supine position, 90° hip flexion and knee of the analyzed leg. The athlete exerts maximum force with the heel on the force platform for 3 seconds. 3 attempts were made with each leg with 30 seconds rest between each attempt, at the start of the tournament and at the end of the tournament. The athletes played 8 90-minute matches during 4 days of competition. A statistical analysis was performed using the student T test and the Wilcoxon test.

RESULTS: Significant differences were found between the pre and post-tournament evaluation in the variables of peak vertical force of the right leg (314 ± 51.5 vs 256 ± 38.5 N $p = < 0.001$), compared with the peak vertical force of the left leg (272 ± 43.5 vs 246 ± 46.6 N $p = 0.4$) that had a non statistically significant change. It was also found that the force in the right leg had significant differences at 100 ms (113 ± 37.6 vs 95 ± 40.1 $p = 0.02$) 150 ms (165 ± 52.8 vs 133 ± 53.9 $p = 0.002$) and 200 ms (200 ± 57.3 vs 167 ± 57.5 $p = 0.0004$).

CONCLUSIONS: The decrease found in hamstring peak vertical force corresponds to the fatigue that athletes present and accumulate during the tournament and predispose to be a risk factor for hamstring and anterior cruciate ligament injury due to changes in direction and unipodal landings. They are frequent in this sport. Likewise, the predisposition of the right leg as the dominant leg increases the incidence of injuries in the knee joint compromising dynamic stability

1049 Board #175 May 27 1:30 PM - 3:00 PM
Effect Of Moxibustion On Knee Joint Stiffness Characteristics In Recreational Athletes Pre And Post Fatigue

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Stiffness is the coupling of nervous system and joint mechanics, and thus the comprehensive representative of joint stability. It has been reported that moxibustion can improve weakness and alleviate fatigue symptoms.

PURPOSE: To investigate whether moxibustion could enhance knee joint stiffness characteristics in recreational athletes pre and post fatigue. **METHODS:** Twenty-four participants were partially randomized into intervention (9 males: 20.2 ± 1.5 yr; 6 females: 20.7 ± 1.2 yr) and control group (5 males: 19.4 ± 0.9 yr; 4 females: 20.5 ± 0.6 yr). Intervention group: Acupoints ST36 (bilateral) and CV4 for indirect moxibustion 30 min every other day for 4 consecutive weeks; control group: no moxibustion intervention. Peak torque (PT) of right knee extensors, relaxed and contracted muscle stiffness (MS) of vastus lateralis, knee extensors musculoarticular stiffness (MAS) were assessed by isokinetic dynamometer IsoMed 2000, Myometer and free oscillation technique respectively, at three time points: pre-intervention (time-point 1), post-intervention (time-point 2), and after a treadmill fatigue protocol (time-point 3). **RESULTS:** Two-way repeated measures ANOVA found a significant interaction between time and group in MAS ($p = 0.001$) and normalized PT ($p = 0.004$). Post-hoc tests with the Bonferroni-adjusted α were conducted and identified that MAS in intervention group (time-point 1: 521.8 ± 201.3 N/m, time-point 2: 637.7 ± 181.2 N/m) increased more from pre to post intervention when compared to the control group (time-point 1: 615.4 ± 196.6 N/m, time-point 2: 597.1 ± 190.4 N/m) ($p = 0.022$). There was a tendency that after fatigue MAS increased more in intervention group (time-point 2: 637.7 ± 181.2 N/m, time-point 3: 712.1 ± 156.9 N/m) than in control group (time-point 2: 597.1 ± 190.4 N/m, time-point 3: 629.8 ± 172.7 N/m) ($p = 0.202$); and the tendency that normalized PT (PT/body mass) increased in intervention group (time-point 2: 1.49 ± 0.20 Nm/kg, time-point 3: 1.53 ± 0.17 Nm/kg) whilst it decreased in control group (time-point 2: 1.41 ± 0.21 Nm/kg, time-point 3: 1.34 ± 0.21 Nm/kg) ($p = 0.033$). **CONCLUSION:** Moxibustion enhanced the knee MAS, may benefit the ability of fatigue resistance in young recreational athletes, and thus could be utilized in injury prevention.

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1050 Board #176 May 27 1:30 PM - 3:00 PM
Acute Effects Of Practical Blood Flow Restriction On Knee Proprioception During Low Intensity Aerobic Exercise

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Practical blood flow restriction (pBFR) exercise techniques decreases blood flow to targeted muscles while increasing local metabolic accumulation, both of which could impair joint proprioception post-exercise. The impaired proprioception which typically occurs after high intensity aerobic exercise can provide faulty sensory feedback to the brain during movement, resulting in increased risk of injury. Currently, there have been no studies investigating whether pBFR low intensity aerobic exercise has an effect on joint proprioception. **PURPOSE:** To investigate how low intensity aerobic exercise with pBFR affects knee joint proprioception. **METHODS:** Fourteen participants (8 males and 6 females) completed 3 sessions. On the first session, participants walked at 5.6 km/h at a 0% grade for two minutes followed by a 2% increase in the incline each minute until 40% of their heart rate reserve was achieved. Participants were familiarized with a "7/10" (moderate tightness) on the perceived tightness scale using elastic knee wraps as well as the position sense and countermovement jumps.

On session 2 or 3, participants walked on a treadmill for 15 minutes with or without elastic wraps at 5.6 km/h at the grade determined on the first session. Absolute angular error (AAE) was measured before and immediately after each treadmill walking protocol. Muscle fatigue was determined by changes in average power and peak power measured during countermovement jumps. Change scores were computed for each condition and paired sample t-tests were used to determine differences between pBFR and Control. **RESULTS:** The change in AAE was not different (pBFR: -1.5 vs. Control degrees: 0.19, $p = 0.171$) between low intensity exercise with and without pBFR [mean difference of -1.73 (-4.3, 0.85) degrees]. The change in peak power was also similar (pBFR: -34.5 vs. Control: 150.1 W, $p = 0.739$) between exercise with and without pBFR [mean difference of -185 (-1358, 988) W]. Similarly, the change in average power (pBFR: 9.1 vs. Control: -3.4 W, $p = 0.544$) was also not different [mean difference of 12.6 (-31.1, 56.2) W]. **CONCLUSION:** The walking exercise with pBFR did not effect joint proprioception in young adults, suggesting that walking exercise with pBFR might be safely applied without increasing the risk of injury.

1051 Board #177 May 27 1:30 PM - 3:00 PM
Flight Stability Control Mechanism Of Ski Jumping In Lateral Wind Environment

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Wind is not only closely associated with the discussion of fairness in ski jumping, but also very important to flight safety. Flight stability is essential for performance and safety in ski jumping, and mainly involved several factors, such as environmental wind and flight posture. However, the flight stability control mechanism of ski jumping in lateral wind environment remains unclear.

PURPOSE: To determine the flight stability control mechanism of ski jumping in lateral wind environment.

METHODS: The aerodynamic characteristics of ski jumping during flight under different lateral wind and yaw angles are predicted by numerical simulation of computational fluid dynamics, and the effects of the above two elements on flight stability are compared and analyzed. The jumper and skis were regarded as a multi-body system, and partially averaged Navier-Stokes turbulence model was used to simulate aerodynamic characteristics of the system based on a general flight attitude and then the forces and torques were obtained. The lateral wind speed involved in the numerical prediction includes 1.5 m/s, 3 m/s, 4.5 m/s and 7.5 m/s, and the flight yaw angle involved includes 2.5°, 5° and 7.5°.

RESULTS: When lateral wind speed is small (less than 3m/s), yaw force, yaw torque and rolling torque are small and almost negligible, and when lateral wind speed is larger than 4.5m/s, yaw force, yaw torque and rolling torque are more obvious. When wind speed is 4.5m/s and 7.5m/s, yaw force, yaw torque and rolling torque are 9.5 N and 26.3 N, 2.3 Nm and 6.3 Nm, 2.8 Nm and 7.8 Nm, respectively. When yaw angles are 2.5°, 5° and 7.5°, yaw force, yaw torque and rolling torque are 6.8 N, 12.9 N and 21.9 N, 2.5 Nm, 5.0 Nm and 6.8 Nm, 2.7 Nm, 5.7 Nm and 8.3 Nm, respectively. When wind speed is 4.5 m/s and yaw angle is 2.5°, yaw force, yaw torque and rolling torque results of these two conditions are close to each other. Similarly, When wind speed is 7.5 m/s and yaw angle is 7.5°, yaw force, yaw torque and rolling torque results of these two conditions are close to each other.

CONCLUSION: The larger lateral wind can have a significant adverse effect on flight stability control of ski jumping, but it is possible to compensate or even eliminate this adverse effect by taking the appropriate flight yaw angle.

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1052 Board #178 May 27 1:30 PM - 3:00 PM
Effect Of Footwear On Leg Stiffness Of Female Athletes

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Leg stiffness is a fundamental property of the lower limb spring pattern, and is expressed by the ratio of the maximum vertical ground reaction force (GRF) to the vertical displacement of the body's center of mass. The foot-ground interface, i.e. the footwear (FW), is an important factor that contributes to the functional leg stiffness. **PURPOSE:** To examine the FW effect on leg stiffness of young female athletes in a variety of team sports. **METHODS:** Twenty - six female basketball, handball and volleyball players (24.9 ± 6.1 years, height 176.4 ± 7.6 cm, body mass 71.0 ± 6.9 kg) performed 30 s of two-legged hopping in place, barefoot (BF) and with their usual FW, at a preset hopping frequency (digital metronome at 2.2 Hz which approximates the natural hopping frequency). Two-legged hopping was performed on a force platform (Kistler 9260AA, 1000Hz, Bioware Software 2812 A1-3) which was used to record

the vertical GRF. The variables used for the statistical analysis of the FW effect were extracted from 10 consecutive hops, and were analyzed using two-way ANOVA ($p < 0.05$). **RESULTS:** leg stiffness was significantly increased in the FW condition, both in absolute (BF: 32.7 ± 8.5 kN/m, FW: 36.9 ± 8.3 kN/m, $p = 0.014$), as well as in relative to body mass values (BF: 0.478 ± 0.101 kN/m/kg, FW: 0.520 ± 0.110 kN/m/kg ($p = 0.017$)). Also, despite the instruction to follow the same hopping frequency as set by the digital metronome in both the BF and the FW, hopping duration was shortened (BF: 0.469 ± 0.022 s, FW: 0.430 ± 0.013 s, $p = 0.001$) and the propulsive vertical GRF was increased (BF: 32.4 ± 4.7 N/kg, FW: 33.7 ± 5.6 N/kg, $p = 0.048$) in the FW condition. **CONCLUSIONS:** FW appears to increase leg stiffness, which may favor the myotendinous force transfer and contribute to a more effective lower limb spring pattern.

1053 Board #179 May 27 1:30 PM - 3:00 PM

Characteristics Of Eight Irish Dance Landings: Implications For Overuse Injury And Training

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The aesthetics in Irish dance have evolved to create greater physical demands on dancer's bodies. Irish dancers must land from difficult movements without letting their knees bend or heels touch the ground, causing large forces to be absorbed by the body. The majority of injuries incurred by Irish dancers are due to overuse (79.6%). **PURPOSE:** The purpose of this study was to determine loads on the body in female Irish dancers, including peak force, rise rate of force, and impulse in selected Irish hard shoe and soft shoe dance movements. It was hypothesized that the 8 movements would produce different GRF characteristics. **METHODS:** Sixteen female Irish dancers were recruited from the three highest competitive levels. Each performed a warm-up, reviewed 8 common Irish dance movements, and then performed each movement three times upon a force plate. Of the 8 movements, 4 were performed in soft shoes and 4 were performed in hard shoes. Ground reaction forces (GRFs) were measured using a three-dimensional force plate recording at 1000 Hz. Peak force, rise rate, and vertical impulse were calculated. GRFs were normalized by each dancer's body weight. **RESULTS:** Peak forces, rise rates, and impulses were significantly different across movements ($F = 65.4$, $p < 0.01$; $F = 65.0$, $p < 0.01$; and $F = 67.4$, $p < 0.01$ respectively). The movement with the highest peak force was the stomp. The movement with the highest rise rate was the double-toe. The movement with the highest impulse was the leap. The skip had the lowest values for all GRFs measured. Individual peak forces ranged from 0.67-9.86 times body weight. Individual rise rates ranged from 10-147 body weights per second. Individual impulses ranged from -0.12 to 0.32 body weight seconds. Years of experience was not correlated with peak force, rise rate, or impulse ($p > 0.40$). **CONCLUSIONS:** There is a large range in GRF characteristics created by Irish dancers. Dance movements that have high average peak forces may be associated with higher risk of overuse injury. Irish dancers should use appropriate training methods to strengthen the tissues at greatest risk of overuse injury.

1054 Board #180 May 27 1:30 PM - 3:00 PM

The Effect Of Treadmill Speed And Grade On Ice Hockey Skating Biomechanics

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Skating treadmills are used by ice hockey players to develop stride efficiency, power, and endurance. **PURPOSE:** Evaluate the effect of treadmill speed and grade on biomechanics. It was hypothesized that greater speeds and grades would elicit larger ranges of motion (ROM) and decrease stride time. **METHODS:** Seven competitive male ice hockey players (22.0 ± 0.6 y, 86.5 ± 4.4 kg, 1.82 ± 0.06 m) skated at five speed and grade conditions including 4.47 m·s⁻¹ at 4% grade (10/4), 5.36 m·s⁻¹ at 0% grade (12/0), 5.36 m·s⁻¹ at 4% grade (12/4), 5.36 m·s⁻¹ at 8% grade (12/8), and 6.26 m·s⁻¹ at 4% grade (14/4). Left leg biomechanics were assessed using three-dimensional motion capture. Stride time was determined as the mean time between successive initial contacts of the left skate blade with the treadmill. Kinematics were normalized to percent of gait cycle. ROM was calculated as the difference between the maximum and minimum left hip and knee angles during the stance phase of the normalized kinematics. Separate repeated measures ANOVA and corrected, paired t-tests were used to assess the effect of condition. Significance was set to $p < .05$. **RESULTS:** A significant effect of condition on stride time ($p < .001$) was identified. Pairwise comparisons revealed that stride time was different for each condition (10/4 = $.87 \pm .07$ s, 12/0 = $1.18 \pm .13$ s, 12/4 = $.83 \pm .06$ s, 12/8 = $.68 \pm .05$ s, 14/4 = $.77 \pm .06$ s). A significant effect of condition on hip sagittal plane ROM ($p < .001$) was identified. 12/0

($57.4 \pm 4.4^\circ$) had smaller ROM than 12/4 ($65.4 \pm 6.6^\circ$), 12/8 ($70.8 \pm 7.0^\circ$), and 14/4 ($66.6 \pm 7.3^\circ$), 10/4 ($63.0 \pm 5.5^\circ$) had smaller ROM than 12/8, and 12/4 had smaller ROM than 12/8. A significant effect of condition on hip frontal plane ROM ($p = .007$) was also revealed, although no significant pairwise comparisons were identified (10/4 = $27.6 \pm 4.4^\circ$, 12/0 = $31.3 \pm 4.8^\circ$, 12/4 = $26.6 \pm 4.6^\circ$, 12/8 = $23.3 \pm 5.3^\circ$, 14/4 = $26.7 \pm 4.0^\circ$). No effect of condition on knee sagittal plane ROM was revealed ($p = .271$; 10/4 = $44.6 \pm 4.7^\circ$, 12/0 = $44.6 \pm 4.9^\circ$, 12/4 = $44.8 \pm 2.6^\circ$, 12/8 = $41.9 \pm 3.0^\circ$, 14/4 = $42.3 \pm 2.6^\circ$). **CONCLUSIONS:** In this small sample, increasing skating treadmill speed, grade, or both appears to decrease stride time, increase hip joint sagittal plane ROM, and have no effect on knee joint sagittal plane ROM. Results may aid in training program design and future ice hockey biomechanics research.

1055 Board #181 May 27 1:30 PM - 3:00 PM

The Characterization Of The Transition Phase During A 180° Change Of Direction Task

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The evaluation of change of direction ability should not merely rely on the measurement of total sprinting time, but it should focus also on the understanding of specific movement patterns. **PURPOSE:** To evaluate the transition phase (TP) during a 180° change of direction (COD) task. **METHODS:** 14 recreational basketball athletes (age: 21.4 ± 2.6 years) were evaluated during a 10-m COD test. TP has been identified considering 3 consecutive steps (i.e., final decelerating foot contact [DFC], turning foot contact [TFC], first accelerating foot contact [AFC]), using two force platforms. Differences in total (TCT), braking (BCT), and propulsive (PCT) contact time, vertical braking (VBGRF) and propulsive (VPGRF) ground reaction force (relative to body mass), and vertical braking (VBI), propulsive (VPI), and total (VTI) impulse (relative to body mass) were evaluated in relation to leg preference, the 3 steps, and groups (slower vs. faster defined as those below and above the 50th percentile of total sprinting time). **RESULTS:** No differences emerged for leg preference. TP (1.199±0.11 s) contributed for an average of 42.6±3.4% to the total sprinting time (2.817±0.14 s), with DFC involving only a braking action, whilst TFC and AFC comprising both a braking and propulsive action. Differences ($p < 0.05$) among the 3 steps emerged for TCT (DFC: 0.380 ± 0.07 s; TFC: 0.525 ± 0.06 s; and AFC: 0.303 ± 0.04 s), VBGRF (DFC: 22.7 ± 7.5 N·kg⁻¹; TFC: 20.3 ± 2.8 N·kg⁻¹; and AFC: 8.1 ± 2.7 N·kg⁻¹), VBI (DFC: 2.1 ± 0.4 m·s⁻¹; TFC: 2.5 ± 0.5 m·s⁻¹; and AFC: 0.4 ± 0.2 m·s⁻¹), and VTI (DFC: 2.1 ± 0.4 m·s⁻¹; TFC: 5.6 ± 0.6 m·s⁻¹; and AFC: 2.6 ± 0.3 m·s⁻¹). Furthermore, differences ($p < 0.05$) between TCF and AFC were evident for VPGRF (TFC: 14 ± 1.2 N·kg⁻¹; and AFC: 15.6 ± 1.7 N·kg⁻¹) and VPI (TFC: 3.1 ± 0.6 m·s⁻¹; and AFC: 2.2 ± 0.4 m·s⁻¹). Differences between groups emerged in the TFC only, with faster individuals demonstrating shorter TCT (0.489 ± 0.1 s) and PCT (0.281 ± 0.1 s), and lower VPI (2.8 ± 0.5 m·s⁻¹) compared to slower individuals (TCT: 0.542 ± 0.1 s; PT: 0.339 ± 0.1 s; and VPI 3.4 ± 0.6 m·s⁻¹). **CONCLUSIONS:** Findings revealed specific movement patterns during the TP of a COD task and the central role played by the turning step in differentiating faster and slower recreational basketball athletes, with potential further implications for future testing and training procedures.

1056 Board #182 May 27 1:30 PM - 3:00 PM

Effects Of Different Pressure Compression Garments On Oxygen Uptake And Blood Lactate

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Compression garment (CG) has now been viewed as a potential tool for enhancing performance and recovery. CG may boost lactate removal and enhance oxygen supply. However, there are only a small amount of research supporting usefulness of CG. **PURPOSE:** To determine the effect of different pressure CG on oxygen uptake during running and lactate removal after exercise. **METHODS:** 12 recreational male long-distance runners (age 22.5 ± 1.9 y, height 1.78 ± 0.04 m, mass 70.7 ± 4.9 kg) participated in this study. Subjects performed 3 maximal incremental exercise test (the Bruce protocol) on a treadmill with 3 different garments. The subjects performed experimental trials with a high pressure CG (HCG, 17.5 mmHg at the middle of thigh), low pressure CG (LCG, 8.0 mmHg at the thigh), or without a CG (CON condition). The 3 tests were assigned in a random order under a cross-over design, and were conducted at the same time of the day, 3-5 day apart. Oxygen uptake were continuously determined using the METAMAX 3 system. Fingertip blood samples of 20 µl were taken at 1, 4, 7 and 10 min after exercise. The lactate concentration was determined by EKF Biosen C-Line Clinic system. An ANOVA with repeated measures followed by Bonferroni pairwise comparisons were used to analyze the differences in 3 conditions. All tests were two-tailed and a .05 probability level was considered

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significant. **RESULTS:** The Oxygen uptakes were significantly lower with CG at 6 min time point ($P < .05$, HCG 22.0 ± 1.5 , LCG 21.3 ± 2.0 vs CON 23.2 ± 2.7 ml/min*kg), and there were no significant differences on VO₂ between 3 conditions at any other time point. There were no significant differences on the maximum lactate and lactate elimination rates between 3 conditions at any time point. **CONCLUSIONS:** Different pressure CGs have no significant effect on the maximum oxygen uptake during running, but it is possible to reduce oxygen consumption during exercise at low intensity. CGs have no significant effect on the removal of blood lactate after running.

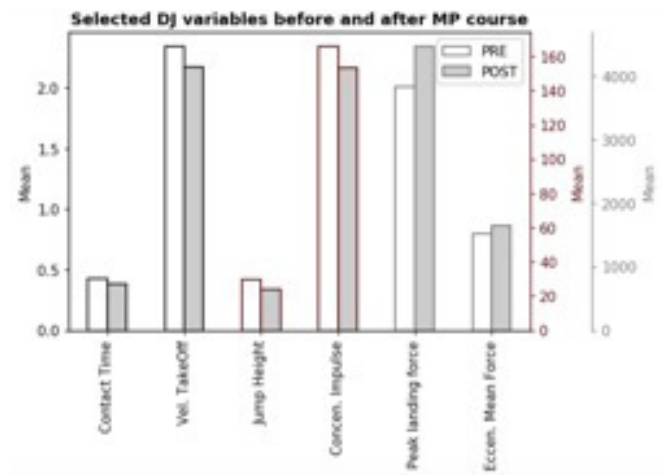
TABLE 1 Oxygen uptake (ml/min*kg) during maximal incremental exercise

TIME	HCG	LCG	CON
3min	15.45±1.03	14.87±1.09	15.04±0.74
6min	22.04±1.49*	21.34±1.96*	23.23±2.74
9min	34.16±2.80	33.41±1.06	35.22±3.59
12min	49.01±4.03	46.52±2.68	48.50±2.67
15min	56.85±4.34	55.67±2.35	56.50±3.48
VO ₂ MAX	59.24±5.10	58.50±3.62	59.59±3.91

Note. *Significantly ($P < 0.05$) different from Control

TABLE 2 Blood lactate concentration (mmol/L) measured during recovery

Post exercise	HCG	LCG	CON
1min	14.7±3.2	13.2±2.5	14.1±2
4min	14.5±3.3	14.3±3.4	13.7±2.2
7min	13.8±3.2	13.4±3.5	13.4±2.7
10min	12.9±3.2	12.6±3.2	12.1±2.5



1057 Board #183 May 27 1:30 PM - 3:00 PM
Parachuting Course Impact In The Lower Limbs Neuromuscular Performance In Militaries From Colombia

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 (No relevant relationships reported)

Most of the injuries in the military parachuting course (MPC) occur during the landing phase because of intrinsic or extrinsic variables. It is important to assess the lower limbs neuromuscular (NM) impact of the MPC to understand the muscular adaptations and the eccentric work, because via the reflex activated by the eccentric phase, it can strengthen the elastic characteristics of the muscle-tendon complex (MTC). Besides, the evaluation of the ground reaction forces (GRF) allow to evaluate muscles function in eccentric-concentric conditions, elastic and reflex components of the MTC through jumping tests that report NM changes due to a training. **PURPOSE:** Assess the lower limbs neuromuscular impact of the MPC in Colombian militaries. **METHODS:** A prospective study was performed in 43 male cadets from the military school who went to the MPC (4 weeks). Each cadet performed 5 drop jump (DJ) test before and after the course, and landed in uniaxial force platforms. For the statistical analysis a paired t-student was performed to determine the changes in the variables that described the DJ, due to the MPC. **RESULTS:** Positive changes were found in the reduction of contact time (0.43 ± 0.1 vs 0.38 ± 0.1 s, $p < 0.01$) and the increase of the eccentric mean force (1513.5 ± 281.4 vs. 1642.9 ± 289.1 N, $p < 0.01$). However, negative changes were observed in the reduction of the jump height (27.7 ± 3.9 vs. 24 ± 3.6 cm, $p < 0.01$), concentric impulse (165.7 ± 26 vs. 153.1 ± 23.7 Ns, $p < 0.01$) and vertical velocity at takeoff (2.34 ± 0.18 vs. 2.17 ± 0.16 m/s, $p < 0.01$) and an increase in the peak landing force (3836.4 ± 825.1 vs. 4461.5 ± 1032.2 N, $p < 0.01$). **CONCLUSION:** There is an improvement in the myotatic reflex related to the adaptations of the lower limb extensor in response to the eccentric force. However, the variables that defined the power and the GRF shown a negative effect over NM characteristics of LL performance, increasing their risk of injury because of high impacts that are not transfer properly to other soft tissues.

1058 Board #184 May 27 1:30 PM - 3:00 PM
Estimation Of Joint Torque During Countermovement Jump From Position Coordinates Using Deep Residual Recurrent Network

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Mechanical outputs (MO) exhibited explosively in the lower limbs are important in many sports. Vertical countermovement jump (VCMJ) is often utilized to evaluate the ability to exhibit MO. To calculate MO, inverse dynamics is performed with body position data and ground reaction forces (GRFs) recorded by the motion-capture system and force-plates. However, it is difficult to obtain GRFs without laboratory setting because force-plates are usually quite expensive. Because of this device-dependent issue, it is hard to obtain MO in the common sporting scenes. **PURPOSE:** To create and develop an artificial neural network that is possible to estimate MO without force-plates, with body position data as inputs. **METHODS:** We designed a deep residual recurrent network (DRRN) to estimate the sagittal right knee torque as MO. Datasets were established for training and evaluating DRRN. Eighteen young males performed VCMJ under 3 conditions (make counter movement freely, deeply and shallowly) with arm swing. Body position data and GRFs were recorded by motion-capture system (250Hz) and force-plates (1250Hz). Three out of 18 subjects' data were randomly chosen as validation data (validation subject A, B, and C). The other 15 subjects' data were divided into two groups, i.e., 80% for training data and 20% for test data. As the objective variable, sagittal right knee torque was calculated using inverse dynamics. Explanatory variables were sagittal body position data. Parameters of DRRN were determined by an optimization calculation that aimed to reduce the difference between actual and estimated torque. To evaluate the predictive performance of DRRN, R² score (R²) and root mean square error (RMSE) were calculated. **RESULTS:** R² and RMSE of whole validation data were $87.7\% \pm 6.2$ and 0.23 ± 0.07 , respectively. These indicators suggest DRRN model has a consistency in the level of predictive ability. R² and RMSE of validation subject A, B and C were $82.8\% \pm 7.1$ and 0.26 ± 0.07 , $89.2\% \pm 3.6$ and 0.25 ± 0.06 , $91.2\% \pm 3.5$ and 0.18 ± 0.06 , respectively. These differences among subjects suggest that personal characteristics might not have been processed sufficiently. **CONCLUSIONS:** Deep RRN is effective in the estimation of joint torque with only body position data as inputs.

B-74 Free Communication/Poster - Upper Extremity

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

1059 Board #185 May 27 1:30 PM - 3:00 PM
Three-dimensional, Isotonic Comparison Of Dominant And Non-dominant Upper Limb Force Production
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(No relevant relationships reported)

Athletes and coaches have traditionally relied on isokinetic devices to compare dominant and non-dominant strength ratios; the information provided is limited in its application. Recent technology permits strength and power comparisons in an isotonic, three-dimensional environment that is more compatible with the load profiles experienced during sport performance. **PURPOSE:** To determine the difference in power between dominant and non-dominant arms across various loads, motions, and planes. **METHODS:** 206 subjects performed 3,727 unilateral sets of 10 repetitions in upper-extremity movements on Proteus (Proteus Motion, USA). Loads were applied through magnetic resistance and ranged from 5-25 lbs; they were divided between dominant (n=1,975) and non-dominant (n=1,747) arms. The performance variables were explosiveness (peak force development rate), peak power, and braking (rate of deceleration). Descriptive statistics characterized mean performances. Linear regression models predicted the effect of arm dominance on performance parameters, holding the load and exercise constant. **RESULTS:** Across all sets, explosiveness was 852.61 ± 629.46 watts/sec, peak power was 206.40 ± 112.42 watts, and braking was 1059.90 ± 766.63 watts/sec. Dominant and non-dominant arms were different in explosiveness (p=0.005), peak power (p=0.041), and braking (p=0.035). With confounding variables held constant, linear regression found use of the non-dominant arm to predict a 10-watt decrease in peak power (R²=0.691; p<0.001), a 46-watt/sec decrease in mean explosiveness (R²=0.553; p=0.001), and a 65-watt/sec decrease in braking (R²=0.668; p<0.001). **CONCLUSIONS:** In an athletic population, the independent use of dominant and non-dominant limbs is often critical to success. It is important to know the non-dominant performance deficit in a setting applicable to sport performance. This information can contribute to optimal training protocols and return-to-play testing batteries.

1060 Board #186 May 27 1:30 PM - 3:00 PM
Muscle Activity In Upper Extremity Is Modulated During Arm Cycling Exercises After Cervical Spinal Cord Injuries
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Regaining upper extremity function following spinal cord injury (SCI) is one of the most important outcomes for quadriplegics with regards to enhancing quality of life. To facilitate locomotor recovery through increased activation of the lower limb muscles, ground reaction forces are commonly manipulated to optimal levels. Using similar mechanisms, manipulating power production during arm cycling exercises could facilitate activation of the upper limb muscles after SCI. **PURPOSE:** To determine if upper limb muscles activation is modulated during arm cycling exercises after SCI. **METHODS:** Five participants with chronic SCI at C4; classified as AIS A (1), B (2), C (1) and D (1) according to the American Spinal Injury Association Impairment Scale performed arm cycling exercises at four power levels (0, 5, 10, 15W) with their hands securely attached to the handles. Surface EMG signals were recorded during a series of 10 consecutive cycles from one muscle above the lesion: medial trapezius (C2-C4); and six muscles below the lesion: deltoid posterior (C5-C6), biceps brachialis (C5-C6), triceps brachialis (C6-C8), extensor digitorum (C6-C8), flexor carpi radialis (C6-C8) and extensor carpi radialis (C6-C8). **RESULTS:** Arm cycling exercises were successfully performed at cadences ranging from 30 to 50 rpm. EMG signals were detected in all muscles from all participants. Modulation of EMG signals within the cycle was seen in most exercise conditions and participants, while modulation was most identifiable when participants produced larger levels of power. Increasing power production from 0 to 15 W led to an increase in the peak EMG activity of the trapezius muscle, as well as in four muscles below the lesion: deltoid, biceps and triceps brachialis, and extensor carpi radialis (P < 0.05). **CONCLUSIONS:** Participants of all levels of impairment successfully performed the arm cycling exercises. Increasing power production up to 15W improved modulation of EMG signals during the cycle and increased activation of some muscles below the lesion, crossing the shoulder, elbow and wrist joints. Including arm cycling exercises

in rehabilitation programs should be considered to take advantage of spinal circuitry available below the level of injury and facilitate the recovery of upper extremity function after SCI.

1061 Board #187 May 27 1:30 PM - 3:00 PM
An Investigation Of Bilateral Differences In Emg Responses During Submaximal Arm Ergometry
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PURPOSE: To determine bilateral differences in neuromuscular fatigue patterns in the Biceps Brachii (BB), Triceps (Tri), and Latissimus Dorsi (LD) muscle groups during arm cranking exercise. **METHODS:** A sample of 4 male and 4 female subjects (aged 22.2 ± 2.2 yrs) performed a submaximal arm cranking test for 10-minutes each @ 40% and 60% of the maximal workload attained previously, in randomized order. Oxygen consumption was determined continuously via indirect calorimetry. Mean EMG Root Mean Square (EMG_{RMS}) was calculated for 10 epochs from 15-second recordings at each minute. Slope coefficients were determined and a 2-way repeated measures ANOVA was used to analyze the differences between exercise intensity and side (left vs. right) for each of the three muscle groups. **RESULTS:** Submaximal VO₂ @ 60% (1.54 L·min⁻¹ ± 0.2) was significantly greater (p ≤ 0.01) than the VO₂ @ 40% (1.2 L·min⁻¹ ± 0.2) indicating an expected energy cost difference. However, there were non-significant differences in EMG_{RMS} for muscle (F=1.8, p ≥ 1.0) and intensity (F=0.49, p ≥ 0.4). **CONCLUSIONS:** During submaximal arm ergometry at two different workloads, possible limb dominant asymmetries were not evident, indicating similar time-dependent acute neuromuscular adaptations for the three muscle groups studied.

1062 Board #188 May 27 1:30 PM - 3:00 PM
Quantifying Kinematic Fidelity Of Demonstrated Therapeutic Shoulder Exercises Between Therapist And Patient
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Reduced cost and greater portability of 3D motion tracking technology increases the likelihood of its use in clinical settings to evaluate therapeutic exercise quality in reference to an ideal movement pattern. It must first be determined how accurately healthy individuals can mirror a demonstrated exercise to understand the inherent variability of this approach. **PURPOSE:** To test the kinematic fidelity between therapeutic shoulder exercises demonstrated by a therapist and mirrored by patients. **METHODS:** Ten, healthy, young (21.4 ± 0.5 yr, 70.2 ± 12.3 kg, 1.68 ± 0.08 m) men and women with a history of resistance exercise training simulated the roles of therapist and patients. A physical therapy aid performed unloaded forward and lateral raise shoulder exercises while a 2D video camera and 12-camera, 3D motion capture system recorded shoulder kinematics. The 2D video recording of the therapist was played back on a life-size screen to each patient who emulated the therapist's demonstrated exercise. Upper-body marker data of both therapist and patients were recorded at 250 Hz, smoothed with a 6 Hz low-pass filter, and shoulder joint kinematics were obtained. Custom software was used to time normalize kinematic data, obtain cross-correlations between each patients' joint positions and the therapist's as a global measure of agreement, calculate the mean absolute error across the range of motion, and error at peak joint excursion. Shoulder angles were compared in the sagittal plane for forward flexion and frontal plane for lateral flexion exercises. **RESULTS:** The mean cross-correlation coefficient for the forward raise was r = 0.98, 95% CI [0.96, 1.00], the mean error across the range of motion was 11.9 deg, 95% CI [7.8, 16.0], and error at peak excursion was 7.1 deg, 95% CI [1.6, 12.5]. The mean cross-correlation coefficient for the lateral raise was r = 0.96, 95% CI [0.95, 0.98], the mean error across the range of motion was 14.6 deg, 95% CI [11.6, 17.7], and error at peak excursion was 4.4 deg, 95% CI [0.6, 8.2]. **CONCLUSIONS:** After time normalization, cross-correlations revealed healthy, young people have an excellent ability to replicate the shape of demonstrated uniaxial shoulder exercises. Yet, a modest amount of absolute position error exists across the range of motion and at peak joint excursion.

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1063 Board #189 May 27 1:30 PM - 3:00 PM
Alterations In Scapular Kinematics And Scapular Muscle Activity After Fatiguing Shoulder Flexion And Extension Movements

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(No relevant relationships reported)

Repetitive overhead motions in combination with heavy loading were identified as risk factors for the development of shoulder pain. However, the underlying mechanism is not fully understood. Altered scapular kinematics as a result of muscle fatigue is suspected to be a contributor. **PURPOSE:** To determine scapular kinematics and scapular muscle activity at the beginning and end of constant shoulder flexion and extension loading in asymptomatic individuals. **METHODS:** Eleven asymptomatic adults (28±4yrs; 1.74±0.13m; 74±16kg) underwent maximum isokinetic loading of shoulder flexion (FLX) and extension (EXT) in the sagittal plane (ROM: 20-180°; concentric mode; 180°/s) until individual peak torque was reduced by 50%. Simultaneously 3D scapular kinematics were assessed with a motion capture system and scapular muscle activity with a 3-lead sEMG of upper and lower trapezius (UT, LT) and serratus anterior (SA). Scapular position angles were calculated for every 20° increment between 20-120° humerothoracic positions. Muscle activity was quantified by amplitudes (RMS) of the total ROM. Descriptive analyses (mean±SD) of kinematics and muscle activity at begin (task_b) and end (task_e) of the loading task was followed by ANOVA and paired t-tests.

RESULTS: At task_b activity ranged from 589±343mV to 605±250mV during FLX and from 105±41mV to 164±73mV during EXT across muscles. At task_e activity ranged from 594±304mV to 875±276mV during FLX and from 97±33mV to 147±57mV during EXT. Differences with increased muscle activity were seen for LT and UT during FLX (mean_{diff} = 141±113mV for LT, p<0.01; 191±153mV for UT, p<0.01). Scapular position angles continuously increased in upward rotation, posterior tilt and external rotation during FLX and reversed during EXT both at task_b and task_e. At task_escapula showed greater external rotation (mean_{diff} = 3.6±3.7°, p<0.05) during FLX and decreased upward rotation (mean_{diff} = 1.9±2.3°, p<0.05) and posterior tilt (mean_{diff} = 1.0±2.1°, p<0.05) during EXT across humeral positions.

CONCLUSIONS: Force reduction in consequence of fatiguing shoulder loading results in increased scapular muscle activity and minor alterations in scapula motion. Whether even small changes have a clinical impact by creating unfavorable subacromial conditions potentially initiating pain remains unclear.

1064 Board #190 May 27 1:30 PM - 3:00 PM
Wrist Guards/supports In Gymnastics: Are They Helping Or Hurting You?

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(No relevant relationships reported)

BACKGROUND: The prevalence of wrist pain among gymnasts ranges from 46-79%. To reduce and prevent wrist pain, gymnasts wear "wrist guards/supports" (WG) and most worn are Tiger Paws (TP) or Skids/Ultimate Wrist Supports (SUWS). There are no studies that have investigated what WG actually do to the wrist in terms of motion and force. **PURPOSE:** To examine whether WG decrease or increase the angle and force at which the wrist impacts the ground while performing a back handspring. **METHODS** A cross-sectional study design was used. Twenty-three young female gymnasts (age: 12.3±1.5 years) performed back handsprings with the following three conditions: wearing no WG, wearing SUWS, and wearing TP. Kinematics and kinetics were captured by 3D motion analysis and force plates. Analysis of variance (ANOVA) was employed to analyze the data. **RESULTS:** Not wearing WG was found to be statistically significant (P= 0.036) in having an increased arc of motion when compared to wearing WG (no WG (67.8 ± 11.0 (62.6, 72.9)), SUWS (59.6 ± 9.4 (55.2, 64.0)), and TP (60.6 ± 11.2 (55.0, 66.1))). There was a statistically significant finding (p= 0.001) with an increased sagittal plane moment when performing a back handspring with SUWS when compared to no WG (no WG (3.75 ± 0.79 (3.39, 4.12)), SUWS (4.76 ± 0.76 (4.40, 5.12)), and TP (4.00 ± 0.97 (3.52, 4.48))). **CONCLUSIONS:** WG do decrease the arc of motion at the wrist when performing a back handspring which could be beneficial if a Sports Medicine provider is trying to limit motion at the wrist joint; however, our data indicated an increase in moment while wearing WG, which may be indicative to an increased risk of injury.

1065 Board #191 May 27 1:30 PM - 3:00 PM
The Effect Of Kinesio Taping On Wrist Flexor Sensorimotor Control In Healthy People

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(No relevant relationships reported)

Sensorimotor control of hand is important for our daily function. Kinesio taping can improve our joint position sense(JPS), force sense(FS), and corticomuscular coherence(CMC) which means the functional connection of our brain and muscle. We can have additional tension on kinesio tape, but we don't know how tension influence its sensorimotor control effect. In addition, the effect of kinesio taping on wrist flexor sensorimotor control has not been thoroughly investigated.

PURPOSE: To determine the effect of kinesio taping on wrist flexor sensorimotor control in healthy people and explore how additional tension influence its effect.

METHODS: This is an observational study with one group repeated measures design. 14 healthy participants were recruited. Participants randomly received three types of taping: (1) without taping; (2) taping with neutral tension;(3) taping with additional 20% tension. The four outcomes were JPS, FS, reaction time(RT), and CMC were measured and compared among the three taping conditions. Friedman's test and Wilcoxon sign-rank test (post hoc comparison test) were used to compare the difference between the three taping conditions. Significant level was set at 0.05.

RESULTS: We recruited 14 participants (7 males and 7 females). Results revealed no significant difference in joint position sense (2.8±1.64 vs. 2.3±1.53 vs. 2.1±1.49 deg., P=0.319), FS(1.47±1.02 vs. 1.28±0.89 vs. 1.5±0.88 Kgw , P=0.751), RT(263±71 vs. 255±53 vs. 306±92 ms, P=0.794), and CMC(0.3±0.29 vs. 0.37±0.34 vs. 0.45±0.47, P=0.755) between the three conditions. However, subgroup analysis revealed that taping with neutral tension and taping with additional 20% tension have a tendency to reduce errors for people having error over 2.5 degrees on JPS test without taping condition (2.1±1.58 vs. 4±1.4 vs. 2.5±1.65 deg., P=0.05). Subgroup analysis also showed that taping with neutral tension and taping with additional 20% tension have a tendency to increase CMC for people having error over 2.5 degrees on JPS test without taping condition (0.2±0.16 vs. 0.45±0.36 vs. 0.68±0.55, P=0.066).

CONCLUSIONS: Kinesio taping seems to have positive effects for people with poorer JPS and increase their CMC. There is no difference in the sensorimotor control effect of taping with neutral tension and taping with additional 20% tension.

1066 Board #192 May 27 1:30 PM - 3:00 PM
Effects On Hand Grip Strength: An Evaluation For Fifa E-sport Players

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PURPOSE: This research project found the effects at the neuromuscular level in the forearm of training session usage of video games through measuring of hand grip strength in players of the FIFA19 video game. **METHODS:** The present study had a universe of 25 men aged 25±5 years, body mass 67.6±9.9 kg and body height of 172.4 ± 6.72 cm, who practiced the FIFA video game for more than 3 days per week and three hours training sessions. Participants were asked for a 24-hour rest period in which they should not have done any physical activity, nor used their video game consoles. An initial measurement of hand grip strength was made using a portable dynamometer Baseline (±1) with a capacity of 90 kg of hand grip, and a competition system that was randomly designed in the FIFA19 all-in-all game, for a consecutive 30-minute practice per player. Finally, new measurements of hand grip strength were found to verify that the strength in the forearm changed. **RESULTS:** An average decrease of 10 kg of force in the right hand and 6 kg in the left hand were found. The statistical test of Shapiro-Wilk was applied in order to conclude whether the sample had a normal distribution; finding that the data followed a non-parametric behavior, based on this result a Mann Whitney U test was used with a confidence interval of 92% confirming that the change of strength in the right arm had a substantial change effect with a p=0.061 and the left arm presented a non-significant variation p=0.122. **CONCLUSIONS:** Prolonged exposure to video games with the use of joysticks represented a risk at the neuromuscular level in the forearm due to the continued position that each player usually maintained. Additionally, the loss of strength could lead to generate injuries such as tendonitis, carpal tunnel, epicondylitis and other musculoskeletal disorders or Trigger-finger due to the fatigue presented. Therefore, it is essential to develop strategies that improve the response level in the resistance and strength of the forearm in people who practice E-Sports both in professional or amateur mode.

B-75 Free Communication/Poster - Health Promotion

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

**1067 Board #193 May 27 2:30 PM - 4:00 PM
 Analysis Of The Current Situation Of Chinese Youth Science And Fitness**

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PURPOSE: The purpose of this study is to analyze the status of Chinese youth participation in scientific fitness activities and to provide reference for enhancing the scientific fitness activities of Chinese youth.

METHODS: A total of 4663 healthy adolescents (age: 22.56 ± 5.81 yrs, female: 54.5%) were investigated for the intervention from 33 provinces (central municipality, national autonomous region). Divided into three groups according to age: juvenile (12-17yrs), pre-youth (18-28yrs), and late youth (29-40yrs); divided into three regions based on the administrative districts: Eastern Region (ER), Central Region (CR) and Western Region (WR).

RESULTS: The Questionnaire consists of two parts: (1) Knowledge and Skills (RRC 0.91), and (2) Cognitive, Attitude and Behavior (ICC 0.97, RRC 0.93). The content validity of the questionnaire was assessed by 11 experts. The structural validity was evaluated by the factor analyses. The results show that: (1) fitness location analysis: 70.6% of youth fitness venues in playground and park squares, gyms accounted for 12.1%, and other proportions of 9.1%. (2) Analysis of fitness methods: 81.5% of fitness methods tend to run and ball sports, the proportion of fitness and bodybuilding projects is 9.4%, the proportion of water projects is 2.5%, and the other proportion is 6.6%. (3) Analysis of fitness duration: 58.1% of young people's fitness time is 30-120 minutes, 30 minutes or less accounted for 33.0%, and more than two hours accounted for 8.9%. (4) Fitness frequency analysis: 62.1% of teenagers are not regular fitness, 17% have planned fitness, and 20.9% do not exercise very much. (5) Analysis of the number of fitness times in the week: 57.5% of the youth fitness no more than 2 times, 29.2% of the teenagers were 3-4 times and 13.3% of the teenagers were 5 times or more.

CONCLUSIONS: Chinese youth participation in fitness activities is relatively concentrated; most of the youth fitness can be controlled within a relatively scientific range but the fitness activities are not regular. Relevant departments use a variety of strategies to promote the systematic and diverse participation of young people in fitness activities. (This study was supported by NPOPSS Grant 15CTY011)

**1068 Board #194 May 27 2:30 PM - 4:00 PM
 Physical Activity And Its Association With Other Wellness And Risk Behaviors From A College Sample**

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PURPOSE: The University of Vermont Wellness Environment App Study is an app-based longitudinal research study focused on promoting health and reducing risky behaviors in a college student population. The mobile ecological momentary assessment over an academic year provides a unique opportunity to accomplish two aims in this study: 1) to assess physical activity (PA) variation across days of the week and throughout the academic year and 2) to explore the correlates that were associated with PA. **METHODS:** Students who enrolled in the study were asked to report their wellness and risk behaviors on a 14-item survey through a smartphone app every day. Each student was also provided an Apple Watch to track their real-time PA. Data were collected from 805 college students, with an average of 97 days of daily surveys and steps data from Sept 2017 to early May 2018. Daily survey and step data were merged by day for each participant. General estimating equations were implemented in SAS PROC MIXED, with an autoregressive covariance structure to estimate the daily steps by demographic variables and other wellness behaviors. **RESULTS:** Based on average daily step counts, females were significantly more active than male college students (Female=8904 and Male=8488, p=.0082). Age-related PA decline was found from freshmen to seniors, but only freshmen was significantly more active than seniors (freshmen=8714 and senior=8023, p=.0051). Students were significantly more active (p<.0001) during the weekday (Monday to Friday ranged from 8800 to 9384 steps) than weekend (Sat=8356 and Sun=7145). Temporal patterns were also revealed that students were less active during Thanksgiving, Winter, and Spring breaks.

Strong correlations were found between daily steps and self-reported mood (p<.0001), sleep (p<.0001), fruit and vegetable consumption (p<.0001), water intake (p<.0001), and screen time (p<.0001). No significant associations were found for marijuana use (p=.997), cigarette use (p=.2518), drug use (p=.1546) but significant associated were observed for illicit pill use (p=.0083), alcoholic drink consumption (p<.0001), and liquor shot consumption (p<.0001). **CONCLUSION:** The study provides a comprehensive surveillance on longitudinal PA pattern and its association with a variety of wellness and risky behaviors in college students.

**1069 Board #195 May 27 2:30 PM - 4:00 PM
 The Effects Of Adhering To ACSM Physical Activity Guidelines On Female University Employees**

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Despite the benefits of physical activity (PA), 50.9% of Americans do not meet the American College of Sports Medicine (ACSM) guidelines for exercise. Physical inactivity, low cardiovascular fitness (CVF), obesity and body fat percentage (BF%) are risk factors for increased cardiometabolic morbidity and mortality. Universities create sedentary environments that do not promote PA, thus jeopardizing their employees' health. **PURPOSE:** To educate university employees about the health-related benefits of PA and the time frame needed to see changes by meeting the minimum ACSM PA guidelines. **METHODS:** Female physically inactive university employees were targeted (age 40 ± 11 yrs, body weight 76.9 ± 4.4 kg). Participants underwent basic anthropometric, mean arterial pressure, body composition measurements, and a submaximum oxygen consumption test (using a Bruce protocol) as baseline measurements. Participants were given the ACSM guidelines and instructed to follow them for 12 weeks. No other control was made on participants' lifestyle factors between the pre- and post-measurements. They were given a Fitbit® tracker to record and monitor their PA activity levels. This is an ongoing funded project from the Advancement of Interprofessional Collaboration and Education (ADVANCE) project and the reported results reflect pre- and post-values from the end of weeks 1 to 4 (N=4). Thus, all measurements were repeated after 4 weeks of the intervention. One-way factorial ANOVA was used to detect changes between Week 1 and Week 4. Significance was set at p < 0.05. All analyses were performed using SPSS®. **RESULTS:** BF% was significantly reduced by 38.8% ($F_{1,5} = 9.943, p = .025, \eta^2 = .665$). Lean mass was increased by 15.6%, mean arterial pressure was reduced by 9.6% (p > .005), waist circumference was reduced by 5.7% (p > .005), waist hip ratio was reduced by 20.7% (p > .005), minutes of being physically active were increased by 13.7% (p > .005), and predicted maximum oxygen consumption was increased by 4% (p > .005). **CONCLUSION:** Even though these results represent preliminary data from small sample size the practical significance of this study is that university employees can improve their risks factors for cardiometabolic morbidity and mortality by adhering to the ACSM PA guidelines for even 4 weeks.

**1070 Board #196 May 27 2:30 PM - 4:00 PM
 Motivational Factors Associated With Physical Activity In Middle School Students**

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 (No relevant relationships reported)

PURPOSE: The purpose of this study was to identify physical activity motivators in middle school students.

METHODS: Students (n = 219) self-reported demographics and physical activity motivators via questionnaire. Predetermined options for motivators were: friends, advertisements, music, family, look good, feel good, fun, and other. Weight status was determined by the age- and gender-specific BMI percentile CDC recommendations for children: underweight (< than 5th), healthy weight (5th - 85th), overweight (85th - 95th), obese (95th or greater).

RESULTS: Male students (n=113) were 12.65 (± 1.63) years old, had a BMI of 21.23 (± 6.03). For males, 53.8% were categorized as healthy weight, 18.7% as obese, 17.6% as overweight, and 9.9% as underweight. Grade distribution for males was 37.2% 6th graders, 39.8% 7th graders, and 23% 8th graders. The top activity motivators for males were to look good (24.5%), friends (22.7%), and music (20.0%). Additionally, underweight and overweight male students were motivated by feeling good (22.2%; 57%, respectively) and overweight males by advertisements (14.3%). Evaluating motivators by grade for males showed 8th graders were motivated by music (33.3%), 7th graders by looking good (26.7%), and 6th graders by friends (29.3%). Females (n=106) were 12.57 (± 1.05) years old, had a BMI of 21.43 (± 6.47). For females, 60.3% were categorized as healthy weight, 17.8% as obese, 12.3% as overweight, and 9.6% as underweight. Grade distribution for females was 44.8% 6th graders, 28.6% 7th

graders, and 26.7% 8th graders. The top activity motivators for females were friends (25.0%), looking good (24.0%), and music (23.1%). Additionally, overweight students were motivated by feeling good (50.0%) and obese females were motivated by family (15.4%). Evaluating motivators by grade for females showed the top motivators for 8th graders to be looking good (36.4%) and feeling good (27.3%); while the top motivators for 7th and 6th graders were friends (32.1%, 27.7%) and looking good (21.4%, 25.5%). **CONCLUSIONS:** In this study of middle school students, motivators for activity were influenced by gender, grade and BMI. Recognizing and addressing population-specific motivators may enhance activity program outcome success.

1071 Board #197 May 27 2:30 PM - 4:00 PM
Efficacy Of Smartphone App In Worksite Physical Activity Intervention And Anthropometric Changes In Obese Women

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Most U.S. office workers engage in little physical activity and increased time sitting which increases risk for adverse health conditions such as obesity. Research on the effectiveness of smartphone apps to increase physical activity and reduce sitting time in workers is limited. **PURPOSE:** To examine the efficacy of a smartphone app and worksite physical activity intervention program to increase daily physical activity with the goal of reducing sitting time via walking or increased steps on anthropometric changes over an 8-week period. **METHODS:** Subjects (N=22) were obese, female volunteers, all of whom had access to a smartphone and the Stridekick™ app, that recorded steps, with a progressive goal of 7,500-15,000 daily steps. Relative (%) body fat was measured via DEXA scan, along with five anthropometric measurements, biceps, waist, abdomen, hips and thigh, prior to and after 8 weeks. Dependent samples t tests probed for significant differences at the $p < 0.05$ level. Values are expressed as mean±standard deviation. **RESULTS:** Significant changes were determined for the pre-post anthropometric measurements: biceps, hips and thigh (12.0 ± 1.1 vs. 11.5 ± 1.3 ; 42.8 ± 5.1 vs. 42.2 ± 5.1 ; 24.9 ± 2.7 vs. 23.8 ± 2.8 in, respectively). Pre-post BMI, waist, abdomen measurements and % relative fat were not significantly different (31.0 ± 5.7 vs. 30.5 ± 5.7 kg/m²; 34.1 ± 4.8 vs. 34.1 ± 4.9 in; 39.2 ± 4.7 vs. 39.0 ± 4.8 in; 41.4 ± 6.6 vs. 41.8 ± 6.3 %fat, respectively). **CONCLUSION:** This work is suggestive that the incorporation of a smartphone app into a worksite physical activity intervention may change anthropometric measures via increasing steps and ultimately reduce adverse health concerns.

1072 Board #198 May 27 2:30 PM - 4:00 PM
Effects Of Aerobic Exercise On Vascular Function Of Recessive Obese Women

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 (No relevant relationships reported)

PURPOSE: To reveal features of changes in vascular function among recessive obese women after aerobic exercise, instruct them to do exercise scientifically and prevent cardiovascular disease.

METHODS: Thirty nine young women (21.8 ± 1.9 yrs) participated in the study that was approved by IRB at Beijing Sport University. There were twenty recessive obese women (RO group) and nineteen normal weight women (NC group). Everyone completed 30min walking exercise at the intensity of 65% HRR on the treadmill. The exercise began after two hours of the meal. The pulse wave velocity (PWV) and ankle brachial index (ABI) were determined before exercise, immediately after exercise, then every 5 minutes for half an hour.

RESULTS: (1) There were no significant differences between the participants of two groups in age, height, weight, body mass index, PWV or ABI at rest. However, the percent body fat in the RO group were significantly higher than in the NC group ($P < 0.01$). (2) Immediately after the exercise, the RO group demonstrated significantly decreased level of PWV (912.8 ± 88.1 vs 1001.0 ± 112.6 cm/s, $P < 0.01$). And 30 minutes after the exercise, the level of PWV in the RO group returned to the baseline level. Whereas PWV level in the NC group remained unchanged ($P > 0.05$). (3) Immediately after the exercise, participants in the RO group had a significant reduction in the ABI level (13.6%, $P < 0.01$). 30 minutes after the exercise, participants in the RO group demonstrated significantly increased level of ABI (11.6%, $P < 0.01$). Participants in the NC group had the same trend. Moreover, there were significant differences in changes in ABI level between the two groups (13.6% vs 9.5%, $P < 0.05$).

CONCLUSIONS: Although there was no difference in arterial stiffness between recessive obese women and normal weight women in resting state, the vascular elasticity of recessive obese women was weaker than normal weight women during exercise. Vascular function of healthy women in the same intensity exercise was more adaptable than that of recessive obese women. Aerobic exercise at the intensity of 65% HRR could ameliorate arterial stiffness and improve vascular elasticity of recessive

obese women, which were beneficial to prevent cardiovascular disease in early life. Supported by Scientific Fitness Guidance Program of General Administration of Sport(2017B064).

1073 Board #199 May 27 2:30 PM - 4:00 PM
Investigation Of Physical Activity Instruction In United States Nurse Practitioner Curricula

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Investigation of Physical Activity Instruction in United States Nurse Practitioner Curricula

Purpose: The purpose of this study is to investigate formalized physical activity (PA) training in United States (US) Nurse Practitioner (NP) curricula. There are over 270,000 currently certified NPs with over 72% delivering primary care. PA is an important lifestyle behavior that can aid in prevention and treatment of chronic conditions therefore, having primary care providers trained in PA assessment and counseling to patients is vital in disease prevention and chronic conditions management.

Methods: Data was collected in 3 faculty-student teams in the Pacific Northwest, Eastern, and Southern US from 1083 NP training programs through website evaluation. Examined program descriptions, course titles and course descriptions for mention of general health keywords, PA and nutrition. General health key words included: health promotion, chronic disease, disease prevention. Exclusion criteria included: programs unaccredited at time data extraction or with non-primary care focus. Chi-square and Fisher's exact tests were used to compare differences in keywords within course titles and descriptions by institution type, program type, program specialty, and program delivery were assessed.

Results: There was a dearth PA keywords in program descriptions. Differences were found for general keywords in course titles by program specialty ($p < 0.001$) and program delivery ($p < 0.001$); general keywords in a course descriptions by program specialty ($p < 0.001$) and program delivery ($p = 0.011$); and nutrition keywords in a course descriptions by institution type ($p = 0.038$).

Conclusion: These results are the first step in the process of ensuring that NPs have a working knowledge of PA and the skills to provide PA counseling to their patients. Direct assessment of NP programs should be done to confirm our findings. The presence of general keywords is promising and can be built upon, and this will lead to the next step of confirming findings through survey collection.

1074 Board #200 May 27 2:30 PM - 4:00 PM
Changes In Physical Activity Patterns Upon Transitioning To College And Away From Organized Sports Participation

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The trend for individuals between 18 and 24 years of age, many of whom are undertaking tertiary education, is to reduce their amount of physical activity upon their transition to college. Reasons cited for the decline in physical activity among these vulnerable individuals usually include 'not enough time' due to studying and taking exams, yet different physical activity opportunities for college students may also influence how these individuals change if and how they remain physically active.

PURPOSE: To examine changes in physical activity patterns in students who recently transitioned from high school to college.

METHODS: A Qualtrics survey was emailed to approximately 3,500 undergraduate students who lived in the residence halls at a moderately-large Mountain West university during the 2016-2017 and the 2017-2018 academic school years. Survey questions addressed known correlates of physical activity such as age, sex, self-efficacy, attitude, history of physical activity, and social environment.

RESULTS: Two-hundred thirteen students responded to the survey, and approximately 73% of the respondents who reported that they were physically active on a regular basis when they were in high school remained so during their first year in college. There was a significant association of previous activity levels and whether these students continued to be active when they were in college ($\chi^2 = 10.3973$, $df = 1$, $p\text{-value} = 0.001262$, $p < 0.01$). Also, survey respondents reported an 88% reduction in organized sports participation (e.g., high school basketball, soccer, and volleyball team sports) and a concomitant 87% increase in activities such as 'personal workouts,' running, and weight training.

CONCLUSIONS: Student suggestions to enhance engagement in physical activity on campus included better advertisement of Campus Rec programs and reduced costs for intramurals and group exercise classes suggesting increased opportunities to engage more in organized sports and activities.

1075 Board #201 May 27 2:30 PM - 4:00 PM
Relationship Between Different Bouts Of Physical Activity And Physical Fitness In Preschool Children

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Purpose: To examine the relationship between bouts of physical activity and physical fitness in preschool children. **Method:** Sporadic sessions (2-4 seconds) of moderate-to-vigorous physical activity (MVPA), short bouts (5-9 seconds) of MVPA; and medium-to-long bouts (≥ 10 seconds) of MVPA were measured over 7 days using ActiGraph GT3X accelerometers. Physical fitness was assessed by a 20-meter multistage shuttle run test (cardiorespiratory fitness), handgrip and standing long jump tests (musculoskeletal fitness), and the 2x10-meter shuttle run test (speed/agility). A composite score of physical fitness was created from the mean of the standardized values of all physical fitness tests. The bouts of physical activity and composite scores were categorized into quartiles (Q1-Q4 group) by sex; the highest quartile (Q4) of composite scores were assigned as high healthy fitness (HPF). Logistic and linear regression were used to investigate the relationship between bouts of MVPA and HPF. **Results:** A total of 265 participants were included in the final statistical analysis (boys, 149; girls, 116; 57.19 \pm 5.33 months). After adjusting for confounding factors, relative to Q1, the odds ratios (OR) for a HPF in Q4 were 11.72 (95% CI=2.27- 60.53), 7.53 (95% CI=1.83-30.90) and 8.98 (95% CI=1.78-45.39) for sporadic MVPA, short bouts and medium-to-long bouts of MVPA in boys, respectively. Similar results were also observed in girls, 11.85 (95% CI=2.33-60.19), 12.34 (95% CI=2.47-61.57) and 8.58 (95% CI=1.70-43.41), respectively. There was a non-linear relationship between overall MVPA and HPF in boys. When the total MVPA ≤ 65 min/day, the OR of achieving HPF increased by 17% (OR = 1.17, 95% CI = 1.02-1.35) for every 1 minute/day increment in total MVPA; no increases in HPF with increased MVPA were observed for >65 min/day. This non-linear relationship was not found in girls. **Conclusion:** There is a significantly positive relationship between bouts of MVPA and HPF in preschool children. To achieve HPF in preschool children, it is recommended that boys accumulate total MVPA 65 minutes or longer every day. Supported by National Natural Science Foundation of China (81703252)

1076 Board #202 May 27 2:30 PM - 4:00 PM
Injury Rates For Novice Half And Full Marathoners As A Function Of Increased Distance

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Purpose: To examine the change in training load, i.e. the increase in distance from week to week, that causes injury in half-marathon and full marathon runners. **Methods:** Runners, N=292, wore foot pods tracking distance and duration of runs. The runners also submitted a survey each week indicating areas of pain, how much it hurt, and the training effect of that pain. They chose whether their pain was minimal (did not miss any training), moderate (missed one day of training), severe (three or more days of training), or crippling (could not participate in that week of training). The majority were novice, college aged runners (runners who had never ran a half-marathon or full-marathon distances) who participated in a 15 week class training for a half or full marathon, with a weekly lecture and a weekly long run. The runners also had access to a physical therapist during the lecture and the long run. Runners excluded from the study did not have at least three consecutive weeks of training, including the week of the injury. **Results:** The data indicates that the runners ran erratically, with an average 1 week distance increase for uninjured runners of 27.9% and a 2 week increase of 58.9%. In contrast, injured runners (N=41) changed their distance from the week prior to injury to the week of reporting the injury by 0.95% and 2 weeks prior to injury to the injury by -1.1%. **Conclusion:** This data was derived from novice runners with deadline driven schedules leading to less consistent training habits. This may account for the lack of correlation to previous studies which show a 10% increase in mileage week to week, or a 30% increase over 2 weeks, leads to an increased risk of injuries rather than the lack of mileage difference seen in this study. What was apparent, rather than week to week mileage, was cumulative load over the duration of the class appears to have led to the injury, as the average time to injury was 11.2 weeks and standardized distance increase prescriptions are not applicable to novice runners.

1077 Board #203 May 27 2:30 PM - 4:00 PM
Exercise Patterns And Perceptions Among South Asian Adults In The Us: The Shape Study

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Purpose: Our objective was to determine biological differences and perceptions about exercise among an immigrant South Asian population living in the southeastern United States (US). **Methods:** This is a descriptive study of exercise patterns and perceptions using baseline data from a diabetes intervention study with immigrant South Asian adults now living in the US. The sample included middle aged, predominantly male, well-educated, immigrant South Asians. Participants were recruited through advertisements in local South Asian magazines, information sent through community organization listservs, and in-person outreach at health fairs and screening, diabetes information events, and South Asian stores. Participants reported to the Georgia Clinical and Translational Science Alliance General Clinical Research Center at Emory University Hospital and completed a baseline visit for the South Asian Health and Prevention Education pilot study. **Results:** The mean age of this cohort was 44.6 [10.6] years and 35% female. Of the 52 people included in this analysis, 81% did not exercise at least 150 minutes per week to meet the US Physical Activity Guidelines. Of those that did meet the Physical Activity Guidelines, 90% reported walking as their primary form of exercise. Overall, 65% reported preferring walking to other modes of exercise. There were no differences between exercisers and non-exercisers when asked about the benefits or barriers of exercise. **Conclusion:** South Asians living in the southern US do not meet the US Physical Activity Guidelines. The preferred mode of exercise is walking close to home. Although barriers to exercise are similar to those of other races in the US, preferred mode of exercise and preferences of women should be considered when implementing physical activity interventions.

1078 Board #204 May 27 2:30 PM - 4:00 PM
Design Of A Questionnaire To Support Behaviour Change In Fitness Centres

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The 6-month dropout rates of fitness centres' members (FCM) are reported to be up to 85%; while the attendance rate oscillates between 1.1 and 5.6 sessions/month.

PURPOSE: Design a questionnaire that identifies individual determinants of FCM to engage in regular exercise at fitness centres.

METHODS: A pragmatic literature review and three discussion groups (n = 9) were used to design the draft version of the questionnaire that addresses the six components of the COM-B Model (Capability [Physical & Psychological]; Opportunity [Social & Physical]; and Motivation [Reflective & Automatic]). An external panel (5 PhD in behaviour change; 4 PhD in sport science and 4 professionals from the fitness industry) critically reviewed the questionnaire until achieving sufficient consensus on items' relevance and clarity (content validity). The current version consists of 35 items categorized as Physical Capability = 3 items; Psychological Capability = 6 items; Social Opportunity = 4 items; Physical Opportunity = 11 items; Reflective Motivation = 7 items; Automatic Motivation = 4 items. Construct validity was assessed via Known-group validity by using the responses from 162 FCM. We hypothesized that those who have a low attendance rate (< 2 days/week) get lower punctuation on the studied variables than those with a middle attendance rate (2-3 days/week) and high attendance rate (≥ 4 days/week). One-way ANOVA, Kruskal Wallis Test and Monte Carlo simulation were used for groups comparisons. The internal consistency reliability was assessed with Cronbach's Alpha.

RESULTS: Content validity: Relevance (CVI = 0.94; Aiken's V = 0.980); Clarity (CVI = 0.97; Aiken's V = 0.990). Construct validity: FCM with low attendance rate showed lower values ($p < 0.05$) for Motivation (Reflective & Automatic), Opportunity (Social & Physical) and Capability (Physical & Psychological) than the other two groups. The internal consistency of the questionnaire was $\alpha = 0.884$.

CONCLUSIONS: The questionnaire shows acceptable content validity, known-group validity and internal consistency reliability. Moreover, the questionnaire has proved to be sensitive to the FCM with low attendance rate as the group-validity hypothesis was confirmed. Therefore, it may be used to support individual FCM's in increasing their attendance and engaging in regular exercise.

1079 Board #205 May 27 2:30 PM - 4:00 PM
Physical Activity And Cognitive Characteristics Of 5th Grade Student Participants In The Power Program

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High volumes of sedentary instructional time during the school day contradicts research supporting the role of physical activity (PA) in enhancing students' attention, academic achievement and executive function (EF).

PURPOSE: To describe PA, EF and academic performance in 5th grade student participants prior to a multimodal classroom curriculum called POWER that incorporates both PA and the teaching of EF skills.

METHODS:

A convenience sample of six 5th grade classes in two diverse schools in New Jersey were studied. Three classes in one school received POWER starting September 2019 (POW); 3 waitlist control classes in the other school (CONT) will begin POWER in January 2020. Students wore wrist-worn accelerometers for a full school week and completed the Youth Activity Profile (YAP). EF was assessed by 3 cognitive tests from the NIH Toolbox (NIHTB). Academic performance was assessed via STAR math tests. Data are reports as mean (standard deviation). Groups comparisons were made by independent samples t-test.

RESULTS:

86 students (POW n = 49; CONT n = 37; mean age = 10 (0.2) years) completed the YAP and NIHTB cognitive tests at baseline. A subset of 70 students (n = 35 in each group) wore accelerometers. POW spent 77.4% (2.6%) of the school day in sedentary behavior and 20.2% (2.6%) in MVPA, while CON spent 87.2% (1.4%) and 11.39% (1.3%) respectively in sedentary and MVPA. The YAP activity score at school was 3.5/5 for POW and 3.2/5 for CON. The age-corrected composite score for NIHTB was 94.1 (10.8) for POW, and 97.4 (9.5) for CON (national average=100). Students' scaled score for the STAR math assessment was 735 (86.3) and 730.5 (78.7) (~70th percentile) for POW and CON, respectively.

CONCLUSIONS:

POW PA was significantly higher than CON ($p = .001$), possibly due to intervention teachers' implementing some aspects of POWER earlier than instructed. Students tested below age-corrected national averages on both the NIHTB and academic tests; there were no significant differences between groups ($p = .15$ and $p = .81$).

1080 Board #206 May 27 2:30 PM - 4:00 PM
Effects Of An 8-week CrossFit Program On Psychophysical Well-being In Healthy Adolescents

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It is well known that High-Intensity Interval Training, such as CrossFit, positively influences physical and mental well-being. However, few rigorous studies evaluated both psychological and physical fitness variables in young people.

PURPOSE: To investigate if 8 weeks of CrossFit training program could positively influence the psychophysical well-being in adolescents.

METHODS: 30 healthy participants (n= 18 males and 12 females) were matched into pairs based on gender and randomly allocated into an intervention group (n=15; 18.2 ± 0.8 years) that performed the 8 weeks CrossFit training program or control group (n=15; 18.3 ± 0.8 years). At baseline and after 8 weeks, physical fitness tests (i.e. squat, push-up, lunge, and 20-meter run) and psychological measures (PCS and MCS indexes of the Short Form-12, and Regulatory Emotional Self-Efficacy scale (RESE, negative and positive)) were performed.

RESULTS: After 8 weeks, the intervention group showed significant improvements in the number both of maximal repetitions for the squat test ($\Delta 6.66 \pm 2.58, p < 0.001$), push-up test ($\Delta 5.87 \pm 4.23, p < 0.05$), and lunge test ($\Delta 7.89 \pm 3.11, p < 0.001$) and of maximal laps for the 20-m run test ($\Delta 3.60 \pm 2.27, p < 0.01$). Also, higher scores for the PCS ($\Delta 4.7 \pm 1.3, p < 0.01$) and MCS ($\Delta 5.2 \pm 0.9, p < 0.001$) indexes, and the RESE negative ($\Delta 6.0 \pm 3.9, p < 0.001$) and RESE positive ($\Delta 4.0 \pm 2.7, p < 0.001$) scales were found in the intervention group. No statistical differences were detected in the control group for all dependent variables.

CONCLUSION: Findings suggest that an 8-week CrossFit intervention program could positively affect the general physical well-being and mental attitude and improve the emotional perceived self-efficacy in managing negative affect and in expressing positive emotions in healthy adolescents.

1081 Board #207 May 27 2:30 PM - 4:00 PM
Motivation, Segmented Physical Activity, Sedentary Behavior, And Weight Status In Adolescents: A Path Analysis

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PURPOSE: The purpose of this study was to examine the relationships linking motivational variables with BMI percentile (BMI%) via segmented physical activity (PA) and sedentary behavior (SB) in adolescents using path analysis.

METHODS: Secondary data analysis was performed using participants from the Family, Life, Activity, Sun, Health, and Eating (FLASHE) study. A non-probability panel balanced to the US population on sex, Census division, household income and size, and race/ethnicity were screened for eligibility. The final sample consisted of 1,643 adolescents (822 girls, 821 boys). Motivational variables consisted of PA enjoyment, self-efficacy, and peer social support. Mediator variables consisted of segmented weekly PA and SB assessed using the Youth Activity Profile (YAP). BMI% was the outcome. A recursive bootstrapped path analysis was conducted to examine the relationships between motivational variables, segmented PA and SB, and BMI% with indirect effects calculated via bootstrapped mediation analyses.

RESULTS: The relationships between motivational variables and segmented PA and SB were stronger than relationships between segmented PA and SB and BMI%. Three mediated paths were observed: self-efficacy and BMI% using sedentary YAP as the mediator (IE = -0.38, 95%CI: -0.65, -0.18), enjoyment and BMI% using weekend YAP as the mediator (IE = -0.62, 95%CI: -1.14, -0.12) and social support and BMI% using weekend YAP as the mediator (IE = -0.53, 95%CI: -1.00, -0.07).

CONCLUSIONS: The relationship between adolescent motivational variables and segmented PA and SB is relatively strong and specific motivational variables' relationships with BMI% is mediated through segmented PA and SB. This is one of the few studies to examine these relationships using a large U.S. sample of adolescents, supporting strong external validity evidence to the U.S. adolescent population. It also adds to the knowledge base regarding the relative strength of the inter-relationships among the observed variables. The relationships among motivation, PA, and health outcomes are complex and this study provides some new information that can be used to promote PA and reduce SB in the adolescent population.

1082 Board #208 May 27 2:30 PM - 4:00 PM
Perceptions And Use Of Internet-based Physical Activity And Health Resources Among Postmenopausal Women: A Qualitative Analysis.

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PURPOSE: With about 80% of women over age 50 reporting little/no regular physical activity (PA), this group is the most sedentary population in the U.S. Social media and new technologies provide an opportunity for home-based health promotion and behavioral interventions. **Purpose:** Use a qualitative approach to explore how women over age 50 use social media and online activities to access health information and participate in PA.

METHODS: Telephone interviews were conducted on a sample of healthy women over the age 50 years. A semistructured interview guide was used to acquire information on common internet use, online health information search history, and history of accessing physical activity programming. Responses were transcribed and examined for recurring themes and language-based sentiments using established qualitative content analytic procedures.

RESULTS: All women were in their mid-50's with a mean age was 55.5 years (range 53-56 years). All women were peri- or post-menopausal, and were either married or widowed. Facebook was the most commonly used online social app and was used to "keep up" with family and friends, to access support groups and read health articles. Fitbit was used by the majority of interviewees to track daily steps, sleep patterns, and calories burned during workouts. The participants also liked the goal-setting, self-monitoring, and social component (competition/social comparison) provided by Fitbit. MyFitnessPal was a commonly used app to track activity and monitor the relationship between calories consumed and calories expended. A number of women, particularly those with health conditions, accessed online sources to research medications/drug interactions and learn more about their condition. Participants reported that they were distrustful of much online information and were skeptical of many health web sites. Additionally, the women indicated that they would like to see more age-related content and access to communities of women of similar age.

CONCLUSIONS: Internet access to social groups and health/PA information is important to women over the age of 50. This demographic is receptive to information and interventions accessed online that are age-appropriate and include a strong social support component.

1083 Board #209 May 27 2:30 PM - 4:00 PM
The Relationship Of Physical Activity And Motor Ability Development In Children Aged 7-8 Years

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Two thirds of children does not meet physical activity (PA) guidelines in China. The fundamental movement skills (FMS) level is a good predictor of physical activity levels and weight status in children. Also, early motor skill has long-term effect on individual's PA level. So, understanding the relationship of FMS and PA is important for physical activity intervention planning. **PURPOSE:** To analyze the relationship of daily physical activity participation and the motor ability of children aged 7-8 years. **METHODS:** The Movement Assessment Battery for Children-2 (M-ABC-2) and the Test of Gross Motor Development - 2nd edition (TGMD-2) were used to test the motor ability of 91 children aged 7-8 years. The ActiGraph GT3X+ accelerometer was used to measure the physical activity participation for 7 consecutive days. **RESULTS:** The total time of boys spent in moderate physical activity (MPA) and moderate-to-vigorous physical activity (MVPA) was 21.4±7.5min and 27.3±11.2min, respectively, which was higher than those of girls (17.5±7.4min and 22.2±9.7min, $P<0.05$). The score of object control subscale in boys was 6.73±2.49, which is better than that of girls (5.71 ± 2.14, $P<0.05$); children's fine motor skill and locomotor skill were positively correlated with VPA, MPA and MVPA ($r = 0.2 - 0.3$). **CONCLUSION:** In this study, children spent less time in MVPA, especially in girls. The development of object control ability in boys is better than that of girls; there is a positive correlation between children's fine motor skills and physical activity. Therefore, children need to learn and practice FMS for participation and maintenance of PA. FMS should be tested in primary schools, so weaknesses could be identified in children and improved via proper intervention. Supported by The National Social Science Fund of China(Key Project of National Education Science, ALA190015)

1084 Board #210 May 27 2:30 PM - 4:00 PM
Hkjc Physical Activity Tracker (a Wrist Tracker) Validation Study

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 (No relevant relationships reported)

PURPOSE: To investigate whether the number of steps from the tracker can accurately reflect the energy expenditure and movement intensity in various exercise activities.

METHODS: Fifteen participants (9 males, 6 females; age range: 19-36 years; body mass index range: 18.4-29.7) were fitted with JC tracker on the wrist to record steps and Cosmed K5 metabolic analyzing system to measure energy expenditure. Participants performed low, moderate and high intensity exercise respectively, in which the exercise was randomly selected, including running, cycling, arm curl and squat. They performed these activities for 5 min or reached to the targeted number of repetition. Descriptive statistics and one-way ANOVA were used to test if with the change of exercise intensity, the number of steps of the JC tracker will change accordingly. **RESULTS:** The Mean-VO₂ (mL/min/Kg) was significantly changed as the exercise intensity elevated in running (low intensity: 14.13±0.63; moderate: 28.53±2.13; high: 34.96±7.08, $p<0.05$), stationary bike (low intensity: 11.5±2.3; moderate: 25.8±2.8; high: 25.6±2.08, $p<0.05$) and arm curl (low intensity: 6.88±1.6; moderate: 10.17±5.82; high: 14.54±4.3, $p<0.05$), but the changes are not obvious in the squat exercise (low intensity: 13.51±2.56; moderate: 16.55±2.15; high: 19.02±4.01, $p=0.144$). However, as the Mean-VO₂ changed, there was no significant difference of steps measured by the tracker. Moreover, although there was a trend of increasing the number of steps in the running exercise (low intensity: 607.5±79.9; moderate: 736.4±97.8; high: 742.2±95.35), it was not statistically significant ($p=0.252$).

CONCLUSIONS: The JC tracker can reflect the changes in energy consumption in the dynamic movement, such as running; while doing stationary cycling, arm curl or squat, the tracker did not accurately reflect the participants' actual energy expenditure. A tracker with both heart rate and steps may be able to more accurately measure and reflect energy expenditure and physical activity levels regardless of motion. This project was supported by Hong Kong Jockey Club Charity Trust Fund.

1085 Board #211 May 27 2:30 PM - 4:00 PM

Understanding Associations Of Children's And Parents' Enjoyment With Their Subsequent Co-participation In Physical Activity

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PURPOSE: To determine if children's or parents' enjoyment of physical activity (PA) is associated with future co-participation in PA.

METHODS: Each parent-child dyad (n=28; age (mean±SD), parents: 38.0±6.6 years, children: 6.0±1.7 years) was guided through five PAs (walking, jumping games, body-weight exercises, tag, dancing) in a research fitness center. Immediately after completing each PA, researchers provided the Visual Analog Scale (1-"Do not like it at all" to 5-"Like it very much") to assess children's and parents' independent enjoyment of the PA. Dyads were asked to complete the PAs at home during the following week. Parents reported their dyad's participation in the PAs one week later. Separate logistic regression analyses were performed to examine the association of children's and parents' PA enjoyment with subsequent completion of the PAs at home.

RESULTS: For all five PAs, children's enjoyment of the activity was not significantly associated with the dyad's completion at home (all $p>0.05$). However, parents' enjoyment of the activity was significantly associated with the dyad's completion of the PA at home for jumping games (parental enjoyment (mean±SD): 4.73±0.65 for dyads that completed PA at home; 3.78±1.1 for dyads that did not; $p=0.033$) and dancing (parental enjoyment (mean±SD): 4.32±0.82 for dyads that completed PA at home; 3.10±1.73 for dyads that did not; $p=0.032$).

CONCLUSIONS: Parents' enjoyment of PA may be more important than children's enjoyment of PA in predicting whether dyads complete activities at home. This could inform future exercise promotion research of parent-child dyads by focusing on PAs that the parents enjoy.

1086 Board #212 May 27 2:30 PM - 4:00 PM

Applying The RE-AIM Framework To The Health Promotion Policy In Toyooka City.

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PURPOSE: Toyooka city, located on the western frontier of Japan, is regarded as harboring a typical Japanese super-aging society. The rapid aging of the population is placing a hefty financial burden and has led to an increased focus on strategies that help the elderly maintain physical activity. In 2012, the health promotion policy of "Walking as a way of life" was formulated to enforce the municipal office to play a more significant role in promoting physical activity at the population level in Toyooka city. This study aimed to evaluate the implementation and impact of this policy based on the RE-AIM (Reach, Effectiveness, Adoption, Implementation) framework. **METHODS:** A sample comprising 2,500 randomly selected residents were mailed a questionnaire. The data were analyzed using the RE-AIM framework. The use of the RE-AIM framework can enhance the generalizability of results when implementing the enforcement of the policy. Reach was defined as the proportion of eligible citizens that reported being aware of this program. Effectiveness of physical activity and social capital factors (i.e., networks in the neighborhood, trust for the community, social participation) was compared between citizens who were aware of the policy against those who were not aware of it. Independent sample t tests were used to compare groups for differences. Adoption was evaluated according to the proportion of organizations that had delivered results. Implementation governed how the results would be publicized. **RESULTS:** In total, 873 response questionnaires were completed and returned. There were 340 citizens (38.9%) who were aware of this policy. The group that was aware had significantly higher social capital than the group that was not ($p<.01$). However, no significant differences were found in adherence to physical activity. Of all organizations, 30.9% reported adoption. When considering the most cited information sources, the print media from the municipal office was distributed to 100% of homes. **CONCLUSIONS:** The use of the RE-AIM framework revealed that the health promotion policy of "Walking as a way of life" in Toyooka-city could reach residents with high social capital, but could not increase their physical activity. The authors have no conflicts of interest.

1087 Board #213 May 27 2:30 PM - 4:00 PM
Time-Based Changes In Physical Education Offerings In Response To A Legislative Mandate

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Physical education (PE) remains one of the most effective strategies for promoting school-based physical activity. Fewer than 10 states mandate public schools meet current public health recommendations for PE. Moreover, it remains unknown how implementing such mandates affects PE offerings. In 2007, Oregon passed legislation requiring elementary schools to provide 150+ min/week of PE by fall of 2017. No funding was offered to support this mandate.

PURPOSE: To evaluate time-based changes in PE offerings among Oregon public elementary schools for 8 years (2009-10 to 2016-17) preceding required compliance to the legislative mandate requiring 150+ min/week of PE.

METHODS: A total of 752 Oregon public elementary schools reported yearly minutes of PE offered and the total number of school weeks in session per year. Mean PE min/week were calculated by dividing yearly PE minutes by weeks in session. Additional publicly available explanatory variables including rurality (rural vs. non-rural county designations) and school schedule (four vs. five-day school week) were collected. A linear-mixed effects model was fit to evaluate time based-changes in PE with min/week of PE as the dependent variable, school year, rurality, and school schedule as fixed effects, and school as a random effect.

RESULTS: Although significant year-to-year variability in PE minutes was observed ($p < 0.001$), between 2009-10 to 2014-15 mean PE minutes remained relatively stable at 74 to 77 min/week before experiencing two larger year-to-year increases in 2015-16 (+3.9 min/week from 2014-15 to 80.8 ± 1.8 min/week) and 2016-17 (+4.0 min/week from 2015-16 to 84.8 ± 1.9 min/week). Schools located in rural counties were offered significantly more PE than non-rural schools (80.7 ± 1.7 vs. 74.6 ± 1.8 min/week, respectively, $p < 0.001$). No significant difference in mean PE min/week was observed between four vs. five-day school week formats (77.7 ± 2.3 vs. 77.5 ± 1.3 min/week, respectively, $p = 0.924$).

CONCLUSION: Despite having a 10-year lead-in period to increase PE time to 150+ min/week, Oregon elementary schools were only offering about half the required PE min/week (56.7%) in the year prior to mandatory compliance. Unfunded mandates requiring large increases in PE offerings may not effectively increase PE min/week to the required level.

1088 Board #214 May 27 2:30 PM - 4:00 PM
Partnering With Cooperative Extension To Advance Physical Education Policies And Practice: Evaluating The Train-the-trainer Approach

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Optimizing physical education (PE) is a proven strategy to increase children's physical activity. In Oregon, elementary schools are required to provide PE for ≥ 150 minutes/week. However increasing PE delivery requires resources (e.g. personnel, space, training) which many schools do not possess. One tactic to meet the minute requirement is for classroom teachers to deliver PE, which is permissible in Oregon using programs aligned to national PE standards. **PURPOSE:** We evaluated the effectiveness partnering with Cooperative Extension to train classroom teachers to implement Be Physically Active 2Day (BEPA 2.0), a standard-aligned classroom-based PE program. **METHODS:** Extension trainers (ET) were trained by the BEPA 2.0 Master Trainer (MT). Teachers (N=244) were subsequently trained by either ET or the MT. Trainers provided information about school-based physical activity, best practice strategies, and BEPA 2.0 activity simulations. Trainers also facilitated barrier-busting brainstorm sessions to elicit implementation problem solving strategies. Teachers completed post-training surveys to assess confidence, comprehension, and self-efficacy to implement BEPA 2.0. Survey scores were compared between MT and ET groups using the Wilcoxon-Mann-Whitney test. Transcriptions from the barrier busting activities were assessed qualitatively to evaluate teachers' perceptions of barriers and supports to implement BEPA 2.0. **RESULTS:** Surveys were returned by 152 teachers (response rate 62.3%). Over 94% indicated a high level of satisfaction with the training. There were no differences between MT (n=58) and ET (n=94) training groups in perceived confidence ($p=0.12$), comprehension ($p=0.08$), or self-efficacy ($p=0.18$) to implement BEPA 2.0. Qualitative results highlighted four themes encompassing implementation barriers and related problem-solving strategies; time constraints, space constraints, classroom interruptions/distractions, and limited school support. **CONCLUSIONS:** High training satisfaction and similar quality across ET and MT

groups indicate the train-the-trainer approach is a promising strategy to enhance BEPA 2.0 dissemination. Cooperative Extension partnerships may be an overlooked mechanism to enhance physical activity promotion efforts in school settings.

1089 Board #215 May 27 2:30 PM - 4:00 PM
Self-reported Confidence And Movement Competence Are Associated In Children

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(No relevant relationships reported)

Physical literacy is a growing concept in the United States and is vital for a child's long-term physical activity participation. Physical literacy is the ability, confidence, and desire to be active. There is little known about the relationship between confidence and physical ability in children. **Purpose:** To evaluate the association between a child's self-reported confidence and movement competency. **Methods:** A cross-sectional design with a single test session was used. Children (ages:5-14) recruited from local schools volunteered to participate. The Physical Literacy Assessment for Youth (PLAY) Self survey was completed by the student with an adult. Children were asked to rate "I'm confident when doing physical activities" with the following options: not true at all, not usually true, true, and very true. Responses were coded as: confident ("very true") or not confident (all other responses). Participants completed the PLAY Fun assessment in a randomized order, which evaluates movement competency in 5 domains: balance, lower extremity object control, upper extremity object control, running, and locomotor. Each task was scored on a 100cm visual analogue scale (VAS). Tasks were dichotomized into "not competent" (≤ 50 cm) or "competent" (> 50 cm). Total and domain-specific competency were calculated as the average total score across all tasks, or within each domain, respectively. Chi-square tests were used to evaluate associations between confidence (Yes, No) and competence (Yes, No). Sensitivity and specificity were calculated to evaluate the ability of confidence to predict competency. **Results:** A significant association was observed between confidence and competence for lower extremity object control ($p < 0.001$, specificity=.899, sensitivity=.289), upper extremity object control ($p = 0.020$, specificity=.872, sensitivity=.247) and running ($p = 0.041$, specificity=.883, sensitivity=.235). No other significant associations were present. **Conclusions:** The observed associations between self-reported confidence and competency are important because both factors likely impact future physical activity participation. Future research should evaluate if these results can improve the efficiency of measuring physical literacy, and identify the causal factors leading to confidence and competence.

1090 Board #216 May 27 2:30 PM - 4:00 PM
Sports Injury In China School Environment: A Policy Study

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PURPOSE: The frequent incidents of sports injuries in Chinese schools have seriously jeopardized the physical and mental health of students. The economic and legal disputes are so frequent that many schools reduced or limited their students' physical activities (PA). Therefore, this study aimed to collect and research the Chinese school sports injury policy from 1949 to 2019, and provide reference for the formulation and improvement of relevant policies in the future.

METHODS: We searched historical documents, searched government websites, Baidu, Google, other search engines, and CNKI, VIP, other scientific research databases, to collect and sort out the policy documents related to sports injuries in China. The searched data were collated and analyzed in chronological order and the department category of the issued documents.

RESULTS: Together, there are 11 policy documents about the school sports injuries were issued in China, only one of them *Interim Measures for Risk Prevention and Control of School Sports* issued by the Chinese Ministry of Education in 2015 is a policy document specifically aimed at school sports injuries in China. Other more related documents are *Interim Provisions on Health Work in Schools (Draft)* (1976,1980), *Regulations on Student Health Work(1990)*, *Regulations on the Handling of Student Injury Accidents Law(2002)*, and *Tort Liability Law(2009)*, etc.. At the same time, some provincial people's congresses in China have also issued policies related to campus sports injuries, such as Jiangsu Province (2006), Shanghai (2011), Guizhou Province (2014), Jiangxi Province (2015) and Hunan Province (2018), etc., which have successively issued some policies, some items in these policies are related to school sports injuries. Because there is not a report system for sports injuries of students, and no information communication channels between schools and hospitals and clinics, there is a lack of statistical data related to sports injuries in schools in China.

CONCLUSIONS: A great improvement is urgently needed for China's school sports injury policy, and the lack of reporting system and statistical data on school sports injury made the policy developed untargeted and ineffective. Urgent actions are needed to address these barriers so that school sport-related injury can be better prevented.

1091 Board #217 May 27 2:30 PM - 4:00 PM
Physical Activity Changes Before And After Connection Of A Multi-use Trail In Rural Appalachia
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Physical inactivity is a significant global health issue. The State of Kentucky, one of the 13 Appalachian states has a greater rate of physical inactivity than the national average. Most research directed at the built environment and recreational opportunities for physical activity has focused in urban areas with little attention to rural settings. **PURPOSE:** To examine the changes in physical activity before and after the connection of two multiuse trails in a rural Appalachian city. **METHODS:** The primary outcome measures were mode (walking, jogging, or cycling) of physical activity, distance and duration. A valid and reliable survey was used to intercept and interview trail users, modeled after a rails to trails conversion of the American Tobacco Trail. Data were collected on each of the trail segments during the months of May, June and July in 2017, 2018, and 2019. **RESULTS:** During the 3-year study period, 51% of users were female, 93% were white, and the age range of users was 18-85 years. Physical activity time: there was no significant differences in total physical activity time before or after connection of the trail. Average activity time was 58.2 ± 35.5 minutes in 2017 (n = 95), 64.5 ± 62.7 minutes in 2018 (n = 140) and 62.3 ± 30.3 in 2019 (n = 80). There were no significant differences in mode of trail use, or trail use by gender. However, after connecting the two one-mile segments total distance significantly increased. In 2017, walkers (n = 84) average 2.4 ± 1.2 miles, after trail lengthening participants walked an average of 3.12 ± 1.7 miles (p = 0.27) in 2019. Thirteen runners statistically significantly lengthened runs in 2017 an average of 3.40 ± 1.9 miles to 4.02 ± 2.5 (p = 0.28). Cycling length did not change. **DISCUSSION:** The results indicate that in the two years that the trail was not expanded, physical activity usage patterns did not change. Yet, once the one-mile connector was completed and lengthened to three miles, trail users significantly increased the distance traveled on the trail. Given the emphasis on built environments to improve community physical activity, further analysis is warranted to estimate health impact and return on investment for municipalities.

1092 Board #218 May 27 2:30 PM - 4:00 PM
Comparison Of Participating New Competitive Sport Motives Among University Students With And Without Exercise Habit
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PURPOSE: The aim of this study was to examine differences in participation motives of new competitive sport among university students with regard to their gender and exercise habit. **METHODS:** Before the commencement of the 3-month university rowing team training program which consists of three 2-hour water and land training sessions per week, one hundred fifty-six novice rowers (103 men, 53 women; mean age: 19.5±1.5 years; BMI=20.9±2.2 kg/m²) completed the Exercise Motivation Inventory-2 (EMI-2; Markland & Ingledew, 1997), Rosenberg's Self-Esteem Scale (Chinese translation: Ng, Barron & Swami, 2015), Body Appreciation Scale-2 (BAS-2; Swami & Ng 2015) and Dissatisfaction with Body Parts Scale (Chen & Jackson, 2012). They self-reported whether they had undergoing at least 150-minute moderate exercise per week. **RESULTS:** There was no statistically significant interaction effect between gender and exercise habit on the combined dependent variables, F(17, 136) = 0.801, p = .690; Wilks' Λ = .909. Among all the participants, the three top reasons for participating the selection were positive health (M = 4.05, SD = 0.67), strength and endurance (M = 3.97, SD = 0.66) and challenge (M = 3.84, SD = 0.70). There was no statistically significant gender difference on the combined dependent variables, F(17, 136) = 0.801, p = .317; Wilks' Λ = .875, whilst statistically significant exercise habit difference was found on the combined dependent variables, F(17, 136) = 2.733, p = .001; Wilks' Λ = .745. Results of independent samples Mann-Whitney U test showed that students with exercise habit (n=105; 71 male, 30 female) had significantly higher mean scores than those with no exercise habit (n=51; 30 male, 21 female) for strength and endurance, competition, stress management, affiliation, enjoyment, revitalization, positive health, self-esteem and BAS-2. **CONCLUSIONS:** Participants with and without exercise habit were motivated to take part in regular training by intrinsic factors such as positive health, strength and endurance, revitalization and challenge.

1093 Board #219 May 27 2:30 PM - 4:00 PM
Examining College Students' Motivation Participating In Virtual Reality-based Exercise: A Self-determination Theory Perspective
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Virtual reality (VR) has become a popular modality for exercise, physical therapy, and rehabilitation. VR-based exercise is becoming more available and could be a viable form of exercise. In addition, the self-determination theory (SDT; Deci & Ryan, 1985) has been used to examine college student's motivation to exercise. However, more empirical research evidence is needed to examine college students' motivation to participate in VR-based exercise from the SDT perspective.

PURPOSE: The purpose of this study was to examine the relationship between college student's situational motivation and intention to participate in VR-based exercise. **METHODS:** Seventy-two college students (Male = 39; Mage = 20.72, SD = 1.66) experienced at least 5 minutes of VR-based stationary bike gaming using the VirZoom Arcade. Afterward, they were assessed on situational motivation and intention to participate in VR-based exercise via a validated survey. The Situational Motivation Scale (Guay, Vallerand, & Blanchard, 2000) was used to assess situational motivation and one question was used to assess their intention for future participation in VR-based exercise. In order to determine the relationship between situational motivation (i.e., intrinsic, identified, external, amotivation) and intention to exercise, a multiple linear regression was performed to investigate motivation to predict intention to exercise. **RESULTS:** The multiple regression model showed a statistically significant effect, F(2, 69) = 12.920, p < .001, R² = .272, indicating that 27.2% of the variation in intention can be explained by identified regulation (β = .43) and amotivation (β = -.23). **CONCLUSIONS:** The results suggest that the intention for further participation in VR-based exercise is strongly predicted by the identified regulation or importance college students place on VR-based exercise. As with other modalities of exercise, lack of motivation and interests can be a deterring factor for participation in VR-based exercise. Further research is needed to understand how to empower college students who are motivated to participate in VR-based exercise. Finally, these results confirm the theoretical tenets of the SDT.

1094 Board #220 May 27 2:30 PM - 4:00 PM
BOX-HIT IS PERCEIVED MORE ENJOYABLE AND AS PHYSIOLOGICALLY DEMANDING AS RUN-CONT AND HIT-RUN
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PURPOSE: The aim of this study was to quantify enjoyment and the physiological effects associated with a BOX-HIT protocol, which incorporates boxing and circuit training set in an out of laboratory setting compared to a moderate intensity continuous run (RUN-CONT) and a high-intensity interval run (HIT-RUN) protocol all matched for duration (50 minutes). We hypothesized that the BOX-HIT protocol will be more enjoyable and produce similar physiological effects. **METHODS:** Using a randomized counterbalanced design ten (five male and five female) recreationally active adults (mean ± sd: age, 24 ± 2 years; weight: 73 ± 5 kg; height: 1.71 ± 0.09 m; body mass index: 22.67 ± 2.14; $\dot{V}O_{2max}$: 45.5 ± 6.9 mL·min⁻¹·kg⁻¹) performed three exercise protocols on three different occasions separated by at least 48 hrs. The protocols were a BOX HIT (50 min protocol consisting of running, circuit and core training and boxing), a HIT-RUN (6 x 3 min at 90% $\dot{V}O_{2max}$ interspersed with 6 x 3 min active recovery at 50% $\dot{V}O_{2max}$ preceded by a 7-min warm-up and followed by a cool down at 70% $\dot{V}O_{2max}$) and a RUN-CONT (continuous running at 70% $\dot{V}O_{2max}$).

RESULTS: Ratings of perceived enjoyment were higher following the BOX-HIT (P=0.042) in comparison to the RUN-CONT; however, no significant difference was found between the BOX-HIT and HIT-RUN (P=1.000) or between HIT-RUN and RUN-CONT (P=0.469). There was also a significant difference between mean lactate during the BOX-HIT and RUN-CONT (a difference of 3.82 m·mol⁻¹, P<0.001), mean lactate during the BOX-HIT and HIT-RUN (a difference of 1.83 m·mol⁻¹, P=0.023), and mean lactate during the RUN-HIT and RUN-CONT (a difference of 1.99 m·mol⁻¹, P=0.002). However, there was no difference in average RPE, average heart rate, average $\dot{V}O_2$, average $\dot{V}CO_2$, RQ, or energy expenditure between the three protocols. **CONCLUSIONS:** The greater enjoyment of the BOX-HIT and similar physiological effects to the other exercise protocols make the BOX-HIT a great tool for improving exercise adherence as it is set in a real world setting. This protocol shows great potential for providing health benefits and adaptations similar to those seen following high-intensity and sprint interval training.

1095 Board #221 May 27 2:30 PM - 4:00 PM

Low Tech Or High Tech: How Does Types Of Engagement With An Activity Monitor Influence Physical Activity?

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Commercial physical activity (PA) tracking devices have gained popularity both in the general public and research settings to monitor and increase PA. High tech versions automatically track and record data while low tech versions require regular manual logging to retrieve the data. Different types of activity trackers require different data engagement, which may influence PA levels. **Purpose:** The purpose of the study was to investigate if the differences in data engagement from two types of activity monitors influenced PA levels. **Methods:** Employees at a midwestern university (N=39) enrolled in a four-week worksite walking intervention. A 2-arm randomized study design was used to compare the influence of type of data engagement on average weekly steps between two types of activity monitors: 1) manual log (MANUAL) utilizing a standard hip accelerometer (NL-1000) and 2) digital log (DIGITAL) utilizing a wrist accelerometer (FitBit Charge 2). Participants wore a blinded activity monitor for week to determine baseline averages. Then participants were randomly assigned to track activity wearing one of the two types of activity trackers, unblinded, for four additional weeks. The MANUAL group recorded their steps by hand daily in an activity log. The DIGITAL group was asked to monitor their steps through the activity tracker's app which was downloaded to their personal smart phones. **RESULTS:** Significant increases in weekly step averages was found for both the MANUAL ($t(20) 1,280.89, p < .001$) and the DIGITAL ($t(19) 755.74, p < .001$) groups from Week 1 to Week 4. There were no significant between group differences found for Week 1 step averages ($t(39) -224.17, p = .299$) or Week 4 step averages ($t(39) 300.99, p = .200$). **CONCLUSION:** Steps were significantly increased for both groups during the intervention but there was no statistical difference found between the groups. To our knowledge, no other study has examined if data engagement influences PA. With so many types of activity monitors on the market these findings indicate that cheaper, low tech activity trackers are as effective in behavior change as their more expensive, high tech counterparts. Since differences in data engagement does not appear to impact short-term step increases individuals can choose either high tech or low tech options depending on resources and preferences.

1096 Board #222 May 27 2:30 PM - 4:00 PM

Physical Activity Preferences Of Urban, Middle School Students

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PURPOSE: The purpose of this study was to investigate the physical activity preferences of middle school students. **METHODS:** Participants were 219 students in grades 6-8 at a public, urban middle school. Data were collected via self-report questionnaire that included questions with specified options and questions with write-in opportunities assessing demographic information, physical activity preferences, and activities students would like to learn. **RESULTS:** Results indicated that the middle school boys (n=113) were 12.65 (± 1.63) years old and overall preferred basketball (38.3%) and football (25.2%) and wanted to learn more about basketball (19.8%), football (12.9%) and soccer (11.9%). Eighth grade boys (n=26) preferred basketball (19.8%) and football (12.9%) and wanted to learn basketball (21.7%), football (17.4%) and baseball (13.0%). Seventh grade males (n=45) preferred jogging (44.4%), basketball (28.9%) and football (15.6%) and wanted to learn basketball (20%), baseball (12.5%), soccer (17.5%), tennis (10.0%) and swimming (10.0%). Sixth grade boys (n=42) preferred basketball (32%) and football (28%) and wanted to learn basketball (21.7%), football (17.4%) and baseball (13.0%). Girls (n=106) were 12.57 (SD = 1.05) years old and overall preferred basketball (28.3%), jogging (23.2%) and dancing 12.1%, and wanted to learn about basketball (29.3%) tennis (15.2%) and soccer (13.0%). Eighth grade girls (n=28) preferred basketball (33.3%), jogging (29.6%) and dancing (11.1%) and wanted to learn baseball (30.4%) and soccer (13.0%). Seventh grade girls (n=30) preferred dancing (17.9%), jogging (17.9%), swimming (17.9%) and basketball (14.3%) and wanted to learn about baseball (36%), soccer (16%), swimming (12%) and tennis (12%). Sixth grade girls (n=47) preferred basketball (34.9%) and jogging (23.3%) and wanted to learn about basketball (25.6%), tennis (20.9%) and soccer (11.6%).

CONCLUSIONS: In addition to population team sports, participants in this study indicated interests in individual and dual sports and fitness activities. Understanding preferences and interests is crucial to the development of population specific programs aimed at promoting current and lifelong physical activity participation.

1097 Board #223 May 27 2:30 PM - 4:00 PM

Young Adults' Rating Of Perceived Exertion And Mood In Exergaming Dance And Aerobic Dance

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PURPOSE: Exergaming has been evident to be a novel and interesting channel to enhance young adults' affection and emotion while engaging in physical activity, yet no known research has been conducted to compare its efficacy versus traditional exercise modality. In response, this project investigated mean differences in young adults' rating of perceived exertion (RPE) and mood in different exercise modalities (exergaming aerobic dance vs. traditional aerobic dance).

METHODS: Forty young adults (20 females; $M_{age} = 20.38$) were recruited from a Chinese university and completed two separate 12-minute dance sessions: 1) non-stop exergaming aerobic dance (Xbox 360 Kinect Just Dance - Just Sweat around the World); and 2) traditional aerobic dance led by an experienced instructor. Participants' RPE was assessed via the Borg Rating of Perceived Exertion (14-point Likert scale) every 4 minutes and mood was measured by the Brunel Mood Scale (5-point Likert scale; anger, confusion, depression, fatigue, tension, and vigor) during each session. MANOVA with repeated measures was used to detect mean differences in these outcomes between the two dance sessions.

RESULTS: Significant differences were identified between dance sessions for the overall model, Wilks' Lambda = 0.13, $F(7,33) = 31.05, p < 0.01, \eta^2 = 0.87$. In detail, participants had significantly lower RPE toward exergaming dance (9.06 ± 1.07) compared to aerobic dance (11.36 ± 0.85), $F(1,39) = 209.45, p < 0.01, \eta^2 = 0.84$. In terms of mood, exergaming dance showed significantly lower confusion (3.00 ± 1.72) comparing to aerobic dance (4.25 ± 1.50), $F(1,39) = 4.97, p < 0.05, \eta^2 = 0.11$. Similarly, participants reported significantly lower fatigue in exergaming dance (3.00 ± 1.43) versus aerobic dance (4.00 ± 1.78), $F(1,39) = 7.58, p < 0.01, \eta^2 = 0.16$. No other significant differences were detected for other outcomes.

CONCLUSION: Findings suggest that exergaming dance may lead to less perceived RPE, confusion and fatigue among young adults compared to traditional aerobic dance. The findings have practical implications, as young adults might be more likely to engage in game-like exercise when less effort, confusion and fatigue are perceived.

1098 Board #224 May 27 2:30 PM - 4:00 PM

Psychological Needs Satisfaction Self-determined Motivation And Physical Activity Of Students In Physical Education

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 (No relevant relationships reported)

Physical Education (PE) plays a critical role in promoting physical activity participation of school students. There is a need to understand student motivation towards PE and how this motivation work in student PE activities engagement. **PURPOSE:** To apply the self-determination theory (SDT) to test the hypothesized relationships between three basic psychological needs (i.e., autonomy, competence, and relatedness), self-determined motivation, and student moderation-to-vigorous physical activity (MVPA) during elementary and secondary school physical education (PE) in Shanghai, China. Gender and school level differences were also explored. **METHODS:** The participants were 1829 Grade 3-9 students (872 boys and 957 girls) aged six to 15 years in Shanghai. Accelerometers were used to measure the MVPA duration of the students in PE. The Self-regulation questionnaire and Psychological Needs Satisfaction Scale were completed by the participants to assess student PE motivation and three psychological needs. **RESULTS:** The model of hypothesized relationships demonstrated a good fit with the data [$\chi^2 = 29.323, df = 3, p < .001$; CFI = .985; IFI = .985; SRMR = .026; RMSEA = .069]. The results from the multi-group path analysis revealed none of the paths in the model was found to be significantly different in regard to male versus female students. However, the relationship between self-determined motivation and MVPA was stronger for secondary school students ($b = .130, p < .001$) than elementary students ($b = .093, p < .01$), $\Delta\chi^2 = 3.925, \Delta df = 1, p = .048$. No other significant differences existed in the other paths across elementary and secondary school students. **CONCLUSION:** These findings supported the applicability of SDT in understanding and promoting physical activity of Chinese school students in PE. Practitioners should consider tailoring intervention to address school level differences to increase physical activity participation of students in PE.

1099 Board #225 May 27 2:30 PM - 4:00 PM
Efficacy And Feasibility Of Bigu Intervention On Selected Physical Outcome Measures Among Individuals With Obesity
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Bigu is a comprehensive health care technique based on the Chinese traditional health preservation method, including fasting, Qigong, and Chinese medicine. **PURPOSE:** To explore the efficacy and feasibility of a 7-day Bigu intervention on selected physical outcome measures among individuals with obesity. **METHODS:** Twenty-three participants, 11 male, and 12 female (age: 31.65±10.38 yrs; body height: 169.48±9.01 cm; body mass: 98.26±17.14 kg) were enrolled in the comprehensive 7-day intervention of Bigu, which consists of 1) fasting: drinking plenty of water but no food, except some fruits, such as grapes and apples. 2) Qigong exercise: including stretching exercise; eight sections of brocade for 90-minute daily under the instructions of Qigong master. 3) Chinese herb: Linggui Zhugan decoction as daily drink. Before and after the Bigu intervention, the outcome measures were: body weight, body fat, fat-free body weight, waist circumference, heart rate, blood pressure, and blood glucose. The paired test was employed to examine the differences of the outcome measures before and after the Bigu intervention. **RESULTS:** After the Bigu intervention, the body weight (Pretest: 98.26±17.14 vs Posttest: 92.77±16.24, $p < .01$), BMI (Pretest: 34.35±3.73 vs Posttest: 32.37±3.58, $p < .01$), waist circumference (Pretest: 110.83±10.47 vs Posttest: 106.35±10.01, $p < .01$) and body fat (Pretest: 41.91±8.42 vs Posttest: 40.79±8.57, $p < .01$) of the participants were significantly decreased. Heart rate and blood pressure remained no change, however, the skeletal muscle (Pretest: 33.32±6.45 vs Posttest: 31.60±6.61, $p < .01$) and fat-free body weight (Pretest: 59.28±10.66 vs Posttest: 56.28±11.02, $p < .01$) were significantly decreased. The blood glucose (Pretest: 5.69±2.28 vs Posttest: 3.82±1.34, $p < .01$) drops significantly within normal physiological range. **CONCLUSIONS:** Bigu may effectively help individuals with obesity to relieve obesity and control body weight and could be a feasible exercise for the individuals with obesity, however, there may be a risk of losing fat-free body weight during Bigu intervention. How to prevent the loss of fat-free body weight in Bigu intervention would warrant for future research.

1100 Board #226 May 27 2:30 PM - 4:00 PM
You Earn What You Get...Like Old Man Strength: Oral History Accounts Of Wellness
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Health is multidimensional (WHO, 1946) and can include aspects of physical, social, emotional, and spiritual wellness. Social Ecological Models (e.g., Sallis 2012; Van Dyck, et al., 2010) suggest that individuals' personal experiences of health and wellness and lifespan historical narratives are embedded within community resources and built and natural environments. **PURPOSE:** To investigate how adults articulate the intersections of multiple dimensions of health throughout the lifespan with regard to the historical development of built and natural environments supporting health. **METHODS:** An oral history approach was used to allow participants (N=11) to articulate moments in their lives that offered clarity and definition to their self-described meanings of health. Interviews included conversations about physical activity, use of community resources, and the integration of built environment features into personal-historical articulations of health. **RESULTS:** Semi-structured oral history interviews were transcribed verbatim and subjected to thematic analysis (Boyatzis, 1998). Transcripts were coded for content themes using the multiple dimensions of wellness as an organizing model. Inter-coder reliability was established through the use of multiple, independent coders and an iterative discussion process to connections among key themes. Results indicate 1) the importance of historical moments in structuring both natural and built environments to promote health for individuals' narratives of health, and 2) intersections between dimensions of health within individuals' oral histories of lived experiences. Preliminary results suggest generational differences in the articulation of the historical importance of public resources and definitions of wellness. **CONCLUSIONS:** Despite the small sample size and preliminary nature of this study, results support the importance of both built and natural environments for promoting health for how individuals think about and articulate wellness across multiple dimensions. Oral history accounts of personal interactions with built and natural environments offer a useful mechanism for exploring how health emerges in community spaces.

1101 Board #227 May 27 2:30 PM - 4:00 PM
Exercise, BMI, HIV, and PrEP Use among African American Men Who Have Sex With Men
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HIV affects Black/African American gay, bisexual, and other men who have sex with men more than any other group in the United States. The Eastern Health Planning Region of Virginia contains the state's highest percentage (34%) of new HIV diagnoses among Men Who Have Sex with Men (MSM). **PURPOSE:** This study investigated physical activity and body mass index relationship to HIV status, HIV risk perception, and knowledge of and attitudes toward PrEP (an anti-HIV medication) use among men who have sex with men and transgender persons of color in the Hampton Roads area. **METHODS:** A cross-sectional, 61-item online survey was administered from September 28, 2017 to March 4, 2018 to a convenience sample of the priority population. Descriptive analysis summarized all self-reported baseline data, cross tabulations clarified differences in data patterns in respondent subgroups, and Pearson's chi-square test assessed categorical variables of interest. One-way ANOVA assessed differences in subgroup means and was followed with Tukey post hoc analysis. The level of significance was $p < 0.05$. **RESULTS:** Among the 289 participants included in the analyses, 87.5% were Black/African American and the mean age, weight, and height were 31.0 ± 8.7 years, 85.1 ± 21 kilograms, and 175.4 ± 9.4 centimeters, respectively. Mean body mass index (BMI) was 27.7 kg·m² with 38.4% considered overweight and 23.5% obese. Only 30.4% of respondents reported achieving the national physical activity (PA) recommendation (≥ 30 minutes of moderate-intensity physical activity on ≥ 5 days per week) (USDHHS, 2008). Most respondents reported a negative HIV status (62.6%), 6.9% did not know their HIV status, and 19% had not heard of PrEP. After removing participants who self-identified as HIV positive, most respondents did not feel they were at risk for HIV (57.6%). *HIV Status, Willingness to take PrEP, Perceived HIV Risk, and Prior Knowledge of PrEP* were not associated with meeting national PA recommendations or BMI. **CONCLUSIONS:** High rates of obesity and low levels of physical activity may further complicate healthcare outcomes for this population with primary or comorbid chronic conditions creating a competition for prioritization of health conditions. Engagement in regular physical activity and exercise must be promoted.

1102 Board #228 May 27 2:30 PM - 4:00 PM
Evaluation Of Sitting Time On Faculty And Staff In A Small Private University
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Sedentary Death Syndrome (SeDS) is the 2nd greatest, yet preventable threat to public health, resulting in multiple chronic diseases and millions of premature deaths annually. Work-related environmental conditions have been implicated as factors related to declines in physical activity (PA) in the United States and abroad. Staff and faculty in a university setting may experience greater quantity of sitting time at work, which would impair the ability to achieve recommended daily levels of PA. Few studies exist that have evaluated sitting levels among university personnel. **PURPOSE:** The purpose of this investigation was to explore sitting levels among working members of Biola University. **METHODS:** Eligible survey respondents (N = 393) were men (n = 154, 44.9 ± 12.8 years of age, 178.7 ± 8.3cm in height, 85.3 ± 15.0kg in weight, and an average body mass index (BMI) of 26.7 ± 4.5kg/m²) and women (n = 239, 40.9 ± 13.1 years of age, 164.9 ± 8.1cm in height, 69.2 ± 15.5kg in weight, and an average BMI of 25.56 ± 6.1kg. kg/m²) who are employees of Biola University. Participants completed the International Physical Activity Questionnaire (IPAQ), using the Survey Monkey® platform. Distinction between faculty and staff positions were made along with job type and educational status. Total sitting min/day on a weekday and on a weekend were gathered and used to calculate total weekly sitting minutes and average sitting min/day. Kruskal-Wallis Independent Samples testing was employed to assess group differences. **RESULTS:** Weekday, weekly and daily average sitting minutes between staff and faculty were significantly ($p < 0.05$) different. Women employees' (187.84 min/day) weekday sitting was significantly ($p < .014$) greater than men's (137.84 min/day). Average daily sitting was significantly ($p < .002$) different for level of education attained, with masters (157.07 min/day) and doctorate (165.27 min/day) employees sitting less than those with a 2-yr college degree (247.44 min/day). There were no differences in total minutes of sitting on the weekend between faculty and staff, gender, job type or educational status. **CONCLUSIONS:** Clear discrepancy in PA exists between staff and faculty, men and women and educational attainment. Thus necessitating targeted interventions for the increase of PA on University campuses.

- 1103** Board #229 May 27 2:30 PM - 4:00 PM
Low Socio-economic Patients' Preferences For Lifestyle Interventions: A Qualitative Analysis
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Individuals with low socio-economic statuses (SES) have lower physical activity levels and poorer diet compared to their higher SES counterparts. Furthermore, these individuals typically have other health disparities (e.g. race, access to health care), which may impact their health status. Although lifestyle diseases (e.g. diabetes) are managed in the primary care setting, low-SES patients' behaviors and preferences for lifestyle are rarely assessed, despite being needed to guide care. **PURPOSE:** To examine qualitatively the preferences for lifestyle interventions for individuals with low SES within a clinical setting. **METHODS:** Patients (N = 185; 70.2% female; 51.5% African American) were surveyed at two free community health clinics. Survey questions focused on patients' preferences for physical activity and nutrition services; patients' current physical activity and food related behaviors; and desired health information. Data were analyzed using content analysis to identify themes. **RESULTS:** Patients reported preferences for programs that were similar to those provided at the YMCA, general nutrition counseling, and smoking cessation. Majority of individuals who exercised did so at either a gym or at home. The most common reasons for not exercising or preparing food were lack of time, work schedule constraints, pain, and health issues. Patients reported regular fast food consumption. Participants reported they would value information on general wellness, low-impact physical activity, and weight loss. **CONCLUSIONS:** This study is the first to qualitatively examine low SES patients' physical activity, diet, and other lifestyle behaviors along with intervention preferences within the clinical setting. Data demonstrates that individuals desire lifestyle intervention programs, especially ones that address reported barriers (e.g. pain, lack of financial resources, limited time). Notably, this study also asked patients their preferences rather than having program planners and researchers determine the best intervention for this population. As such, planners and researchers should tailor programming to this unique population's needs. Future research and practice efforts should implement tailored lifestyle programs while also evaluating acceptability and feasibility of these programs.

- 1104** Board #230 May 27 2:30 PM - 4:00 PM
The Effect To Adl Of Short-term Intervention To The Ankle Mobility Of Health Club Participant
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Many elderly persons feel anxiety during daily life due to a decrease in walking speed, a fear going up and down stairs, fall by balance capacity decline. Although ankle joint mobility decreases with aging, the relation to activities of daily living (ADL) hasn't been investigated so much. **PURPOSE:** The purpose of this study was to investigate the relation between ankle joint mobility and ADL ability of elderly health club participants, and to examine whether the ADL ability is improved to when ankle joint mobility is improved. **METHODS:** Forty elderly people (age 60 ± 12.9 yrs., height 153.2 ± 6.10 cm, weight 52.1 ± 6.87 kg) health club participants participated in this study. Knee to wall (KTW [cm]; ankle mobility, right and left ankle), timed up and go test (TUG [sec.]) and one leg standing test with open eye (OLS [sec.], ADL function, right and left ankle), and stairs up and down time (SU and SD [sec.]; ADL) were measured before and after health club intervention. Coefficient of correlation between measurements before intervention was calculated. The effect of intervention was considered from the measurements before and after intervention using paired t-test for TUG, 2 factor ANOVA for KTW (each left and right) and SU&SD, and Wilcoxon signed rank test for OLS (each left and right). **RESULTS:** Measurement results before intervention were KTW (average of right and left ankle) 12.5±3.1, TUG 6.7±2.25, OLS (average of right and left ankle) 32.0±20.16, SU 3.6±2.33, and SD 5.4±3.46. The coefficient of correlation with the KTW were TUG -0.674, OLS 0.412 (Spearman's rank correlation coefficient), SU -0.483, and SD -0.579. Measurement results after intervention were KTW (average of right and left

ankle) 13.3±2.75, TUG 6.1±1.94, OLS (average of right and left ankle) 38.8±20.34, SU 4.0±3.66, and SD 4.5±3.07. KTW, OLS and SD were improved significantly (p<.01, respectively). **CONCLUSIONS:** The relation between the ankle joint mobility and ADL ability of elderly health club participant was observed. Improvement of ADL ability was caused by improvement of ankle joint mobility by health club intervention.

- 1105** Board #231 May 27 2:30 PM - 4:00 PM
What Is App With Maintenance? Regular And Enhanced Physical Activity Maintenance Among Latinas
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 (No relevant relationships reported)

PURPOSE: Physical activity (PA) promotion research has increasingly focused on Latina women, as they report comparatively lower rates of PA and higher rates of some related diseases. Nevertheless, there is a paucity of research on PA maintenance upon completion of interventions among this population, and whether smartphone apps could provide tools to help with PA maintenance. This study aimed to: (1) assess 3-month PA maintenance among Latinas who complete a PA intervention; (2) evaluate the acceptability and preliminary efficacy of smartphone apps as tools for PA maintenance; and (3) qualitatively explore the role that apps played in PA maintenance. **METHODS:** 27 participants who reported increasing their moderate to vigorous PA (MVPA) to ≥ 60 minutes/week upon completing a 12-month PA intervention study were recruited. Participants were randomly assigned to enhanced maintenance (i.e., taught how to use 2 commercial smartphone apps, N=14), or control (N=13). After a 3-month maintenance period with no contact, participants' PA was re-assessed via the 7-day PA Recall. Longitudinal mixed effects regression models assessed group by time effects on PA (Aim 1). Frequency and satisfaction with apps were evaluated via a Likert-style questionnaire (Aim 2). Qualitative data were collected and analyzed using individual interviews with 21 participants (Aim 3). **RESULTS:** Mean minutes/week of MVPA was 16.85 (SD=24.73) before the intervention, 230.50 (SD=199.29) immediately after the tapered intervention, and 163.10 (SD=125.49) after the maintenance period. There were significant effects of time (β=102.24, SE=42.06 for pre-intervention to post-maintenance, and β=-85.17, SE=34.62 for post-tapered intervention to post-maintenance), but not of group assignment, on self-reported PA. Nine out of 14 participants in the enhanced maintenance group reported using apps at least a little to help with PA maintenance. Reasons for not using apps included not finding them appealing or necessary. **CONCLUSIONS:** This study used quantitative and qualitative data to provide new knowledge regarding PA maintenance among Latinas. Few women reported returning to pre-intervention levels of PA, yet there was a significant drop in self-reported PA after the tapered intervention ended. Smartphone apps contributed little to PA maintenance.

- 1106** Board #232 May 27 2:30 PM - 4:00 PM
Korean Baby Boomers' Perceptions About Physical Activity
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In South Korea, Baby Boomers - those born after the Korean war, between 1955 to 1963, will contribute to demographic trends. Maintaining the health and independent functioning of the baby boomer generation is public health priority in the nation. Among the baby boomers, there is an increasing trend for older adults to adopt physically active lifestyles in an effort to remain healthy and preserve independence. While participating in physical activities (PA) is one of key elements for maintain health, we know surprisingly little about how baby boomers conceptualize PA and the role that PA plays in their lives. **PURPOSE:** The objective of the study was to identify and analyze active baby boomers self-perceptions, the role that PA plays in their identity, and how they incorporate PA to their everyday lives. **METHODS:** Consensus Qualitative Research (CQR) was employed. CQR is a qualitative research method that helps build consensus among a research team and an auditor to yield robust conclusions. Semistructured interviews were conducted with 12 active baby boomers. Date from the interviews were coded and reviewed in depth by the research team with the goal of achieving consensus about the themes that emerged from the study. **RESULTS:** The themes encountered were: self-perceptions and identity, the definition and significance of physical activity, the experience of PA among active seniors. The

major findings were; the active baby boomers perceived themselves and aging process positively due to their healthy bodies, continuing economic activities, and high self-esteem; they defined PA as all movements which needed for their every lives and they believed that their self-esteem and health could facilitate participating in PA; the interviewers appeared to be content with their decisions to maintain a physical activity routine and that self-satisfaction motivated them to continue physical activities and extend to new sports and hobbies.

CONCLUSIONS: The interviews showed PA appear to be important in active baby boomers lives. Increasing our understanding of how and why preferences and values interact with PA, will assist in the development of strategies for increasing PA among baby boomers who are not yet physically active with the goal of improving their health and quality of life.

1107 Board #233 May 27 2:30 PM - 4:00 PM

Fragile And Feminine? The Effects Of Benevolent Sexism On College Women's Physical Activity

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(No relevant relationships reported)

Women are generally less active than men but the reasons for this gender disparity are not well understood. Benevolent sexism is a seemingly positive, covert form of sexism based on the idea that women are fragile and feminine to compliment the masculinity of men. Endorsement of benevolent sexism has been shown to have a negative impact on work and academic performance in women. Benevolent sexism may inform underlying reasons for the PA gender disparity. **PURPOSE:** To explore the relationship between PA and endorsement of benevolent sexism in young women. **METHODS:** Nineteen women (20.7±1.1 yrs.) completed the International Physical Activity Questionnaire (IPAQ) Short Form and the Ambivalent Sexism Inventory (ASI). The IPAQ was scored for total weekly; minutes of moderate-to-vigorous-PA (MVPA), MET-mins., and Sitting time (ST). The ASI is a 22-item questionnaire with two subscales measuring an individual's endorsement of benevolent and hostile sexism; the mean score (range 0-5) on the benevolent sexism items was used for analyses. Spearman correlations assessed the associations between PA outcomes and endorsement of benevolent sexism. Participants were split into tertiles for each PA outcome. Wilcoxon Rank-Sum tests and Cohen's d assessed the differences in ASI scores between the 1st (T1) and 3rd (T3) tertile. **RESULTS:** MVPA and MET-mins were both negatively associated with benevolent sexism ($r=-0.32$, $r=-0.35$, respectively) but there was no association with ST ($r=-0.06$). There was no significant difference between endorsement of benevolent sexism between participants in T1 and T3 for MVPA (\bar{x} and Interquartile Range) [T1; $\bar{x}=40$,IQR=55), T3; $\bar{x}=685$,IQR=150, $p=0.84$, $d=-0.1$] and MET-mins [T1; $\bar{x}=300$,IQR=960), T3; $\bar{x}=2680$,IQR=5040), $p=0.44$, $d=0.72$]. **CONCLUSION:** There was a small, inverse relationship between benevolent sexism and both MVPA and MET-mins, in the hypothesized direction. Additional work needs to further explore these relationships in larger, more diverse samples.

1108 Board #234 May 27 2:30 PM - 4:00 PM

Exergaming And Body Mass Index Among Female Adolescent In Riyadh Saudi Arabia

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Abstract:

Purpose: To examine the association between exergaming and body mass index (BMI) among female adolescents in Riyadh, Saudi Arabia.

Materials and Methods: A sample of 200 female students age 10-14 years in Riyadh, Saudi Arabia completed a self-administered questionnaire with the help of their parents after the completion of an informed consent letter by the parents. Anthropometric measurements of weight and height took place at schools under controlled conditions after the completion of the enrollment questionnaire. The survey instrument included items and scales adopted from the validated Adolescent Sedentary Activity Questionnaire (ASAQ) that assessed the time spent watching TV, videogames as well as sitting hours during weekdays and weekend. The survey questions included the type and duration of exergaming. The questions on the survey were translated into Arabic using the back-method translation. A multiple linear regression model was conducted to examine the association of exergaming with BMI.

Results: There was a significant negative association between exergaming and BMI among Saudi female adolescents after the adjusting for several covariates ($p<0.001$).

Conclusion: Exergaming is associated with lower BMI among female adolescent in Saudi Arabia. This could be an alternative solution for being more active in a population with limited physical activity options due to cultural norms

1109 Board #235 May 27 2:30 PM - 4:00 PM

Association Between Body Mass Index And Waist-hip Ratio And Parameters Of Diet And Sleep In University Students

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A change of lifestyle, college culture, has shown potential in deteriorating students' well-being, especially diet and sleep parameters, which accompanied by public health concern.

Purpose: To determine the association between body mass index and waist-hip ratio and parameters of diet and sleep in university students.

Methods: The sample consisted of 365 university students (n = 107; male, n = 258; female), aged 18-26 years, who enrolled course of Sports and Exercise in the academic year of 2018. Body mass index (BMI) and waist-hip ratio (WHR) were measured at the initiation of course. BMI was calculated by dividing body weight in kilograms by the square of height in meters. Waist circumference (cm) was measured using a measuring tape, from mid-point of the costal margin to the iliac crest in the mid-axillary line or above the belly button. The hip circumference (cm) was taken by measuring their widest point of the greater trochanter. WHR was then being calculated by the measurement of the waist circumference divided by the circumference of the hip. The data regarding parameters of diet and sleep, including dinner time, bedtime, and sleep duration, were collected by a set of online questionnaires which was used as a surveying tool at the end of course. The data expressed as percentage, means, and standard deviation. Pearson correlation was performed with statistically significant at level .05. **Results:** There was evidence that all categories of BMI, underweight (22.7%), normal weight (49.9%), overweight (10.7%), and obesity (16.7%), were mostly female. More than half of students had dinner at 6-8 p.m. which was greater in male (67.3% within sex). The late bedtime, after 12 a.m., was apparently observed in male (52.3% within sex). Most of students reported 4-6 hours of sleep duration, especially female (74.8% within sex). BMI showed a positive association with WHR across all genders ($p<0.001$). While gender was inversely associated ($p<0.05$) among BMI, WHR, and dinner time. **Conclusions:** Gender has a unique affect BMI, WHR, and dinner time. These findings underscore some of the parameters put some individuals at more risks of developing health problems. This should be expanding the scope of wellness program for promoting health in the university students.

1110 Board #236 May 27 2:30 PM - 4:00 PM

Relationship Between The Use Of Social Networks And Physical Activity Level In University Students

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In 2016, more than 1.9 billion adults aged 18 years and older were overweight in the world and of these over 650 million adults were obese. These are preventable conditions that lead to chronic diseases. Overweight prevention includes: changes in eating habits, reduced time in front of the TV and computer to less than two hours a day and increased physical activity. Physical activities and exercise programs have been promoted by social marketing, especially on the social networks (Facebook, Instagram, Twitter). Social marketing it is a carefully planned, long-term approach to change human behavior. This one can be used in different ways to promote the physical activity.

PURPOSE: The purpose of the research is to determine the relationship between social marketing through social networks aimed at exercise programs and the level of physical activity in a group of university students. 50 participants completed a self-administered questionnaire via e-mail or social network. **METHODOLOGY:** Two self-administered questionnaires were: 1) the level of physical activity will be measured using the IPAQ, and 2) the use of social networks with social marketing directed to physical activity exercise programs.

RESULTS: Most of the participants were women with a participation of 79.6%. Age was between 20 and 25 years (40.8%). 93.8% have some electronic equipment where 91.8% access social networks. 32.6% prefer Facebook, Instagram and Twitter within their selection. 36.7% use it 5 to 10 times a day. 49% Access the networks in order to obtain information on health, nutrition, exercises and lifestyle while 57.1% follow an online health or fitness professional. However, 69.4% do not publish their eating habits and 75.5% do not publish on physical activity habits on social networks. The average of weekly minutes in some physical activity in students who follow a health or fitness professional exceed the average of students who do not follow or look for health or fitness professionals.

CONCLUSION: University- aged students have a high use of social networks where they search information about health and fitness.

1111 Board #237 May 27 2:30 PM - 4:00 PM
DO PHYSICAL ACTIVITY PROMPTS FROM CONSUMER ACTIVITY MONITORS ALTER SEDENTARY OR PHYSICAL ACTIVITY BEHAVIORS?

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 (No relevant relationships reported)

INTRODUCTION: Many consumer activity monitors include features, such as visual and haptic prompts, designed to alter users sedentary (SED) or physical activity (PA) behaviors. However, the ability of these PA prompts to alter SED/PA behaviors is unclear. **PURPOSE:** To evaluate the effectiveness of PA prompts from consumer wearable devices in changing SED/PA behaviors in university employees. **METHODS:** 25 university employees (43.5±9.2yrs) without a history of consumer activity, monitor wear volunteered to wear a Fitbit Alta HR (FB) that was randomly assigned to administer PA prompts (Prompt group) or no PA prompts (Non-Prompt group). Participants were blinded to the aims of the study. Before receiving a FB, participants wore an activPAL (PAL) for 5 days to measure baseline SED/PA behaviors. After returning the PAL, participants wore the FB for 12 consecutive days during all waking hours and rewore the PAL for the last 5 days of the FB wear period. PA prompts were triggered when participants achieved <250 steps in the first 50 minutes of an hour from 6 am to 8 pm each day. Changes in PAL measured SED/PA were adjusted for baseline values. Average FB steps were calculated during the first 50 mins and last 10 mins of each hour and compared between hours when a prompt was received (Prompt group) or would have been received (Non-Prompt group). **RESULTS:** When participants achieved <250 FB steps in the first 50 min of an hour, the average FB steps in the last 10 minutes of these hours was significantly lower ($p<0.01$) when a prompt was given (49±21 steps) compared to when a prompt was not given (Non-Prompt group) (91±45 steps). Changes in overall PAL sitting time were not significantly different ($p=0.36$) between the PA prompt group (Mean±SD change; 38.7±93.4 min/day) and Non-Prompt control group (3.9±88.5min/day). Changes in PAL standing time were also not significantly different between groups ($p=0.47$) (Prompt group: 13.3±76.5 min/day, Non-Prompt group: 36.2±75.7 min/day). **CONCLUSIONS:** PA prompts did not influence SED/PA behaviors in university employees. Further research is needed to assess the effectiveness of PA prompts provided by other wearable brands and in larger and more diverse samples, including clinical populations.

1112 Board #238 May 27 2:30 PM - 4:00 PM
Abstract Withdrawn

B-76 Free Communication/Poster - Health Promotion/Interventions Among Those with Disabilities

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

1113 Board #239 May 27 2:30 PM - 4:00 PM
Perceived Barriers Of Physical Activity In Danish Manual Wheelchair Users

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Physical activity reduces the risk of chronic diseases in mobility disabled populations including manual wheelchair users (MWCU). Nevertheless, physical activity level is low in MWCU.

PURPOSE: To define physical activity barrier prevalence and impact among Danish MWCU and association with physical activity level.

METHODS: We translated The 'Barriers to Physical Activity Questionnaire – Mobility Impairment' (BPAQ-MI) from English to Danish according to published guidelines. Danish MWCU (N=133) completed BPAQ-MI online; 51% were female, 64% had a spinal cord injury, and 50% were unemployed. Mean ± SD for age, BMI, & years in chair were: 48±13 yrs, 25.8 ± 6.3 kg/m², & 17±14 yrs. The BPAQ-MI covers subdomains of intrapersonal, interpersonal, organizational and community barriers. Participants first indicated if a barrier hindered them from physical activity participation in the last 3 months. If "no", impact was scored as 0, and

if "yes", impact was scored 1-very small to 5-very big. Self-reported physical activity level (PAL) was rated from 1-"not being physically active at all" to 10-"extremely physically active".

Individual barrier prevalence was computed as frequencies (% of yes). Individual barrier impact was computed as 1 to 5 and reported as median. Summed barrier impact was computed as the sum of individual questions within each subdomain. Spearman's rho identified associations between PAL and subdomain summed barrier impact.

RESULTS: The 3 most prevalent barriers included 2 intrapersonal (~63%) and 1 community (55%) barrier.

The 3 most impactful barriers all had a median score of 5 (very big impact), but were less common: 2 organizational (0.8%, 23%), and 1 community (40%) barrier, PAL was inversely associated with interpersonal ($r=-0.175$, $p=0.05$) and intrapersonal ($r=-0.523$, $p<0.00$) summed impact. PAL was not associated with organizational ($r=-0.124$, $p=0.16$) or community ($r=-0.025$, $p=0.77$) summed impact.

CONCLUSION: Intrapersonal barriers were highly prevalent. Increased cumulative intrapersonal barrier impact was moderately associated with lower PAL, indicating that a higher perception of physical activity barriers are related to lower PAL. Finally, the results suggests that specific organizational and community barriers could be impactful at the individual level when they are present.

1114 Board #240 May 27 2:30 PM - 4:00 PM
From Development To Global Implementation Of Special Olympics Fitness Programs For People With Intellectual Disabilities

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PURPOSE: People with intellectual disabilities (ID) are at greater risk of obesity, diabetes, and cardiovascular disease compared to typically developing peers. People with ID face disparity and lack access to many healthcare services so community-based fitness and physical activity interventions can be crucial ways to improve health in this population at high risk. Yet, most fitness interventions are not designed for people with intellectual disabilities (ID), often due to cost, accessibility, and literacy level. Special Olympics Inc. (SOI), a leading non-profit sports organization for people with ID, has made it a priority to improve health in the ID population through increasing fitness and physical activity. **METHODS:** This case study describes the process of developing and implementing fitness models for people with ID. Special Olympics Inc. (SOI) assessed fitness activities being done in local Special Olympics Programs (SO Programs) for effectiveness, feasibility, replicability, and scalability. Then, SO Programs were funded to continue fitness activities and collect data. SOI endorsed three of these 'fitness models' that showed most promise. SOI then funded other SO Programs to implement the models between 2016-2018. The results from that implementation is assessed. **RESULTS:** 5481 individuals from 75 SO Programs in 48 countries participated. Key components of fitness models were group fitness sessions, including participants without ID, goal setting, and incentives. Over 90% of SO Programs collected baseline systolic and diastolic blood pressure in >80% of participants. Programs were less likely to have >80% completed baseline data for weight (76.7% of programs), height (75.0%), and BMI (75.0%). For those that started in 2016, >99% had data from two time points. In 2017, 88.8% had two data time points or more and in 2018 70.1% had data from 2 or more time points. SO Programs reported participants were empowered and were motivated by the incentives. Getting buy in from participants families and the community greatly improved the implementation. However, data collection issues were common. **CONCLUSION:** Based on the ability to enroll participants, collect data, and implement the activities, SOI fitness models may be a feasible fitness intervention for people with ID. Supported by CDC Grant U27 DD001156.

1115 Board #241 May 27 2:30 PM - 4:00 PM
Effects Of An 8-week Judo Program On Behaviors In Children With Autism Spectrum Disorder

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PURPOSE: Prior studies suggest that a combination of physical activity and mind-body exercises, often seen in martial arts, may attenuate negative behaviors in youth with Autism Spectrum Disorder (ASD). Therefore, the aim of this study was to examine the effects of an 8-week judo program on behavioral factors in children with ASD, using a mixed-methods approach.

METHODS: A total of 25 children (ages 8-17), diagnosed with ASD, participated in an 8-week judo program (1x week). Parents of participants were given the Aberrant Behavior Checklist (ABC) to compare the severity of ASD-related behavior at baseline

and at the end of the program. A subset of parents (n=9) participated in semi-structured interviews that focused on their child's behaviors during the judo program. Non-parametric paired t-tests were conducted to compare differences in ABC subscales (irritability, hyperactivity, stereotypic behaviors, lethargy, inappropriate behaviors) at baseline and at the end of the program. Interviews were coded independently by two trained researchers and categorized into behavioral themes.

RESULTS: Participants attended an average of 7.04 ± 1.06 classes (out of 8 possible sessions). Although both irritability (6.38 vs. 5.28) and hyperactivity scores (11.03 vs. 9.08) decreased following the judo program, the difference was not significant (p>0.05). Parent interviews revealed that 78% of parents observed improvements in both social skills and self-esteem as a result of the judo program.

CONCLUSIONS: Despite no significant differences in ABC scores pre- and post-judo, data from parent interviews indicate improvements in self-esteem and social skills. Future studies should further examine the effects of judo in a larger sample of youth with ASD, and include control conditions (e.g. no exercise group) for comparison purposes.

1116 Board #242 May 27 2:30 PM - 4:00 PM

Use Of Smartphones To Self-report Eating And Exercise In Young Adults With Intellectual Developmental Disability

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Internet applications (apps) have been shown to motivate people to form and maintain healthy dietary (D) and exercise (Ex) habits. However, research on the effectiveness of using apps by persons with Intellectual and Developmental Disabilities (IDD) is limited. **PURPOSE:** To evaluate the use of a smartphone app (Ap) compared to app plus text reminders (Ap+T) for tracking D and Ex behavior in persons with IDD in an independent setting without caregiver support. **METHODS:** Young adults (n=5, 19-26 yrs) who were enrolled in a college experience program consented to participate in the study which had been approved by the university's IRB. Participants were living on campus and had their own smartphones. Baseline conditions were determined as participants used paper and pencil to self-record D and Ex for at least 5 days. In a single-case design, participants served as their own controls and were randomly assigned to alternating treatments of Ap or Ap+T conditions. The Ap (Kurbo Health Inc.) allowed tracking of food items and portions as well as exercise tracking in 10-minute segments. The Ap+T condition added 4 times/d text message reminders about recording D and Ex. Treatment conditions changed every 1-2 days in random order over the course of 3 weeks. Data analysis included evaluation of mean level increases and percentages of nonoverlapping data (PND) between conditions. **RESULTS:** Participants demonstrated mean level increases from baseline to Ap (range: 15-66%) and baseline to Ap+T (range: 23-72%). Comparisons between baseline and treatment conditions yielded PND scores ranging from 45-77% for Ap and 33-92% for Ap+T. Comparison between treatments revealed a PND range of 0-50%. **CONCLUSION:** Although neither treatment emerged as superior, results of the study indicated that use of smartphone apps by persons with IDD increased self-recording of D and Ex behaviors and is a promising tool for promoting independent living skills.

1117 Board #243 May 27 2:30 PM - 4:00 PM

Objectively Measured Physical Activity And Sedentary Time In Adults With Autism Spectrum Disorder

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PURPOSE: Adults with autism spectrum disorder (ASD) are purportedly inactive, but this conclusion is inferred from data on children and youth, and parent proxy reports. Objective assessment using activity monitors is needed to better understand physical activity (PA) and sedentary behavior in this population segment. The purpose of this study was to examine the general levels of PA and sedentary time in adults with ASD using accelerometry.

METHODS: Eleven adults aged 18-55 (6 females; mean = 31.9, SD = 12.5) and diagnosed with ASD were included in the study. Participants wore a GT3X+ accelerometer on their right hip for 7 days during waking hours except water-based activities, and accelerometers were programmed to collect data in 60-second epochs. ≥ 10 hours of device wear was defined as a valid day and ≥ 3 valid days was required for each participant to be included in the analyses. Activity intensities were determined using the following cutoffs (counts/min): sedentary <100, low 100-499, light 500-2019, moderate 2020-5999, and vigorous >5999 (Tudor-Locke et al., 2010), and non-wear period was determined by a minimum length of 90 min of consecutive

0-counts by Choi algorithm (Choi et al., 2011). Descriptive statistics were calculated for moderate to vigorous PA, light- and low-intensity PA, sedentary time, and walking steps.

RESULTS: The average total monitored length was 761.5 min/day (SD = 76.4). Results of the PA measures are as follows: moderate to vigorous PA - 42.8 min/day (SD = 30.5); light PA - 109.9 min/day (SD = 32.4); low PA - 97.9 min/day (SD = 33.9); and sedentary time - 511 min/day (SD = 84.6). The daily average percentage of time spent in moderate to vigorous PA was 5.8% (SD = 4.4), and the average step counts were 3799.7 steps/day (SD = 2953.9). 81.8% of the participants met the recommended PA guidelines of 150 min of moderate to vigorous PA per week.

CONCLUSION: Although the majority of adults with ASD in this study met the PA guidelines, they were also extremely sedentary. More research is needed to determine if sedentary time, rather than PA, should be targeted to improve preventive health in adults with ASD.

1118 Board #244 May 27 2:30 PM - 4:00 PM

Feasibility Of The Assessment Of The H-reflex In Adult Dancers And Non-dancers With And Without Down Syndrome: A Pilot Study.

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PURPOSE: The analysis of monosynaptic Hoffman's reflex (H-reflex) involves recording the response to electrical stimulation of Ia-afferent fibers from the muscle spindle. The H-reflex can be used as a probe to study spinal neuronal pathways and mechanisms at rest and during movement in humans. The purpose of this study was to analyze the feasibility of the assessment of the H-reflex in people with Down syndrome (DS), and to compare it between adult dancers and non-dancers with and without DS.

METHODS: Twenty-five participants were included and divided into four groups (6 non-dancers and 6 dancers with DS and, 7 non-dancers and 6 dancers without DS). The H-reflex was recorded at the level of the soleus muscle in its central area. We analyzed the H response in three different conditions: decubitus prone, static standing position with open eyes and closed eyes. **RESULTS:** Non-dancers with DS showed a faster H-reflex latency than both groups without DS (all p < .005). In the present study, we provide evidence of the feasibility of eliciting the H-reflex in adults with DS. Interestingly, the H-reflex was present in decubitus position but not in standing position in most non-dancers with DS and dancers without DS. **CONCLUSIONS:** The data from this study can help to perform future research in adults with DS and the development of full-scale studies to analyze this variable in adults with intellectual disability with and without DS.

1119 Board #245 May 27 2:30 PM - 4:00 PM

Heart Rate Variability Response Following Two Physical Activity Programs In Senior With Intellectual Disability

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Introduction: Improvements on heart rate variability (HRV) in healthy persons were found following exercise programs. There are gaps in our knowledge about the response of the HRV in seniors with intellectual disability (ID) without Down Syndrome (DS). **Purpose:** To compare the HRV response before, during and after 6-minutes walking test (6MWT) in seniors with ID without DS after two different exercise programs.

Methods: Fifteen seniors with mild to moderate ID without DS participated in this study. Participants were randomly divided into 3 randomized groups: sprint interval training group (SITG), combined-aerobic exercise group (AEG) and control group (CG). Participants from the SITG and AEG performed exercise 3 times/wk, 1.5 hs, during 24 wks. The 6MWT was performed before and after the programs. The intervals between R waves (RRi) were registered at rest (10 min), during the 6MWT and during the recovery (10 min) with a Polar RS800CX. HRV was analyzed by linear measures (variance) and nonlinear measure (symbolic analysis - 0%V and 2U%V). 0%V indicates sympathetic and 2U%V parasympathetic modulation.

Results: Distance walked on 6MWT, variance and 0%V values do not present effect of group, moment or interaction. Better values on mean (p < .001) and 2U%V (p < .01) were founded in post-intervention in comparison with pre-intervention, but neither group effect nor interactions were observed.

Conclusion: Despite there is a tendency showing better HRV response values after physical activity programs, it cannot be concluded that exercise promotes beneficial

changes on HRV responses. We believe that future studies with larger sample size are necessary to get across the changes on autonomic cardiac function and exercise in seniors with ID without DS.

Funding sources: MINECO (DEP2017-86862-C2-1-R); AGAUR (2019 FI_B 00893); Ministerio de Ciência e Tecnologia de Brasil (PDSE/CAPES 88881.189815/2018-01).

Moment	Variables	AEG (n = 5)		SITG (n = 4)		CG (n = 6)	
		Pre-training	Post-training	Pre-training	Post-training	Pre-training	Post-training
Resting period	RRi mean (ms)*	867.80 (70.47)	820.34 (130.29)	757.17 (87.02)	813.89 (48.07)	844.52 (141.96)	850.51 (128.42)
	Variance (ms ²)	1045.36 (483.70)	848.69 (545.10)	1516.70 (1096.26)	1254.71 (367.72)	1881.25 (1064.71)	2068.76 (2361.60)
	0V%	32.07 (08)	34.03 (8.90)	32.94 (6.27)	24.11 (11.66)	38.24 (13.18)	36.21 (26.29)
6MWT	2UV%**	11.84 (3.33)	12.78 (4.64)	8.63 (2.26)	15.68 (6.75)	13.40 (8.68)	17.19 (12.35)
	RRi mean (ms)*	509.16 (92.53)	502.44 (104.67)	516.73 (23.25)	517.10 (67.68)	569.73 (142.69)	603.63 (62.58)
	Variance (ms ²)	78.33 (59.10)	66.69 (70.10)	82.03 (46.50)	135.22 (104.45)	409.90 (400.10)	220.36 (241.85)
Recovery period	0V%	29.49 (12.50)	21.57 (6.37)	32.25 (18.49)	28.33 (22.87)	32.03 (12.90)	36.14 (22.17)
	2UV%**	20.71 (7.91)	26.35 (2.95)	15.10 (8.35)	21.18 (10.27)	20.98 (10.52)	22.81 (15.25)
	6MWT distance	515.40 (47.51)	539.80 (44.57)	508.50 (62.98)	537.75 (69.77)	470.17 (87.50)	464.33 (66.62)
Recovery period	RRi mean (ms)*	763.14 (92.43)	757.94 (107.57)	699.48 (88.98)	694.49 (76.17)	796.50 (125.33)	821.34 (116.30)
	Variance (ms ²)	1206.15 (1226.26)	1014.60 (1211.97)	766.06 (426.17)	1566.97 (891.03)	1462.89 (1017.59)	2011.49 (1287.76)
	0V%	32.82 (7.29)	32.47 (15.81)	34.90 (10.87)	46.67 (15.59)	27.84 (9.57)	38.69 (16.53)
Recovery period	2UV%**	9.98 (4.02)	14.04 (9.86)	8.13 (3.38)	6.47 (3.64)	19.74 (9.81)	13.46 (9.75)

Note: values are means (Standard Deviation).
 Results are based on a Two-way repeated-measures ANOVA at rest, 6MWT and recovery condition. Effect of group, moment (pre vs post training) and interaction was verified with significant level set at p<0.05
 Abbreviations: 6MWT (6-minutes walking test); AEG (Aerobic group); SITG (sprint interval training group); CG (control group); RRi (intervals between R waves)
 * Significant difference (p ≤ .01) between moments
 ** Significant difference (p ≤ .001) between moments

1120 Board #246 May 27 2:30 PM - 4:00 PM
Analysis Of The Cortical Hemodynamic Responses To Active-assistive Exercise In Individuals With Parkinson's Disease.

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 (No relevant relationships reported)

Background: Gait and motor impairments are common symptoms in people with Parkinson's disease (PD). Previous studies found active-assistive exercise to be effective in improving PD symptoms. The underlying neural mechanism contributing to these improvements is currently unknown. No previous studies have investigated how the brain responds to active-assistive exercise in people with PD. **Purpose:** To investigate the cortical hemodynamic responses to active-assistive exercise in individuals with PD. **Methods:** A total of 7 individuals with PD (70.29 ± 5.44) and 10 controls (58.71 ± 9.30) participated in this cross-sectional study. All participants completed three modes of exercise including active exercise (AE), passive exercise (PE), and active-assistive exercise (AAE) using computerized cycling equipment (MOTomed viva 2, RECK MOTomed, Betzenweiler, Germany, 2017). Each mode of exercise was performed at a predetermined pace for 10 minutes on three separate days while a neuroimaging device, functional near-infrared spectroscopy (NIR Sport, NIRx Medical Technology, Berlin, Germany, 2017) captured oxy-hemoglobin (HbO) levels in the prefrontal lobe. **Results:** Repeated measures ANOVA showed no significant difference in ΔHbO among exercise modes. A trend showed that the PD group displayed the greatest level of ΔHbO during PE and minimum with AE. A 2x3 mixed model ANOVA revealed no significant group x mode interaction. However, a trend showed that the PD group displayed greater levels of ΔHbO during PE and AAE whereas the control group revealed greater levels during AE and AAE. Four representative channels were selected for regional comparison of brain activation during AAE between groups. They demonstrated significant differences in the middle frontal cortex (p<.049), orbital cortex (p<.039), intermediate frontal cortex (p<.033), and granular frontal cortex (p<.022). **Conclusion:** Our findings suggest that people with PD showed higher levels of brain activity during passive and active-assistive modes of exercise as compared to active cycling. Brain activity levels during active-assistive

exercise can be different when compared to those without PD. The results may help understand the underlying neural mechanism associated with positive outcomes following active-assistive exercise in PD.

1121 Board #247 May 27 2:30 PM - 4:00 PM
Impact Of Marriage On Physical Activity Behavior In Women With Multiple Sclerosis

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PURPOSE: Support is critical for individuals with multiple sclerosis (MS) to adopt and continue physical activity (PA). The role that spouses play in the adoption and continuation of PA in women with MS has yet to be explored.

METHODS: Four women with MS volunteered for in-depth interviews lasting approximately an hour. The interviews were semi-structured and covered topics such as: marriage context, PA choices and behaviors, PA activities alone and with spouse, etc. Interviews were transcribed (with identifiers removed) and analyzed in case studies, then cross-cases for overlapping themes.

RESULTS: Four cases were developed. Theresa is an older woman with MS for which PA is encouraged by her spouse, and some PA is engaged in together, such as walking pets. She states, "It's not walking like we used to walk, but we are out there together." Margaret is an older woman with MS for which PA is engaged in completely alone. Intentional PA is performed alone because of her spouse's lack of motivation. She states, "I always feel like he could use it as much as I could, but there's no motivation and he has to motivate himself." Claire is a young woman with MS who engages in PA outdoors with her spouse but feels her choices in PA done together can be dependent on her spouse's desires over her own. She states, "Maybe sometimes if he's not with me, I would um... push myself harder I think." Joanna is a mid-life woman with MS who engages in PA outdoors with her spouse and children, as well as indoors with a personal trainer focused on mobility. She feels that her spouse provides support in both types of PA. She states, "Oh, he so strongly encourages it! He, he is honestly my #1 fan if, if there is something new that I did at the gym that day, he wants to see it, he wants to do it... knowing he has my back and is in my corner lets me know that you know it will be a struggle but it is, it is worth it." All four women discussed the importance of support in PA, despite differences in spousal engagement in PA.

CONCLUSIONS: This study points to the importance of support and perception of support by marriage partners for women with MS. Future physical activity programs for women with MS should consider the role marriage partners play in decisions to be physically active. Effectiveness of PA interventions might be enhanced by increasing the involvement of marriage partners.

1122 Board #248 May 27 2:30 PM - 4:00 PM
Multimodal Pain Management Following Total Knee And Hip Arthroplasty: Impact On Functional Outcomes

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PURPOSE: To investigate if multimodal pain medication management improves functional status and decreases opioid consumption in the inpatient subacute rehabilitation setting following total hip and knee arthroplasty.

METHODS: Retrospective cohort electronic medical record analysis over a three-year period. Patients divided into 3 groups based on pain regimens: Opioid Only (O), Opioid and NSAIDs (NS), Opioid and Neuromodulators (ON). Morphine milligram equivalent (MME) doses were calculated for all opioids. Charts were evaluated for Functional Independence Measure (FIM) scores in walking, wheelchair, bathing, toilet transfer, bed transfer, and walking distance.

RESULTS: A total of 161 patients were included in the study: 99 O, 43 ON, and 19 NS. The mean age of the study population was 65 years old, with 70% of patients being female, African American, and having received unilateral knee replacement surgery. There were no significant inter-group demographic differences. The ON group showed the greatest improvement in FIM scores for Walking, Wheelchair mobility, Bathing, and Bed transfers (See FIM Score table). All patients treated with multimodal pain regimens improved from walking 50-149 feet on admission to greater than 150 feet on discharge, whereas 3/17 patients treated with opiates only did not improve to walking greater than 150 feet. At discharge, the O group was using ~59 morphine milligram equivalent (MME) doses per day, whereas the ON group was using 50 MME, and the NS group was using 41.5 MME. Differences in FIM scores and MME dosing did not reach statistical significance.

CONCLUSIONS:

Patients treated with multimodal pain regimens achieved CDC recommended guidelines of <50 MME per day on discharge. Patients treated with opiates and neuromodulators showed the greatest functional outcome gains in 4/5 categories.

Functional Status

	Group	Walking	Wheelchair	Bathing	Toilet transfer	Bed transfer
Admit	O	3.48	4.32	3.76	4.11	3.89
	ON	2.84	3.67	3.11	3.95	3.55
	NS	3.52	4.05	3.94	4.31	3.94
Discharge	O	5.72	5.81	5.63**	5.88	5.84
	ON	5.42	5.55	5.46**	5.65	5.6
	NS	5.89	5.57	5.31**	6	5.94
FIM Change	O	2.24	1.49*	1.86	1.77	1.94
	ON	2.58	1.88*	2.34	1.69	2.04
	NS	2.36	1.52*	1.36	1.68	2

*p = 0.076
**p = 0.073

1123 Board #249 May 27 2:30 PM - 4:00 PM

Addition Of A Kinesiologist-guided Functional Exercise To Intradialytic Cycling Program: A Randomized Controlled Trial

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Purpose Intradialytic cycling is a widely used workout mode for hemodialysis patients whereas added benefit of other exercise modalities remains unknown. This is the first randomized controlled trial on the effects and sustainability of the functional training and exercise counseling in addition to a standard basic intradialytic cycling exercise program. **Methods** Patients were randomly assigned to a kinesiologist-guided functional training in addition to intradialytic cycling (n = 20, experimental group) or intradialytic cycling only (n = 20, control group) over 16 weeks. The experimental group attended predialysis guided functional exercise and counseling session in the first 8-week induction phase. In the second 8-week maintenance phase, the experimental group was encouraged to perform functional training at home on non-dialysis days. The main study endpoint was 10-repetition-sit-to-stand test time at 8 weeks. **Results** In the 10-repetition-sit-to-stand test at 8 weeks, the experimental group improved significantly better than controls (-4.5±1.9 s, 95% CI -8.4 to -0.7; P=0.021), which was maintained at week 16 (-4.7±2.1 s, 95% CI -9.0 to -0.3; P=0.037). For the secondary endpoints at week 8, the experimental group significantly outperformed controls at handgrip strength for 3.7±1.2 kg (95% CI 1.3 to 6.2; P=0.004), sit-and-reach lower body flexibility test for 5.8±1.4 cm (95% CI 2.9 to 8.6; P<0.001), Stork balance test for 0.7±0.2 s (95% CI 0.4 to 1.1; P<0.001), and back scratch upper body flexibility test for 5.8±1.8 cm (95% CI 2.2 to 9.5; P=0.003). At week 16, superior results of the experimental group in secondary end-points remained preserved for handgrip strength, balance, and back scratch flexibility tests (p<0.05 for all). No major exercise-related adverse events were observed. **Conclusions** Functional training with exercise counseling added to basic intradialytic cycling program meaningfully improves physical performance and successfully prepares dialysis patients for sustainable home exercise.

1124 Board #250 May 27 2:30 PM - 4:00 PM

Effect Of A Rural Multidisciplinary Community Program On Postural Stability Among Individuals With Parkinsonism

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Parkinson's disease (PD) is a multimodality disorder that often times impairs an individual's gait, balance, cognition, speech, swallowing and overall quality of life. Alarming, individuals with PD are two times more likely to fall when compared to individuals with other neurological disorders and are thus 60-70% more likely to experience a fall when compared to the generally healthy geriatric population. **PURPOSE:** The purpose of this study was to examine the effect of a rural multidisciplinary community program on balance among individuals with Parkinson's disease and Parkinson plus conditions. **METHODS:** Participants with idiopathic PD or corticobasal degeneration (CBD) with no co-existing neurological disorders (n=6) engaged in a 16-week rural multidisciplinary community program that met weekly for 90 minutes. The Biodex Balance System was used to assess postural stability which

is an indicator of balance. The dependent variables were OSI, API, MLI with eyes opened and eyes closed. Wilcoxon Signed Rank test was utilized to analyze differences in balance pre and post 16-week intervention. The treatment session consisted of 45-minute dual-task fall prevention exercises followed by a 45-minute speech and cognitive program (i.e., the LOUD Crowd® program). **RESULTS:** The average duration of the disease was 5.5 years. There were statistically significant results at post-data collection for MLI eyes open (Z = -2.201, p = .028), OSI eyes closed (Z = -1.997, p = .046), API eyes closed (Z = -2.023, p = .043), and MLI eyes closed (Z = -2.207, p = .027). However, there were no statistically significant results for OSI eyes open (Z = -.420, p = .675) and API eyes open (Z = -1.472, p = .141). **CONCLUSION:** Findings from the study suggest that a rural multidisciplinary community program that utilizes dual-task fall prevention, speech, and cognitive exercises may be beneficial for improving balance among individuals with Parkinson's disease and Parkinson plus conditions. Researchers recommend a follow-up study with a larger sample size and a true control group. This research project was partially sponsored by the Parkinson's Foundation Community Grant.

1125 Board #251 May 27 2:30 PM - 4:00 PM

Effectiveness Of SNPE On Disability, Range Of Motion, Muscular Strength, And Pelvic Pain In Women With Chronic Low Back Pain

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Purpose The SNPE (Self Natural Posture Exercise), developed and practiced widely in Korea uses unique tools and body correction belts to make tension release and to correct unbalanced posture. This study examined the effectiveness of SNPE on disability, range of motion (ROM), muscular strength, and pelvic pain in young women with chronic low back pain. **Methods** Twenty five women (27.6±6.5 yrs, 23.8±3.8 kg/m²) who had back pain for more than 3 months and scored 5-14 of the Korean Oswestry Disability Index (KODI) were divided into three groups; SNPE group (SNPEG, n=9), stretching group (SG, n=8), and non-exercise group (NG, n=8). SNPEG and SG participated in a respective 60 min exercise program twice a week for 12 weeks, while NG did not. KODI, Remodified Schober Test, Finger-to-Floor Distance Test, back strength, and VAS were measured at pre and post of 12 weeks. Statistical analysis was performed by paired t-test and ANCOVA. **Results** The lumbar disorder index was significantly decreased in SNPEG (pre: 7.6±2.7 vs. post: 3.1±2.7, p<0.001), and the decrease was the biggest in SNPEG than other two groups (p<0.001). Flexion of lumbar increased from 22.4±2.7 to 26.8 ± 2.9 cm (p<0.05) while extension decreased from 12.2±1.0 to 10.9±1.0 cm (p<0.05). Lateral flexion to left side was decreased from 46.8±3.9 to 42.5±2.7 cm in SNPEG and from 46.6±3.2 to 44.7±3.4 in SG (p<0.01), and lateral flexion to right side showed similar changes (p<0.01). No changes in lateral flexion to both side in NG was found. The changes in flexion, extension, and lateral flexion to left and right were the largest in SNPEG (p<0.05). Back strength increased in SNPEG from 57.5±13.4 to 72.6±12.5 kg (p<0.001), while other groups did not increase. Pelvic pain in SNPEG decreased in all 10 sites from 4.6±1.1, 3.0±1.5, 6.5±1.4, 5.8±1.6, 4.7±2.2, 5.7±1.9, 5.2±2.5, 6.3±2.1, 6.3±2.2, and 6.4±2.4 to 0.7±0.9, 1.2±1.3, 2.3±1.5, 2.2±1.6, 1.6±1.9, 2.1±1.6, 2.5±2.2, 3.1±2.4, 1.8±0.8, and 1.7±0.8 in Sacrum left and right (L-R), Iliopsoas L-R, Lateral Iliac Crest L-R, Adductor L-R, and Gluteus maximus L-R, respectively (p<0.05). Pelvic pain in SG also decreased in all sites (p<0.05) while not in NG. **Conclusion** The results suggest that the SNPE can be an effective exercise program for improving disability, ROM, muscular strength, and pelvic pain release in young women with low back pain.

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Arm Use In The Humeral Elevation Range Of Tendon Compression For Manual Wheelchair Users

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Shoulder tendon pathology is 10 times more likely in chronic manual wheelchair (MWC) users than in controls [1]. The increase in pathology is often attributed to a narrowing of the subacromial space, which is smallest between 30-60° of humeral elevation (HE) [2]. MWC users spend significantly more time in 30-60° of HE than controls [3]; however, their arm activity while in this workspace is unknown. **PURPOSE:** To determine the active and sedentary time of the arms for MWC users and controls while in 30-60° of HE. **METHODS:** Under IRB approval, participants wore three wireless inertial measurement units (Emerald, APDM, Inc.; 128 Hz) on their bilateral upper arms and

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torso for one to two days. Custom MATLAB (MathWorks, Inc.) code calculated the HE [3] and acceleration-based activity levels [4] of both arms for each second. The percentage of daily wear time each participant spent in sedentary and active time in 30-60° of HE was calculated for each arm. Separate paired t-tests were used to determine differences between cohorts ($\alpha < 0.05$).

RESULTS: 34 MWC users (sex: 6f, age: 43 ± 13, injury level: C6-L1, years since injury 11 ± 11) and 34 controls (sex: 6f, age: 43 ± 13) were enrolled. MWC users and controls spent similar amounts of time active; however MWC users spent a significantly higher percentage of time sedentary.

Percentage of the day spent active, sedentary, and overall in 30-60° of humeral elevation			
	Manual Wheelchair Users	Control	p-value
Percentage of day in 30-60° of humeral elevation (%) [3]: Dominant Arm	63.6 ± 14.4	50.4 ± 13.1	<0.0001
Percentage of day in 30-60° of humeral elevation (%) [3]: Non-Dominant Arm	59.5 ± 14.3	48.4 ± 13.5	0.003
Percentage of daily wear time spent active (%) in 30-60° range of humeral elevation: Dominant Arm	23.6 ± 8.8	21.1 ± 7.6	0.25
Percentage of daily wear time spent active (%) in 30-60° range of humeral elevation: Non-Dominant Arm	21.5 ± 9.3	19.5 ± 8.9	0.41
Percentage of daily wear time spent sedentary (%) in 30-60° range of humeral elevation: Dominant Arm	40.6 ± 15.2	30.2 ± 11.8	0.002
Percentage of daily wear time spent sedentary (%) in 30-60° range of humeral elevation: Non-Dominant Arm	38.9 ± 14.9	29.4 ± 11.6	0.007

CONCLUSIONS: Although MWC users spend more time in 30-60° of humeral elevation, the majority of this time is sedentary, emphasizing the importance of understanding other factors such as arm loading and velocity of movement in this population. MWC users may be loading their arms more while in sedentary (i.e., resting condition) and active (i.e., propulsion) conditions, which may contribute to the increase in pathology.

[1] Akbar M et al., 2010. JBJS. 92:23-30.[2] Larence R et al., 2017. J Orthop Res, 35:2329-37. [3] Goodwin B et al., 2019. Under Review. [4] Lugade V et al., 2014. Med Eng Phys, 36:169-76. Supported by NIH R01HD84423-01 and NCATS UL1 TR002377

1127 Board #253 May 27 2:30 PM - 4:00 PM

An Adapted Judo Program Improves Psychosocial Behaviors In Children With Autistic Spectrum Disorders

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INTRODUCTION: Persons with Autistic Spectrum Disorder (ASD) present several effects on the neurological development, with difficulties on social, behavioral and communication abilities that negatively affect daily life activities. Judo is a sport with great pedagogical tradition that provides benefits in children with ASD further than the physical activity by itself. **PURPOSE:** to study the evolution of psychosocial behavior of children after an adapted judo program, a study of feasibility

METHODS: 11 children of both sexes (age 11,36 ± 2,34 year, height 156,78 ± 7,37 cm, and weight 56,71 ± 7,14 kg) participated in the study after obtaining the IRB approval, informed consent from their parents/legal tutors and informed assent from themselves. After 8 controlled weeks without an intervention, all the children participated in an adapted judo program once every week during 12 weeks. Psychosocial behavior was measured with the Gilliam Evaluation Scale used for ASD diagnosis (GARS-3), who includes 6 sub-scales: Repetitive Behaviors, Social Interaction, Social Communication, Emotional Responses, Cognitive Style, Maladaptive Speech. The GARS-3 was applied to the same sample three times: baseline, after 8 weeks without intervention (as control assessment) and after 12 week of intervention. Descriptive for all variables and an ANOVA of repeated measurements were calculated to study differences Baseline, pre and post intervention ($p < 0.05$).

RESULTS: No differences were found between the first and second assessment in all six sub-scales, as expected. Between the second and the third assessments, there were significant differences in the Social Interaction sub-scale (17.7 ± 10.1 vs 9.1 ± 4.3; $p < 0.05$) showing an improvement post-intervention, as a low value does not correspond to a typical ASD behavior

CONCLUSIONS: Adapted judo program can improve psychosocial behaviors in children with ASD. More research is needed increasing the number of participants and the number of sessions per week.

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Physical Activity And Shoulder Health Behaviors In Recreational Wheelchair Athletes

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PURPOSE: To assess exercise habits, injury prevention behaviors, and the prevalence of shoulder pain in a population with physical disabilities involved in adaptive sports.

METHODS: A cross-sectional descriptive survey was completed by 24 recreational wheelchair athletes (13 male, 11 female) age 13 and older. Participants were surveyed at two separate community events promoting adaptive sports participation. All participants were cognitively able to complete the survey independently. **RESULTS:** 70.8% of respondents practiced, competed, or trained in their primary sport year-round, and 29.2% participated in more than one adaptive sport. When in-season 58.3% reported achieving >150 minutes of moderate to strenuous exercise per week, and 41.7% achieving >240 minutes per week. Compared to the off-season, 45.8% and 25.0% of athletes completed >150 minutes per week and >240 minutes per week of moderate to strenuous exercise respectively. 58.3% reported not being satisfied with their amount of physical activity, citing time, access to adaptive equipment and facilities as the most common barriers. 62.5% reported shoulder pain as a result of adaptive sports participation, 41.7% had experienced shoulder pain in the past year, and 37.5% endorsed shoulder pain interfering with daily function. 75.0% reported regularly performing injury prevention exercises, but of those who did not, access to equipment and lack of information on current recommendations were cited as the most common barriers. Encouragingly, a majority of respondents reported discussing physical activity (95.8%) and shoulder health (75.0%) with a health care professional.

CONCLUSION: Within this group of adaptive athletes most participants reported significant amounts of physical activity when engaged in their primary sport, however a notable decrease in activity was noted during off-season periods. Most athletes had experienced shoulder pain as a result of sport participation, with this pain frequently interfering with daily function. Given barriers identified, implementation of adaptive fitness and injury prevention programs should focus on athlete education, be low-cost, and provide convenient access to appropriate adaptive equipment.

1129 Board #255 May 27 2:30 PM - 4:00 PM

A Comparison Of Sleep And Physical Activity Patterns Between Typically Developing Adolescents And Adolescents With Developmental Disorders

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PURPOSE: Youth with developmental disabilities (such as ASD and CP) may be less like to meet recommendations for moderate to vigorous physical activity (MVPA) or sleep duration compared to typically developing adolescents. However, there is limited research comparing objective measures of activity and sleep among TD children, children with ASD, and children with CP. The purpose of this study was to examine objectively-measured MVPA, sedentary behavior, and sleep quality in TD adolescents and adolescents diagnosed with CP and ASD. **METHODS:** Subjects consisted of 10 TD children, 10 children with ASD, and 8 children with CP, matched on age and gender (mean age: 10.5 years; 60% male). Children wore an ActiGraph GT9X accelerometers, over a 7-day period, to assess minutes per day of MVPA, sedentary behavior, and total sleep time. Sleep efficiency was also collected for all three groups. One-way ANOVA was used to examine differences among TD youth, youth with ASD, and youth with CP. Tukey post-hoc tests were then conducted to determine where differences existed between the three groups. **RESULTS:** Children with CP accumulated significantly more sedentary minutes (662 ± 199) than TD children (388.2 ± 79.9 $p = .002$), while TD children accumulated significantly greater minutes of MVPA (118.45 ± 50.36) compared to both children with CP (17.32 ± 17.89) and children with ASD (53.7 ± 45.8), ($p < 0.0001$). Additionally, youth with CP (95% ± 3.6) had greater sleep efficiency than youth with ASD (89% ± 4.8; $p = .03$). **CONCLUSIONS:** Children with developmental disorders may accumulate lower amounts of MVPA compared to TD youth, however, no differences were found between TD youth and youth with CP regarding sleep quality. These findings suggest that population-specific interventions are critical to improve health in both TD youth and youth with developmental disabilities.

1130 Board #256 May 27 2:30 PM - 4:00 PM

The Effects Of Muscle Quality On Physical Function

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INTRODUCTION: Type 2 diabetes mellitus is associated with loss of muscle quality may alter the functional capacity. **PURPOSE:** To investigate whether handgrip muscle strength or quality could be useful to predict dynapenia and assess functional capacity in Type 2 DM elderly. **METHODS:** A total of 79 elderly with diabetes were recruited (n=79; male=38; female=41; age: 69.8±8.7 years old). Body composition (Inbody), physical function (walking speed, 30 second Sitting-Standing, Timed Up and Go, balance, physical activity scale for the elderly (PASE)), handgrip quality (handgrip strength divided by body lean mass (BLM) in Kg/KgBLM) were evaluated. The correlation between age, muscle strength, PASE score, body composition and physical function tests was analyzed by Pearson's correlation coefficient (r). T-test and One-Way ANOVA were used to analyze the effect of three different muscle strength groups on physical function. P values ≤0.05 were considered statistically significant. **RESULTS:** In male, a positive correlation was observed between the handgrip quality (kg/BLM) and open eyes one leg standing (r=0.567, p=0.002), close eyes sharpened Romberg (r=0.450, p=0.005), 30 second Sitting-Standing (r=0.374, p=0.022), Timed Up and Go (r=-0.375, p<0.02), and PASE score (r=0.423, p=0.01). In female, the results showed a positive correlation between handgrip quality (kg/BLM) and close eyes one leg standing (r=0.391; p=0.011), 30 second Sitting-Standing (r=0.447; p<0.003), and Timed Up and Go (-0.380, p<0.014). There was no correlation between handgrip quality, Romberg test and fasting blood glucose. To evaluate the prediction of handgrip quality on physical function, the participants were divided into three groups by values of handgrip quality 0.6382 and 0.7728. Either male or female, the One-Way ANOVA results showed that the lower handgrip quality the higher age, body weight (p<0.05). The performance of Timed Up and Go, 30 second Sitting-Standing, opened eyes one leg standing, and 5 times Sitting-Standing is better in the higher handgrip quality than low handgrip quality. **CONCLUSION:** Handgrip quality can be used to predict physical function of the elderly diabetic patients in clinical. Supported by grants VN107-07 and V108C-172.

1131 Board #257 May 27 2:30 PM - 4:00 PM

Quality Of Life In Spinal Cord Injury Patients Before And After Exercise Intervention

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More than 1 million people are living with a spinal cord injury (SCI) in the United States alone. Research suggests improvement in daily function as well as biochemical markers in SCI patients who participate in regular exercise. There is limited data on the specific impact of exercise as it pertains to Quality of Life (QOL), complications or general sense of wellbeing. **Purpose** To obtain objective QOL data using validated SCI questionnaire instruments before and after exercises intervention done at the Claremont Club Perfect Step Program. **Methods** The Claremont Club Perfect Step is a fitness facility that has been providing structured exercise programs for patients with SCI for 10 years. We completed a survey of 41 patients regarding their QOL before and after entering this program. The survey questions were drawn from a validated Spinal Cord Injury—Quality of Life (SCI-QOL) survey. A matched-pair t test was used to compare the 6-month answers to the baseline measures of QOL. **Results** Patients with spinal cord injuries who participated in this program reported statistically significant improvements in 83 of 92 survey categories, including improved mental health, reduced complications and fewer or lower doses of medication. With the QOL scores ranging from 1 (lowest) to 5 (highest), the average score increased by 0.72 (18.8%), from 3.82 to 4.54. Measures of mood, energy and confidence significantly improved. Measures of depression reduced. Measures of pain and pain interference on social and work life significantly decreased. Lastly, bladder accidents or disruption of daily life due to bladder incontinence significantly improved. There was also a trend toward reduced urinary tract infections as well as reduced pressure sores or pressure injuries. **Discussion/Conclusions** The depth, breadth, and magnitude in improved QOL scores is impressive. These results indicate that exercise intervention for patients with SCI should be not be the last step, once traditional medical care has been exhausted, but an early intervention to maximize QOL and potentially reduce complications from SCI.

Although structured exercise has often fallen outside the scope of traditional medical care for patients who experience SCI, it should be considered a first-line treatment that appears to be relatively safe and highly effective.

1132 Board #258 May 27 2:30 PM - 4:00 PM

Physical Activity Levels And Health Problems In Employees Of Stationary Nursing Homes: Is There An Association?

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Epidemiological data demonstrate that employees of nursing homes frequently suffer from illness and musculoskeletal disorders. Previous studies were mainly based on medical diagnoses and registered days of absence. The prevalence of pre-diagnostic health problems (HP) and resulting subjective impairments in participation and job-related performance are thus unclear. **PURPOSE:** Our study assessed these factors and their potential association with physical activity levels (PA). **METHODS:** Employees of two stationary nursing homes in Germany (n = 47, age: 47 ± 23 years, 42 females) once per week completed the OSTRC questionnaire over a total period of six weeks. The instrument captures the occurrence of HP (illness and musculoskeletal disorders) as well as related symptoms and restrictions in job participation. Accelerometers, worn on seven consecutive days, were used to assess PA. The association between PA and parameters indicating pre-diagnostic HP and their consequences was tested by means of point biserial correlations. **RESULTS:** About 85% of the participants reported a HP during the past six weeks. Musculoskeletal disorders were more prevalent than illness (66% vs. 47%). Almost one third of the employees (29.8%) had to reduce working time at least once due to a HP and more than 6 in 10 persons (63.8%) experienced restrictions in job performance. The most frequent locations of orthopaedic problems were the neck, lumbar spine, shoulder and knee. With 48 ± 23 MET h/week, the sample was highly active, all participants fulfilled the WHO's minimal recommendation of 7.5 MET/h per week. PA was not associated with the occurrence of HP and their consequences (all p<.05). **CONCLUSIONS:** The association of high PA levels and general/musculoskeletal health may not exist in employees of stationary nursing homes. The development of interventions aiming to tackle the burden of population-specific HP therefore retains high relevance in future research.

1133 Board #259 May 27 2:30 PM - 4:00 PM

Skeletal Muscle Mitochondrial Capacity Is Similar In Ambulatory And Non-ambulatory Children With Cerebral Palsy

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PURPOSE: Cerebral palsy (CP) is the most common childhood movement dysfunction secondary to a brain injury around birth. These children can be classified as ambulatory or non-ambulatory based on their functional abilities. Importantly, they expend significantly increased energy expenditure during movement. Muscle mitochondria, specifically the electron transport system are responsible for oxidative capacity, energy production and are associated with functional capacity. Unfortunately, mitochondrial oxidative capacity in children with CP and its association with different functional levels is not known. We measured maximum mitochondrial respiration rates directly from biopsies in children with CP, compared across ambulatory levels. **METHODS:** Twenty children (6-16 years, 10 M/6F, Ambulatory-12), undergoing surgery participated in this study. Twenty-nine biopsies were obtained from adductors, vastus lateralis, gastrocnemius. Carbohydrate and fatty acid respirometry substrate-uncoupler-inhibitor titration (SUIT) protocols were performed on permeabilized muscle fiber bundles. In addition, muscle homogenate was used to measure citrate synthase activity as a marker of mitochondrial content. Ambulatory capacity was measured using 6-minute walk tests (n=7), muscle strength, and gait velocity (n=15) during routine therapy visits. **RESULTS:** Surprisingly, maximal mitochondrial phosphorylation capacity was similar across between functionally ambulatory and non-ambulatory children (77.1±23.9 vs. 84.9±24.0 pmol O₂/s/mg). This was uncorrelated with mitochondrial content (p>0.1), as measured by citrate synthase. Mitochondria in children with CP still preferentially used carbohydrates over fatty acids based on state-3 respiration. Functionally ambulatory children showed positive associations between mitochondrial function and ambulatory capacity measures (r² values for gait velocity=0.50, 6-meter walk test=0.33, p<0.05).

CONCLUSIONS: Mitochondrial function are typically associated with activity level. Surprisingly, functionally ambulatory children with CP did not have greater mitochondrial function compared to non-ambulatory children and might even be lower. Importantly, within ambulatory children walking capacity was related to maximal mitochondrial function.

1134 Board #260 May 27 2:30 PM - 4:00 PM
Fall Risks Increase In Aging Women

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PURPOSE: Accidental falls are one of the leading causes of hospitalization for injury and result in a high death rate among older Canadians. There are about 30% of people over the age of 65 living in the community fall every year. In addition, aging process is related to individual decrease in physical and functional abilities that increase the risk of falls. Older women are more likely to experience more severe trauma after falling than men. The objective of this study is to evaluate the impact of aging on functionality, postural balance and falls risk in aging women. **METHODS:** 19 women formed two age groups (n = 7 in 45-54 years and n = 12 in 55-64 years) and performed three assessment tests: 1- Step Test to measure lower limbs speed, 2- Sit to Stand Test for lower limbs Strength and 3- Postural Balance Test using the force platform during semi-tandem position, with eyes open and eyes closed. Postural balance response was based in Centre of Pressure (COP) velocity sways in antero-posterior and in medio-lateral directions. **RESULTS:** A large effect size was observed (Hedge's $g = 1.447$), and a significant lower extremity speed ($p = 0.005$) in the older group compared to the younger group. The Lower-limbs Strength showed a large effect size ($g = -0.86$), however, not significant ($p = 0.075$) between groups. A large effect size and significant COP velocity increase was observed in the older group for both antero-posterior ($p < 0.05$, $g = -0.887$) and medio-lateral ($p < 0.05$, $g = -0.731$) directions as compared to the younger group. Finally, significant differences ($p < 0.001$) and a large effect size were observed between eyes open ($g = -1.506$) and closed ($g = -1.441$) conditions for COP velocity sway for both directions. **CONCLUSION:** Aging in women can significantly change the postural balance performance as well as speed adjustments of the lower limb. These findings add to the body of knowledge on aging women and should be considered when planning and developing services. Complication risks after a fall in aging women are deleterious suggesting that developing activities to improve speed and balance are favored to ensure a longer life expectancy in aging woman's health.

1135 Board #261 May 27 2:30 PM - 4:00 PM
People With Disabilities Perception Of Quality Of Life After Participation In A Student Service-Learning Program

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(No relevant relationships reported)

TITLE: People with Disabilities Perception of Quality of Life After Participation in a Student Service-Learning Program

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ABSTRACT:

It is observed that there is a continuous decline in physical function and associated decline in quality of life (QoL) among individuals with disabilities. It has been documented that participating in physical activity significantly improves QoL. Despite many studies proving physical activity improves one's QoL, there is a limited amount of research showing how combining student service-learning with physical activity can improve the QoL of individuals with disabilities.

PURPOSE: The purpose of this study was to qualitatively investigate the perception of QoL of individuals with disabilities and physical activity during a student service-learning program.

METHODS: Semi-structured interviews were performed with 10 individuals with various disabilities. The interviews were designed to explore the perception of QoL and physical activity through each participants' experience working with university students for the first time. Interviews were audio recorded and transcribed verbatim. Thematic analysis was completed using NVivo qualitative analysis software.

RESULTS: Three main themes emerged from the qualitative thematic analysis: (1) peers and students were the motivational factors to physical activity with positive, non-judgmental, and supportive exercise environment, (2) increased adherence to physical activity, and (3) increased self-confidence performing activities of daily living.

CONCLUSION: Physical activity combined with student service-learning programs can potentially improve many different aspects of individuals with disabilities QoL. Our results show improvement in general well-being, as well as a positive experience

of working with students. This research, and future research in the field, will help establish a base of evidence to tailor this type of exercise program for individuals with disabilities.

1136 Board #262 May 27 2:30 PM - 4:00 PM

Harnessing Digital Health To Objectively Assess Motor Capacity In Patient With Chronic Obstructive Pulmonary Disease

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Purpose: Current motor-capacity assessment tools based on gait test is limited in patients with Chronic Obstructive Pulmonary Disease (COPD) because of the need to carry ventilator support, high fall risk, fatigue, and limited space to administer the test in busy settings. In this study, we proposed an alternative tool to determine motor capacity based on 20-seconds rapid repetitive elbow flexion-extension test, called frailty meter (FM) administrable during sitting. FM is based on a single wrist-sensor enables quantifying frailty phenotypes including slowness, weakness, exhaustion, and rigidity.

Methods: Thirty-nine COPD patients (age = 68 ± 8 years, BMI = 29 ± 6 kg/m²) and 49 age-matched controls (age = 70 ± 3 years, BMI = 29 ± 6 kg/m²) were recruited. In addition to FM test, conventional functional tests, including gait, balance, timed up & go, and 5-time sit to stance were performed.

Results: All participants achieved to complete FM test. While the feasibility for conventional tests ranged from 74% to 90%. When compared to the controls, COPD patients exhibited deteriorated motor capacity measured by conventional functional tests (Cohen's $d = 0.60-1.52$, $p < 0.050$). The most sensitive phenotypes associated with COPD was found to be slowness characterized by flexion time (42% deterioration, $d = 1.46$, $p < 0.001$) and rigidity characterized by range of motion (14% deterioration, $d = 0.73$, $p = 0.001$). Significant correlations were found between FM metrics and conventional functional tests with the largest effect observed between slowness and 5-time sit to stance ($r = 0.51$, $p < 0.001$).

Conclusion: This study demonstrated the feasibility of the FM test to quantify digital biomarkers associated with motor capacity in COPD patients. The proposed test could be served as an alternative to gait tests and thus may facilitate routine screening of motor-capacity in busy clinical settings. Future studies need to demonstrate sensitivity to change in response to intervention.

1137 Board #263 May 27 2:30 PM - 4:00 PM

Within Daily Analysis Of Physical Activity Behaviour In Adults With Multiple Sclerosis

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Little is known about the dynamic association between activity pacing and actual physical activity behaviour within the daily routines of persons with multiple sclerosis (MS). Understanding the association between activity pacing and actual physical activity behaviour is relevant to help optimise health promoting behaviour.

PURPOSE: To explore how activity pacing relates to actual physical activity behaviours in adults with MS.

METHODS: 21 persons with MS (mean age = 59 ± 9 years) wore an accelerometer for 7 days to assess physical activity behaviours and filled in questionnaires on their engagement in pacing and perceived risk of overactivity (5-point Activity Pacing and Risk of Overactivity Questionnaire), fatigue (7-point Fatigue Severity Scale), and Health-related quality of life (RAND-12). Physical activity behaviours were assessed by examining activity level (7-day average activity counts per minute) and activity variability (7-day average highest activity counts per minute each day divided by activity counts per minute on that day). The relationships between the variables were examined using hierarchical regression models.

RESULTS: Engagement in pacing, perceived risk of overactivity, activity level and variability were $2.25 \pm .74$, 2.38 ± 1.02 , 241.07 (144.68) and $3.96 \pm .72$ respectively. Lower activity level was related to higher engagement in pacing ($\beta = -.438$, $t = -2.66$, $p = .024$). Higher activity level was associated with higher perceived risk of overactivity

($\beta = .494, t = 2.84, p = .018$). No relations were found between activity variability and engagement in pacing ($\beta = -.225, t = -.96, p = .361$) and between activity variability and perceived risk of overactivity ($\beta = .149, t = .599, p = .562$).

CONCLUSIONS: The results indicate that those with lower activity levels may experience worsening symptoms with respect to physical disability, and may be more inclined and aware to pace their activities. Conversely, those with higher activity levels may experience less disruption through fatigue in daily life and may resort to the execution of too long periods of activity which may cause overactivity. Guidance on optimal use of pacing may be beneficial for persons with MS and improve their physical activity behaviour.

1138 Board #264 May 27 2:30 PM - 4:00 PM
Effects Of Aquatic-based Exercise On Perceived-fatigue In People With Multiple Sclerosis: A Systematic Review And Meta-analysis

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(No relevant relationships reported)

Multiple sclerosis (MS) is a chronic, immune-mediated and neurodegenerative disease of the central nervous system. Since signs and symptoms associated with MS extend to several dimensions, people with MS (PwMS) can experience symptoms at both physical and cognitive dimensions. Among them, perceived fatigue is one of the most disabling symptoms, affecting the majority of the MS population. Hydrotherapy is a novel therapeutic option to improve the perceived-fatigue in PwMS. **PURPOSE:** To analyze the effects of aquatic-based exercise on perceived-fatigue in PwMS using a meta-analytic procedures and systematic review. **METHODS:** Clinical trials comparing aquatic exercise to no exercise treatments were searched on four scientific databases up to June 2019. The standard mean differences (SMD +) was calculated for the outcome *perceived-fatigue*. Firstly, general fatigue was evaluated, from which three sub-dimensions were also assessed (physical, psychosocial, and cognitive). The methodological quality of the included studies was assessed employing the PEDro scale. **RESULTS:** A total of 148 articles were initially identified, from which only 5 fulfilled all the inclusion criteria, other than inclusion of a control group and an experimental group, and a hydrotherapy program. General fatigue, assessed mainly through the Modified Fatigue Impact Scale, showed a significant decrease ($SMD_+ = -2.15$ [95% CI = -3.44 to -0.87]; $p < 0.01$; $I^2 = 91\%$). Regarding fatigue sub-dimensions, physical fatigue achieved a significant improvement in the experimental group compared to the controls ($SMD_+ = -2.15$ [95% CI = -3.72 to -0.58]; $p < 0.01$; $I^2 = 92\%$). Psychosocial fatigue ($SMD_+ = -1.13$ [95% CI = -1.86 to -0.40]; $p < 0.01$; $I^2 = 76\%$) and cognitive fatigue were also significantly improved compared to the control group ($SMD_+ = -0.57$ [95% CI = -0.88 to -0.25]; $p < 0.01$; $I^2 = 0\%$). **CONCLUSIONS:** Aquatic-based exercise significantly decreases all dimensions of perceived-fatigue in PwMS. Based on these findings, it would be useful for future studies to address the dose-response characterization of aquatic-based exercise programs (i.e. intensity, volume, frequency, training length, etc.) in order to optimize the physical exercise interventions for PwMS.

B-77 Free Communication/Poster - Environmental/Occupational Physiology

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

1139 Board #265 May 27 1:30 PM - 3:00 PM
Occupation-Specific Physical Demands And Physiological Strain Of American Football Referees While Officiating

Emily C. Colster, Anne M. Mulholland, Clifton J. Holmes, Brett C. Bentley, Jonathan E. Wingo, FACSM, James B. Robinson, Hayley V. MacDonald. *The University of Alabama, TUSCALOOSA, AL.* (Sponsor: Jonathan E. Wingo, FACSM) Email: ecolster@crimson.ua.edu

(No relevant relationships reported)

Occupational incidences of sudden cardiac death (SCD) are greater among workers that experience high levels of physical exertion, physiological strain, and extreme thermal environments. American football referees fall under this distinction, yet are underrepresented in occupational research.

PURPOSE: To bridge this gap by quantifying the physical demands and physiological strain they experience while officiating. **METHODS:** Twelve male officials (mean±SD; age=43±11 y, body mass index [BMI]=31.9±7.2 kg/m², 67% white), across 3 games, provided urine samples for urine specific gravity (U_{SG}) determination, ingested core temperature (T_c) pills, and wore GPS-enabled performance monitoring systems. Outdoor conditions were monitored using a weather meter. Analyses included descriptive statistics and bivariate correlations. **RESULTS:** Games lasted ≈2.5 h and evening weather conditions were typical of the Southeastern US (wet bulb globe temperature: 23.5±2.2°C, relative humidity: 72.5±9.2%). Across all 3 games, 58% of officials were hypohydrated ($U_{SG} > 1.020$); they covered an average of 5.5±1.6 km (total distance) at a speed of 1.9±0.3 kmph, with corresponding T_c and heart rate (HR) values of 37.4±0.4°C (peak T_c =38.3±0.4°C) and 132±16 bpm (peak HR: 169.2±17.5 bpm), respectively, across all referees and over the entire sampling period. Higher relative humidity at the start of each game was associated with greater physiological strain (average HR: $r = 0.61, P = 0.04$; peak HR: $r = 0.56, P = 0.06$). Pre-game hydration status ($r = 0.50, P = 0.09$) and BMI ($r = 0.50, P = 0.09$) tended to elicit greater physiological strain (defined as the proportion of the game spent above 85% of age-predicted maximal HR). **CONCLUSIONS:** Football referees experience elevated levels of physiological strain while performing officiating duties. Individual and environmental factors appear to influence levels of strain and should be explored in a larger and more diverse sample of referees to identify patterns and develop strategies to best mitigate strain and prevent SCD.

1140 Board #266 May 27 1:30 PM - 3:00 PM
Physiological Responses To Heat Stress In Groundskeepers

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(No relevant relationships reported)

PURPOSE: The extent to which groundskeepers experience heat strain, dehydration, and accompanying declines in kidney function during work in hot-humid conditions is unknown.

METHODS: Hydration, cardiovascular, and internal body temperature measures were assessed in 20 groundskeepers (18 men; mean±SD age=38±8 y, body mass index=32±8 kg/m²) during work on 2 summer days. Before (PRE) and after (POST) the work shift, resting blood pressure (BP) and heart rate (HR) were measured and urine and blood samples were collected. At POST, fluid intake was recalled for the previous 24 h. Gastrointestinal temperature (T_{GI}) was recorded every 5 min via ingestible telemetric sensor.

RESULTS: Average highest daily wet bulb globe temperature=39.1±3.5 °C. In 45% of subjects, PRE BP>130/80 mm Hg on Day 1 (D1) and Day 2 (D2). Highest HR and T_{GI} achieved across both days were 143±15 bpm and 37.7±0.3 °C, respectively. On D1 and D2, urine specific gravity (U_{SG} ; 1.021±0.1) and urine color (U_{COL} ; 6±1) did not change PRE to POST (all $P > 0.28$), but subjects began the workday “underhydrated” (concentrated urine but normal serum osmolality (S_{OSM})]—62% had $U_{SG} \geq 1.020$ and 95% had $U_{COL} \geq 4$ despite $S_{OSM} = 292 \pm 5$. Fluid intake=2.3±1.6 L during work and consisted of 70% water and 25% sugar sweetened beverages. No subject lost ≥2% of body mass on D1 or D2. For 6 subjects, estimated glomerular filtration rate at PRE was ≤60 mL/min/1.73m² averaged across D1 and D2. Although serum creatinine did not change statistically from PRE to POST across days (all $P > 0.18$), 5 subjects had increases ≥0.3 mg/dL, signifying an acute kidney injury (AKI).

CONCLUSIONS: While hyperthermia was not prevalent, subjects began and ended the workday underhydrated. Hypertension, obesity, and low water intake may have contributed to the overall low kidney function and AKIs observed. Using urine color as a self-assessment tool could be a beneficial intervention improve hydration status and kidney function. Funded by NIOSH

1141 Board #267 May 27 1:30 PM - 3:00 PM
Effect Of A Hyperthermic Environment On Selected Physiological Variables During Occupational Stress In Police Cadets

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(No relevant relationships reported)

First responders (e.g., police) may be exposed to physical occupational stressors in the line of duty, which may place them at risk for acute cardio-metabolic events (e.g., myocardial infarction). Environmental challenges may exacerbate this risk. **PURPOSE:** To observe the impact of a hyperthermic versus thermoneutral environment on physiological responses in police cadets performing a simulated occupational task. **METHODS:** Using an environmental chamber, 10 police cadets

(22.2±2.3 years), completed two occupational task exercise conditions in hyperthermic (HT, 38°C) and thermoneutral (TN, 22°C) environments on separate days. During each condition, participants completed a 10-minute treadmill walk at 70%-80% of their maximal heart rate followed by a 5-minute 50lb sandbag lift. Participants had 10 seconds to lift the sandbag onto a table then another 10 seconds to place it back on the ground. The walk and lift were completed two times each per condition. Heart rate (HR), ratings of perceived exertion (RPE), and core temperature (T) were recorded immediately before entering the chamber (baseline), in the chamber at the conclusion of the occupational task (post-exercise), and outside the chamber after 10 min of rest (recovery). Two condition (HT, TN) by three time point (baseline, post-exercise, recovery) repeated measures ANOVAs were utilized to assess all dependent variables. Post-hoc analyses were performed using t-tests. **RESULTS:** Significant ($F \geq 8.6$, $p \leq 0.003$) condition by time interactions were observed for all dependent variables. There were no differences ($t \leq 2.0$, $p \geq 0.07$) across conditions in HR (76±11 bpm TN, 82±14 HT), RPE (6.4±1 TN, 7.1±2.4 HT), or T (37.2±0.3°C TN, 37.5±0.2°C HT) at baseline. However, each of these variables were significantly ($t \geq 2.3$, $p \leq 0.05$) greater post-exercise (104±12 bpm TN, 146±16 bpm HT; 8.9±2.4 RPE TN, 13.4±3.1 RPE HT; 37.6±0.3°C TN, 38.3±0.3°C HT) and during recovery (78±12 bpm TN, 92±13 HT; 6.7±1.2 RPE TN, 7.7±2.2 RPE HT; 37.4±0.2°C TN, 38.0±0.3°C HT) in the HT versus the TN condition. **CONCLUSION:** Concomitant occupational tasks and heat stressors increased physiologic and perceived measures of exertion and body temperature in police cadets beyond that of the occupational tasks alone.

1142 Board #268 May 27 1:30 PM - 3:00 PM
Physically Active Lifestyle Prevents Impairment Of Blood Pressure And Pulse Pressure Work-related To Stress In Police Officers

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PURPOSE: The police profession is a high-risk activity, as these professionals need to deal daily with violence, brutality and death, leading to high levels of stress. Classically, chronic exposure to situations causing stress may lead and facilitate the development of chronic diseases, such as cardiovascular and metabolic diseases. Increased pulse blood pressure (PP) is related to stiffness of large arteries predisposing to acute and chronic diseases, such as cerebrovascular stroke, coronary artery disease, heart failure and kidney diseases, which negatively affect morbidity and mortality, with significant consequences for public health. In addition, heart rate variability parameters are supposed to work as biomarkers of cardiovascular risk in response to stress as well. **METHODS:** We investigate the effects of regular practice of physical activity (moderate to high intensity, minimum of 5 years of regular practice and $\geq 4x$ /week) by police officers who regularly practice physical activity (PAc; 32,92±5,87 years old; n=25) from those who do not practice (PSed; 38,73±6,92; n=25) on systolic and diastolic blood pressure and on pulse blood pressure. The analysis of heart rate variability was performed by using 10 minutes of electrocardiography collection using the digital electrocardiography system (ECG PC, TEB®, Brazil). Body composition was analyzed using octopolar multifrequency bioimpedance (Maltron Inc, England). **RESULTS:** PSed presented increased systolic (136,81±21,31 mmHg x 123,56±10,92; $p < 0.01$) and diastolic blood pressure (81,68±13,80 x 75,37±9,66 mmHg; $p < 0.0123$) as well as pulse blood pressure (57,28±10,42 x 48,71±8,27 mmHg; $p < 0.0001$) when compared with physically active ones. In addition, PSed also presented increased levels of perceived stress ($p < 0.0008$), fat mass ($p < 0.0065$), visceral fat ($p < 0.001$) and reduced fat free mass ($p < 0.0055$), but not for resting heart rate neither for any parameter of heart rate variability (time and frequency domain: RSS, NNS, SDNN, RMSSD, VLF, LF, HF). **CONCLUSIONS:** We conclude that increased levels of stress in police officers impairs functional biomarkers of cardiovascular diseases, which can be partially attenuated by a physically active lifestyle.

1143 Board #269 May 27 1:30 PM - 3:00 PM
Implementation Of Physical Employment Standards For Physically Demanding Occupations

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PURPOSE: Workers in physically demanding occupations are often required to demonstrate appropriate levels of physical capability throughout their careers by undertaking routine in-service physical ability assessments. However, integrating physical employment standards (PES) and associated tests into organisational policies and procedures can be challenging for employers and there is a shortage of best practice guidance in this area. The aim of this study is to describe the process of integrating a developed PES into a physical capability management procedure, using a real-world example in the UK Fire & Rescue Service. **METHODS:** Using physical demands and performance data from a series of studies to investigate the cardiorespiratory, strength and muscular endurance requirements for endorsed UK firefighting activities, a physical capability management process was developed with industry stakeholders, including management, trade unions and subject matter experts. The procedure was designed to manage all levels of physical ability within a physically demanding workforce, prioritising employee safety and fairness. **RESULTS:** Occupational scientists and industry stakeholders defined performance standards relating to unacceptable, unclear, and acceptable performance of criterion tasks for UK firefighters. Cut-scores were identified for unacceptable (red), unclear (amber) and acceptable (green) performance standards related to each predictive test (Table 1). A process for triaging and managing all levels of workers physical abilities was agreed using the traffic-light system. **CONCLUSIONS:** This paper describes the processes involved in implementing a physical assessment procedure, for the administration of routine in-service PES and tests in a physically demanding occupation.
 Table 1. Cut-scores for each predictive test and performance standard.

Criterion Task(s)	Predictive selection test	Physical employment standard		
		Unacceptable (red)	Unclear (amber)	Acceptable (green)
HR/SC/EC/CE	VO ₂ max (ml.kg ⁻¹ .min ⁻¹)	≤ 35.5	35.6 – 42.2	≥ 42.3
Ladder lift	Shoulder press (kg)	≤ 30	32.5	≥ 35
Ladder lower	Single rope pull (kg)	≤ 51	52-59	≥ 60
Ladder extension	Repeated rope pull* (reps)	≤ 14	15-22	≥ 23

HR hose run; SC stair climb; EC equipment carry; CE casualty evacuation; * 28 kg weight.

1144 Board #270 May 27 1:30 PM - 3:00 PM
Psychophysiological Responses Of Swat Team Members During Active Shooter Training: A Pilot Study

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 (No relevant relationships reported)

Law enforcement is considered a stressful occupation, special weapons and tactics (SWAT) team members confront situations of imminent danger, that include exposure to traumatic and/or violent events beyond that of typical law enforcement officer duties. The stress related hormonal response of SWAT team members to active shooter training drills has not been investigated. **PURPOSE:** To investigate psychophysiological responses of SWAT team members during an active shooter training drill. **METHODS:** Six SWAT team members (age = 32.5 ± 4.1 yrs.; SWAT experience = 28.0 ± 13.0 months) participated in a control condition wherein participants practiced building entry techniques and marksmanship drills. During this session, measures of state anxiety, salivary cortisol (SCORT) and testosterone (STEST) were collected prior to and after breaching techniques, and after firearm practice. Participants also engaged in an experimental condition that involved three active-shooter training (AST) scenarios during which measures of state anxiety, task load, SCORT and STEST were collected prior to and immediately after each training episode. The scenarios included a slow-and-deliberate (S&D) search, a S&D search accompanied by a tactical robotic vehicle (TRV), and a rapid deployment scenario with TRV. **RESULTS:** Increases in anxiety approached significance ($p = 0.06$) across time in the AST, but no differences in task load demands ($p = 0.17$) were reported. Measures of SCORT approached significance across time ($p = 0.07$), and differences between conditions ($p = .01$, $n_2 = 0.95$) with the AST resulted in elevated SCORT levels. STEST levels were different between conditions ($p = 0.03$, $n_2 = 0.83$), and

increased significantly ($p = 0.02$, $n_2 = 0.28$) across time in the AST condition only, with the greatest increases occurring after the S&D search. **CONCLUSION:** SWAT team members responded to three active shooter training scenarios with limited anxiety and cortisol responses, although testosterone increases did occur when compared to a control condition. The greater experience levels may have contributed to the lack of significant changes in measures of stress during the AST, whereas increases in testosterone might explain the benefit of increasing aggressive behaviors and fearlessness for SWAT team members.

1145 Board #271 May 27 1:30 PM - 3:00 PM
Heat Strain Assessment Under Three Different Wet Bulb Globe Temperatures With Protective Clothing

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 (No relevant relationships reported)

Personal protective clothing is an important part of personal protective equipment worn by health care workers and first responders. Wearing a vapor-barrier layer of protective clothing inhibits sweat evaporation and impairs physiological and perceptual responses. **PURPOSE:** To evaluate thermoregulatory responses and heat strain indices during simulated healthcare and first responders' tasks under three different wet bulb globe temperatures (WBGT). **METHODS:** Four men (25.8±6.8 yrs, 176.5±6.1 cm, 75.3±16.9 kg) wore an ensemble consisting of a loose-fitting powered air-purifying respirator, chemical resistant overall vapor-barrier ensemble, double gloves, boots, and an apron, while performing a battery of first receiver and health care simulation activities (walking, cutting and removing clothing, scrubbing, placing a splint and cervical collar, and weight carrying) for three repetitions under three different WBGT (18, 26, and 34°C) in counterbalanced order. These environmental conditions were intended to simulate healthcare workplace conditions during mass casualty incidents. Rectal temperature (Tre) and heart rate were continuously monitored and averaged during the last 1-minute of each activity and presented as mean ± standard deviation. Physiological (PSI) and perceptual strain index (PeSI) were calculated at the end of each activity. **RESULTS:** Over time, Tre, PSI, and PeSI all gradually increased. At the end of the trial, Tre was significantly higher in the 34°C condition (38.5±0.4°C) than the 18°C condition (37.8±0.4°C, $p=0.029$) but did not differ from the 26°C conditions (38.2±0.6°C, $p=0.104$). The PSI was significantly higher in 34°C (6.4±1.0) than 26°C (5.1±1.2, $p=0.002$) and 18°C conditions (2.6±1.1, $p=0.001$). The PeSI was significantly higher in 34°C (7.6±1.8) than 18°C conditions (3.3±1.8, $p=0.006$) but did not differ between 34°C (7.6±1.8) and 26°C conditions (5.7±1.4, $p=0.075$). **CONCLUSIONS:** Tre and heat strain indices gradually increased over time across all environmental conditions. Tre and PeSI did not differ between 26°C and 34°C WBGT conditions. Tre and PeSI responses may be blunted by wearing a vapor-barrier ensemble. Future studies should examine this hypothesis to clarify the current findings.

1146 Board #272 May 27 1:30 PM - 3:00 PM
Effect Of Skin Temperature On Dermal Absorption Of Anthracene

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Exposure to a variety of ubiquitous pollutants, including polycyclic aromatic hydrocarbons (PAHs), occurs during daily exposure to vehicular exhaust fumes, smoking, grilling, and in many occupations, including firefighting. Dermal absorption of potential carcinogens has received limited attention compared to respiratory routes due to the challenges with measurement *in vivo*. **PURPOSE:** Our aims were 1) establish the efficacy of microdialysis (MD) as a sampling technique for dermal absorption of PAHs and 2) determine the effect of skin temperature on dermal absorption of the non-carcinogenic PAH, anthracene (ANT). **METHODS:** Two MD fibers were inserted into the ventral forearm of 6 healthy participants (32 ± 5 yrs, 5 male, 1 female) and perfused with lactated Ringers and 10% 2-hydroxypropyl-β-cyclodextrin at a rate of 1 μl/min. 2% ANT cream was applied over each site, dialysate samples were collected and skin blood flow (SkBF) measured at a locally heated (HT, 43°C) and thermoneutral (TN, 33°C) site. The concentration of ANT from dialysate samples were measured via targeted tandem mass spectrometry. **RESULTS:** Dialysate ANT concentration was similar between the HT and TN sites (2.9 ± 0.4 vs. 3.5 ± 0.4 ppm, $P=0.26$). Absolute SkBF was significantly higher at the HT versus TN site (35.7 ± 11.8 and 7.2 ± 1.0 CVC, $P=0.001$). **CONCLUSIONS:** These data provide support for MD as a sampling technique for dermal absorption of PAHs. Despite similar ANT concentrations between sites, dermal absorption and sampling can be modulated by multiple factors. Further research is required to elucidate the influence of skin

temperature versus clearance on dermal absorption of ANT and other PAHs. This has important implications for understanding dermal absorption of potentially carcinogenic compounds in occupational workers and the general population.

1147 Board #273 May 27 1:30 PM - 3:00 PM
Familiarization With Ambulatory Sleep And Blood Pressure Monitoring

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 (No relevant relationships reported)

Purpose: Sleep is a life-sustaining action that has implications in aspects of physical, mental, and emotional health. One necessary event that occurs during sleep is nocturnal blood pressure dipping. Measurement of ambulatory sleep and blood pressure are gaining popularity as these can be completed in an individual's home. However, little is known regarding the reliability of data and the time it takes oneself to familiarize with the equipment. Therefore, the purpose of this study was to determine how many nights of wearing the monitoring equipment were required to restore sleep architecture and blood pressure data to baseline. **Methods:** Eight male and female subjects completed all 3 nights of both sleep and blood pressure readings. Visit 1 consisted of anthropometric and resting blood pressure measurements. The subjects were also familiarized with the equipment and instructed to wear the Sleep ProfilerTM and SunTech Medical Oscar2 ambulatory blood pressure cuff simultaneously for 3 consecutive nights. Visit 2 consisted of the subjects returning the equipment and the data being downloaded to a laboratory computer. **Results:** The percent of time spent in N1, N2, N3, and REM were not statistically different between nights 1, 2, and 3. Time for wake after sleep onset was not statistically different between nights 1, 2, and 3. Time for sleep latency was statistically greater from night 2 to night 3 ($p = 0.042$). Percent nocturnal systolic and diastolic blood pressure dips were not statistically different between nights 1, 2, and 3. Cortical and autonomic arousals were not statistically different between nights 1, 2, and 3. **Conclusions:** These data demonstrate that ambulatory sleep monitoring takes 3 nights before the data is reliable and the person is familiarized with the mode of measurement.

1148 Board #274 May 27 1:30 PM - 3:00 PM
Effect Of Aerobic Exercise And Different Levels Of Pm_{2.5} On Pulmonary Response In Wistar Rats

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 (No relevant relationships reported)

PURPOSE: Exposure of particulate matter of less than 2.5 μm (PM_{2.5}) has been associated with adverse respiratory and the risk of inflammation. While regular physical activity (PA) reduces the risk of many adverse health effects. This study aimed to examine the protection of exercise on adverse pulmonary health induced by PM_{2.5} exposures in rats. **METHODS:** 80 Wistar rats were randomly divided into 8 groups: Sedentary (S), Exercise (E), Sedentary+Low concentration PM_{2.5} exposures (S+LPM), Exercise+Low concentration PM_{2.5} exposures (E+LPM), Sedentary+Medium concentration PM_{2.5} exposures (S+MPM), Exercise+Medium concentration PM_{2.5} exposures (E+MPM), Sedentary+High concentration PM_{2.5} exposures (S+HPM), and Exercise+High concentration PM_{2.5} exposures (E+HPM). The rats in all E-related groups went through 8-week aerobic interval treadmill training (5 days/week, 1h/day). The PM-related groups of rats were exposed to different concentration PM_{2.5} exposure in Beijing. After one bout of PM exposure, the pulmonary function, structure of lung tissues and several pulmonary biomarkers were observed. **RESULTS:** 1) Compared with S group, following changes occurred in various S+PM_{2.5} exposure groups: lung tissues were seriously damaged, local bleeding, pus exudation, and inflammatory cell infiltration, as well as the decline of the SOD (S+LPM: $P=0.020$, S+HPM: $P=0.370$), and CAT (S+HPM: $P=0.012$) while the decline of Penh (S+MPM: $P=0.133$, S+HPM: $P=0.002$), MDA (S+HPM: $P=0.007$), TNF-α (S+MPM: $P=0.018$, S+HPM: $P=0.008$) and IL-1β (S+HPM: $P=0.014$) were observed. 2) Compared with the corresponding different concentration of S+PM_{2.5} exposure groups, the bleeding and inflammatory infiltration were improved, the Penh (E+HPM: $P=0.005$), TNF-α (E+HPM: $P=0.042$) and IL-1β (E+HPM: $P=0.036$) were decreased and CAT (E+HPM: $P=0.039$) and GSH (E+HPM: $P=0.040$) were increased in related E+PM groups respectively. **CONCLUSIONS:** The aerobic interval training improved the pulmonary function and impeded the lesion progression, which is due to effective in impeding the oxidative stress and inflammation.

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Effects Of Outdoor Exercise And Vitamin D3 Capsules Supplementation Interventions On Vitamin D Deficiency Of Swat TraineesYuxin Liu¹, Weimo Zhu, FACSM², Gang He¹. ¹Nanjing Forest Police College, Nanjing, China. ²University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Weimo Zhu, FACSM)

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(No relevant relationships reported)

BACKGROUND: The Chinese special weapons and tactics (SWAT) trainees came from high school graduates, who have often lived in an indoor life style in China so long that many of them suffered from vitamin D deficiency, which made them at high risk of health problems that instructors had to face. **PURPOSE:** To investigate the therapy effects of outdoor exercise and Vitamin D3 Capsules Supplementation, and their combination on vitamin D deficiency symptoms of SWAT trainees.

METHODS: 158 SWAT trainees with low Serum 25-hydroxyvitamin D levels were divided randomly into 3 groups: Outdoor exercise (O), Vitamin D3 Capsules group (C), and their combination (OC). Participants in O-group maintained the outdoor training for four months (4 hours per day) while C-group used oral Vitamin D3 Capsules, (2000IU per day) with indoor training (in the gym), finally OC-group took both outdoor exercise and Vitamin D3 Capsules at the same time. The healing rates (Serum 25-hydroxyvitamin D level went beyond 30ng/ml was considered as healing) were compared 4 months later. The Serum 25-hydroxyvitamin D levels, the whole body muscle mass increment (kg) and the heart rate change (beats per minute) on Head-up Tilt (HUT) were tested both before and after the intervention.

RESULTS: The healing rates of O, C and OC groups were 78.0, 90.9, 100%, respectively; the average Serum 25-hydroxyvitamin D levels in OC (32.28±5.74) group after the intervention was higher than O (26.99±7.83, $p < 0.05$, $\eta_p^2=0.58$) and C (31.11±7.59, $p < 0.05$, $\eta_p^2=0.20$), and the whole body muscle mass increment (2.28±0.54) was significantly higher than that in other two groups ($p < 0.05$, for OC vs O, $\eta_p^2=0.28$; for OC vs C, $\eta_p^2=0.21$). However, the heart rate change showed no statistically significant change.

CONCLUSIONS: A combination of outdoor exercise and Vitamin D3 capsules supplementation was effective for the 25-hydroxyvitamin D level in serum and could get a better result in the four-month vitamin D deficiency intervention.

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Association Between Insulin Resistance And Aerobic Power In Police OfficersMaciste H. Macias Cervantes¹, Claudia Luevano Contreras¹, Arturo Figueroa, FACSM², Ma Eugenia Garay-Sevilla¹, Ana Lilia Gonzalez-Yebra¹, Carlos Kornhauser¹. ¹Universidad de Guanajuato, Leon, Mexico. ²Texas Tech University, Lubbock, TX. (Sponsor: Arturo Figueroa, FACSM)

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(No relevant relationships reported)

Insulin resistance (IR) increases the risk of adverse cardiovascular events. The triglyceride glucose index (TyG) is a simple IR marker. Low skeletal muscle mass is associated with IR. However, the relationship between muscle power and IR is not well known. **PURPOSE:** To investigate the relationship between TyG index and aerobic power in police officers. **METHODS:** Data from 716 police officers were analyzed (125 female and 617 men). They were classified by a TyG index >4.68 in IR (n= 417) and Control (n= 299) groups. All participants performed a graded exercise test in cycloergometer to determine maximal heart rate (HR max), peak oxygen consumption (VO₂peak), and peak aerobic power (final watts obtained during GXT/ weight). Fasting blood glucose, cholesterol, and triglycerides were determined. Anthropometric and body composition measurements were obtained using bioelectrical impedance analysis.

RESULTS: Blood pressure, metabolic, and anthropometric variables were higher in the IR group than in the control group, except that exercise capacity was lower in the IR than control group (Table 1). TyG was inversely related with aerobic power ($r = -0.22$, $p < 0.01$) and VO₂peak ($r = -0.23$, $p < 0.01$) but directly related with fat mass ($r = 0.22$, $p < 0.01$).

CONCLUSIONS: Peak aerobic capacity and aerobic power are lower in individuals with IR. Aerobic power is negatively associated with metabolic control. Police officers need to improve aerobic power and fat mass in order to be metabolically healthier.

Table 1. General characteristics in police officers

	IR (n= 417)	Control (n= 299)	p
Age (yr)	34.6 ± 7.6	31.5 ± 7.6	0.00
SBP (mmHg)	125.7 ± 13.4	119.7 ± 12.9	0.00
DBP (mmHg)	79.2 ± 9.6	74.8 ± 9.7	0.00
Weight (Kg)	82.5 ± 12.1	75.6 ± 12.6	0.00
Height (M)	1.7 ± .06	1.7 ± .07	0.53
BMI (Kg/m ²)	28.8 ± 3.7	26.5 ± 3.9	0.00
Waist circumference (cm)	97.2 ± 8.9	90.5 ± 11.0	0.00
Free fat mas (Kg)	55.0 ± 12.3	51.5 ± 14.3	0.01
Fat mass (Kg)	24.4 ± 7.8	20.1 ± 8.4	0.00
Glucose (mg/dl)	102.7 ± 28.9	92.1 ± 12.4	0.00
Cholesterol (mg/dl)	196.4 ± 34.9	169.7 ± 28.6	0.00
HDL-C (mg/dl)	34.8 ± 8.2	39.9 ± 9.2	0.00
Triglycerides (mg/dl)	253 ± 138	99 ± 27	0.00
VO ₂ peak (ml/kg*min)	36.3 ± 6.4	40. ± 7.6	0.00
Aerobic Power (Watts/kg)	2.2 ± 0.5	2.5 ± 0.6	0.00

SBP= systolic blood pressure. DBP = diastolic blood pressure. BMI= body mass index.

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EFFECT OF RESPIRATORY PROTECTION ON FACIAL TEMPERATURE AND COMFORT AT REST AND DURING EXERCISE

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(No relevant relationships reported)

The role of personal protective equipment (PPE) worn by healthcare workers and first responders, including respiratory protective equipment, has received much attention over the past decade in response to outbreaks of prominent infectious pathogens (pandemic influenza, Ebola). **PURPOSE:** This study compared facial temperature, humidity, and comfort perception among different NIOSH approved respirators at standing rest and treadmill exercise. **METHODS:** Twelve participants (six men, six women) wore a one-piece work coverall and athletic shoes, walked on a treadmill at a speed of 5.6kmh (3.5 mph) and 0% grade for one hour in thermoneutral ambient conditions (20-22°C, 40-50% relative humidity). Participants were randomly assigned to four different types of respirators: filtering facepiece respirator (N95), half-facepiece elastomeric respirator (HFER), loose-fitting powered air-purifying respirator (LPAPR), and tight-fitting PAPR (TPAPR) with the same filter media. Facial temperature, respirator microclimate temperature, and humidity were continuously monitored. Subjective perceptions of facial heat and overall body comfort were recorded at 20-minute intervals. Measured results were compared using factorial repeated measures ANOVA. **RESULTS:** Compared to rest, respirator microclimate temperature and humidity increased over time in all respirators, but at a significantly larger degree in N95 (+7.33°C/52.74%) and HFER (+6.38°C/36.13%) compared to LPAPR(+1.91°C/23.43%) and TPAPR (+2.69°C/24.15%) ($p < .001$). As a result, facial temperature was also significantly higher in N95(+1.62°C) and HFER(+1.01°C) than LPAPR (-.54°C) and TPAPR (-.79°C) ($p < .001$). However, end point subjective perceptions of facial heat and overall body comfort (rated slightly warm - warm) were not different between respirators. In addition, no differences were found between genders in all measurements. **CONCLUSION:** Subjects who wore PAPRs in our study had lower microclimate temperature, humidity and thus facial temperature, compared to other models, possibly due to the effect of forced air flow. However, these differences in measured parameters were not subjectively perceived and may be further offset for workers in hot, humid conditions and may lead to escalating factors for heat stress.

B-78 Free Communication/Poster - Military Physiology

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

1152 Board #278 May 27 1:30 PM - 3:00 PM

Evaluation Of The New Army Combat Fitness Test In ROTC Cadets

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(No relevant relationships reported)

In 2020, the U.S. Army will replace the Army Physical Fitness Test (APFT) with the Army Combat Fitness Test (ACFT). Little is known on how this change may impact evaluating Army personnel, particularly Reserve Army Officer Training Corp (ROTC) cadets.

PURPOSE: To evaluate the ACFT in U.S. Army ROTC cadets.
METHODS: Eighteen ROTC cadets volunteered to participate in the study (mean ± SD; age = 21.9 ± 3.4 y, height = 172.4 ± 7.9 cm, mass = 75.1 ± 10.4 kg, % fat = 16.3 ± 7.4%). Participants performed the APFT & ACFT seven days apart. Physiological data were collected for the ACFT using a bioharness monitoring device which included: physiological load (PL), physiological intensity (PI), maximal heart rate (MHR), and average heart rate (AVGHR). Pearson moment correlation coefficients were calculated to determine relationships between selected variables.
RESULTS: Mean ACFT scores were 453.7 ± 88.1 with a 72% pass rate and APFT scores were 265.4 ± 26.9 with a 100% pass rate. Significant relationships were found between scores for the ACFT hand-release push-up and standard APFT push-ups ($r = 0.75, p < 0.01$) as well as the ACFT and APFT 2-mile runs ($r = 0.96, p < 0.01$). There was not a significant relationship between total scores of the ACFT and APFT ($r = 0.28, p > 0.05$). Body fat percentage and total ACFT score were significantly related ($r = -0.55, p < 0.05$). Physiological data for the ACFT were: MHR = 197 ± 18, AVGHR = 123 ± 29, PL = 454.5 ± 141.8, and PI = 6.1 ± 2.0.
CONCLUSIONS: The results demonstrate that high performance in the APFT may not translate to high performance in the ACFT. In addition, the ACFT requires moderate to vigorous effort throughout the duration of the test. The results of this study are useful as Army leaders prepare to train cadets and soldiers for successful completion of the new ACFT.

1153 Board #279 May 27 1:30 PM - 3:00 PM
Characterizing The Bioenergetic Profile Of White Blood Cells For Utility In Assessing Mitochondrial Dysfunction In Gulf War Illness

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 (No relevant relationships reported)

PURPOSE: Gulf War Illness (GWI) is a chronic multi-symptom illness that affects veterans who served during the 1990- 1991 Gulf War. Similar symptoms between GWI and known mitochondrial disorders have sparked investigations into the health of mitochondria in veterans with GWI. The objective of this study is to characterize the bioenergetic profile of peripheral blood mononuclear cells (PBMCs) in veterans with GWI (GWI+) and controls (GWI-) and assess the relationship with symptom severity and physical activity. **METHODS:** 55 Gulf War veterans (85.5% male; 55.0±6.7 years) volunteered for this study. GWI case status and symptom severity were determined via the Kansas-Steele Questionnaire (KQ). Self-reported fatigue (Fatigue Severity Questionnaire; FSS) and physical activity (International Physical Activity Questionnaire; IPAQ) were obtained via questionnaire. PBMCs were isolated from whole blood to determine bioenergetic profiles (Seahorse XFp), parameters of which are listed in the table. Between-group differences and associated effect sizes for each parameter and symptom/activity scales were assessed via Mann Whitney U and Hedges' *d*, respectively. Spearman's rank correlation was used to evaluate the relationship between reserve capacity and GWI symptom severity (KQ total score), physical activity (IPAQ kcal/week) and fatigue severity (FSS mean score). **RESULTS:** 38 of 55 veterans met case definition for GWI. Self-reported symptom severity, physical activity level, and the profile parameters are reported in the table (mean±SD). Reserve capacity was associated with FSS ($\rho = -0.29, p = 0.04$), but not for KQ ($\rho = -0.26, p = 0.05$) nor physical activity ($\rho = 0.18, p = 0.18$). **CONCLUSIONS:** We observed differences in bioenergetic profiles between veterans with and without GWI. GWI+ veterans demonstrated a profile consistent with mitochondrial dysfunction and one that can be potentially used as a diagnostic tool. Supported by CDMRP GWIRP W81XWH-16-1-0663

Variables and Symptom Severity	GWI- (n = 17)	GWI+ (n = 38)	p value	Effect size (d)
Basal	124.1 (37.6)	103.9 (35.2)	.04	-.57
ATP-linked	100.9 (30.8)	83.5 (28.5)	.04	-.59
Proton leak	23.1 (10.5)	19.6 (10.4)	.23	-.33
Maximal Capacity	326.7 (117.2)	240.9 (79.5)	.01	-.91
Reserve Capacity	202.6 (88.1)	137.7 (57.1)	.01	-.94
Non-Mitochondrial	47.3 (16.6)	41.6 (15.9)	.11	-.35
Kansas Score	4.7 (5.4)	34.47 (14.4)	.00	2.37
FSS Score	1.8 (1.2)	4.43 (2.0)	.00	1.44
IPAQ Score	4636.1 (7560.1)	2847.5 (2679.8)	.83	-.37

1154 Board #280 May 27 1:30 PM - 3:00 PM
Poor Soldier Medical Readiness In The Year Following Return To Unrestricted Duty After Musculoskeletal Injury

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 (No relevant relationships reported)

Not all Soldiers cleared for full unrestricted duty are without injury just because they do not seek medical attention. Using medical care-seeking as proxy for medical readiness & deployability has limitations. Efficient injury detection & long-term management can improve if surveillance begins before patients make decisions to seek care. **PURPOSE 1)** determine proportion of Soldiers reporting new or recurring injuries for which they did not seek medical care, & 2) report perceived ability to perform full military duty when injured & not seeking care. **METHODS** This was a secondary analysis of a cohort of Soldiers (n=469) recently cleared to return to full duty (RTFD) without limitations. Monthly adaptive text messages queried about any new or recurrent injuries for 1 yr after clearance to RTFD after spine or lower extremity injury. Presence of MSK pain, care-seeking behavior, & perceived ability to perform military duties were assessed. **RESULTS** 424 soldiers had at least 1 response over the 1-yr follow-up & a mean response rate of 45.5% (at least 5 months). 315 participants reported injury-related MSK pain at least once. Of those, 276 (87.6%) reported not seeking care during at least 1 pain episode. When care was not sought, 89 (32.2%) reported it affecting their ability to perform military duties. On at least one occasion, 127 individuals believed they would not pass an annual fitness test due to pain, deconditioning, or fear of injury. **CONCLUSIONS** Soldiers do not always seek care for MSK injuries, & thus, many are not confident in their ability to complete military duties. Early indicators & improved surveillance strategies could identify problematic injuries before they reach a threshold of needing to seek care. Equally important is the ability to predict which individuals can self-manage without adversely affecting ability to perform military duties. This research was supported by the Department of Defense Military Operational Medicine Research Program under program number (W81XWH-13-MOMJPC5-IPPEHA). The view(s) expressed herein are those of the author(s) and do not reflect the official policy or position of Brooke Army Medical Center, the U.S. Army Medical Department, the U.S. Army Office of the Surgeon General, the Department of the Army, the Department of the Air Force, the Department of Defense, or the U.S. Government.

1155 Board #281 May 27 1:30 PM - 3:00 PM
Participation In Sports During Adolescence Positively Impacts Bone Health In Recruits Entering Basic Combat Training

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 (No relevant relationships reported)

It is well documented that participation in sports during childhood is beneficial to skeletal health. Almost 40% of bone mineral content is attained during years of peak height velocity (females 10-14y; males 12-16y). Improving bone development during these years may be beneficial in mitigating musculoskeletal injuries (MSKIs) in Soldiers. **PURPOSE:** To evaluate the relationship between participation in sports during adolescence and baseline bone microarchitectural parameters in recruits entering Basic Combat Training (BCT). **METHODS:** Survey data on sport participation from 840 Army recruits entering BCT were analyzed (611M, 25.0±3.7 kg/m², 20.6±3.6y; 229F, 23.6±2.7 kg/m², 20.4±3.5y). Low impact (LI) and high impact (HI) sports were categorized according to effective load stimulus scores. Middle school (MS) was defined as grades 6-8 (11-14y) and high school (HS) as grades 9-12 (14-18y). Baseline bone characteristics were measured at the ultradistal tibia using a high resolution CT scanner. Linear models were used to evaluate the association between bone microarchitecture and timing and impact category of sport played. Models were adjusted for ethnicity, BMI, age, and parents' education. Effect estimates (EE) and p values for bone parameters compared to recruits who did not play sports (98M, 46F) are presented. **RESULTS:** Table 1 shows that participation in both low and high impact sports during adolescence had a significant effect on baseline bone measures in male and female recruits compared to those who did not participate in sports. While male sports participation in HS had a greater effect than MS sports participation, the opposite was observed in females. We found no significant effects in trabecular thickness, spacing or

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number. **CONCLUSION:** Promoting sports participation in children and adolescents, particularly during peak growth years, is important in providing long term skeletal health benefits and may help to reduce MSKIs in Soldiers.

Table 1: Baseline bone measures in recruits who played sports during peak growth years

Male	N	Total vBMD	Trabecular vBMD	Trabecular BV/TV	Cortical vBMD	Cortical Thickness	Cortical Area
LI MS	231	EE=-0.91; p=0.81	EE=-1.42; p=0.65	EE=0.00; p=0.49	EE=3.27; p=0.43	EE=0.00; p=0.84	EE=0.35; p=0.86
LI HS	374	EE=5.10; p=0.15	EE=5.86 [^] ; p=0.05	EE=0.01 [*] ; p=0.04	EE=-0.41; p=0.92	EE=0.00; p=0.99	EE=-0.34; p=0.86
HI MS	377	EE=6.53; p=0.11	EE=7.57 [*] ; p=0.03	EE=0.01 [*] ; p=0.02	EE=-3.73; p=0.42	EE=0.01; p=0.54	EE=2.91; p=0.19
HI HS	417	EE=7.67 [*] ; p=0.02	EE=6.60 [*] ; p=0.04	EE=0.01 [*] ; p=0.06	EE=3.61; p=0.39	EE=0.04 [*] ; p=0.03	EE=5.30 [*] ; p=0.01
Female	N	Total vBMD	Trabecular vBMD	Trabecular BV/TV	Cortical vBMD	Cortical Thickness	Cortical Area
LI MS	76	EE=13.19 [*] ; p=0.02	EE=9.30 [^] ; p=0.06	EE=0.01 [*] ; p=0.08	EE=7.85; p=0.27	EE=0.05 [*] ; p=0.07	EE=2.69; p=0.26
LI HS	110	EE=-0.43; p=0.93	EE=-2.54; p=0.57	EE=0.00; p=0.59	EE=1.04; p=0.87	EE=0.03; p=0.14	EE=4.83 [*] ; p=0.02
HI MS	128	EE=3.42; p=0.57	EE=10.74 [*] ; p=0.04	EE=0.02 [*] ; p=0.05	EE=-21.92 [*] ; p=0.00	EE=-0.03; p=0.22	EE=-1.05; p=0.67
HI HS	153	EE=5.10; p=0.38	EE=3.34; p=0.50	EE=0.01; p=0.50	EE=-2.93; p=0.68	EE=0.02; p=0.50	EE=0.86; p=0.71

*p<0.05; [^]p<0.10

1156 Board #282 May 27 1:30 PM - 3:00 PM

Army Combat Fitness Test & The APFT; The New Frontier

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(No relevant relationships reported)

The Army Combat Fitness Test (ACFT) will replace the ~40 year-old Army Physical Fitness Test (APFT) as the Army's record fitness test in 2020. **PURPOSE:** Investigate performance relationships of U.S. Service Academy Cadets (USSAC) on both the ACFT & APFT. **METHODS:** 551 fit subjects (433 men; 118 women) participated in two testing sessions during a 6-month period. The ACFT focuses on combat readiness components of Strength-Dead Lift (DL), Power-Power Throw (SPT), Muscular Endurance-Hand Release Push-ups (HRPU); Leg Tuck (LTK), Mobility/Speed-Sprint Drag & Carry (SDC), & Cardio-Respiratory Endurance-2-Mile Run (2MR). Specific data analysis & criterion determination (APFT > 285; ACFT %'s 60-90%) were utilized. **RESULTS:** Overall, top 10 ACFT performers, APFT > 285 & ACFT percentiles revealed a stable metric identifying higher end physical performance cadets respectively. Women can score ~72% of the men's ACFT ability versus 103% of the men's APFT ability. Descriptive data:

Group n ()	APFT Pts (±SD)	PU reps	SU reps	2MR secs	DL lbs	SPT meter	HRPU reps	SDC secs	LTK reps	2MR secs	ACFT Pts	Old ACFT Pts
Women (118)	285.1 (34.8)	44.1 (9.6)	74.4 (9.9)	947.5 (95.2)	169.4 (27.5)	5.8 (1.1)	15.7 (9.3)	127.3 (13.4)	3.7 (4.2)	994.9 (103)	367.8 (72.9)	367.7 (73.2)
Men (433)	275.6 (30.7)	67.8 (10.8)	75.5 (9.5)	823.9 (65.7)	272.7 (45.4)	9.8 (1.6)	35.9 (9.1)	96.6 (11.3)	5.1 (5.1)	899.4 (93.1)	510.4 (33.4)	509.5 (32.4)
Women Top 10	337.9 (13.5)	57.4 (8.1)	86.1 (4.7)	834.1 (58.9)	208 (37.7)	7.1 (1.6)	24.4 (7.4)	109.9 (6.7)	10.7 (5.9)	873.8 (64.4)	469.8 (19.6)	469.3 (19.8)
Men Top 10	310.8 (25.9)	76.8 (4.6)	81.6 (8.6)	758 (41.4)	345 (15.8)	12.0 (1.5)	50.4 (7.7)	86.7 (6.1)	19.7 (4.5)	822.8 (50.3)	577.5 (2.9)	571.6 (3.8)
Women (58) APFT >285	312.2 (22.0)	49.9 (8.3)	81.3 (6.5)	894.2 (56.9)	173.0 (31.2)	6.0 (1.3)	18.8 (8.2)	124.2 (11.5)	5.7 (4.6)	948.9 (83.2)	406.8 (54.2)	405.9 (54.2)
Men (143) APFT >285	308.1 (21.1)	76.4 (7.4)	83.6 (6.6)	766.9 (39.2)	285.6 (44.0)	9.8 (1.4)	42.0 (7.8)	93.1 (7.7)	14.5 (4.4)	843.8 (83.6)	532.6 (25.1)	530.9 (23.8)
% of Men Performance	103.4	65.0	98.5	85.0	62.1	59.2	43.7	68.2	32.7	89.4	72.1	72.2

DISCUSSION: The ACFT appears to accurately assess important combat readiness components. Further, the raw data performances and composite ACFT score appear sensitive in discriminating overall performance abilities as opposed to the previous composite APFT score. For soldier-athletes desiring success on the five combat readiness components; strength, endurance, mobility, power/speed, cardio-respiratory realm, the ACFT appears to be a comprehensive combat fitness assessment & soldier-athletes should train and increase their overall physical capabilities. **CONCLUSIONS:**

The ACFT appears to be a reliable field test which can classify, indicate one's physical strengths and weaknesses, and assist in selecting personnel for more arduous military applications. Given the demand & robust nature of military applications coupled with the multi-dimensional ACFT assessment, increased physical performance metrics & thus an overall enhanced physical profile should be the goal of any soldier-athlete.

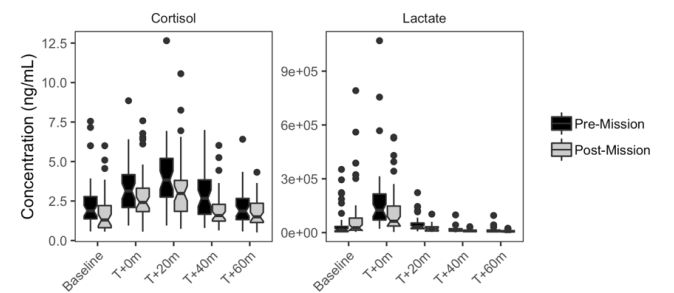
1157 Board #283 May 27 1:30 PM - 3:00 PM
Distinguishing Acute And Mounting Stress Responses Among Active Duty Military

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(No relevant relationships reported)

PURPOSE: To characterize acute vs. mounting cognitive and physical stress responses within a tactical timeline. Biomarkers of stress were extracted from saliva samples taken during a Live-Fire "Stress Shoot" (LFSS), eliciting acute stress. The LFSS was completed prior to (Pre) and following (Post) a 3-day intensive combat training exercise, eliciting mounting stress. **METHODS:** 46 active duty Soldiers (24.47 ± 4.13 years old, 4 women) completed the 3-day mission and 2 runs of the LFSS. The LFSS involved a marksmanship course with complex rules of engagement (high cognitive load) and physically taxing activities (shuttle run test, kettlebell presses). Salivary biomarkers were collected before (Baseline) and after the LFSS at 4-time points: at LFSS offset (T0) and in 20-minute intervals thereafter (T20, T40, T60). Biomarkers included cortisol to capture cognitive stress and lactate to capture physical stress. The main effects of Sample Time (T0 vs T20 vs. T40 vs T60) and of Mission Phase (Pre vs. Post) were analyzed with non-parametric repeated measures analyses (Friedman Test) with Bonferroni-corrected posthoc pairwise comparisons. **RESULTS:** Cortisol peaked at T20 (Pre DC=3.39, p<0.001; Post DC=4.47, p<0.001), while lactate peaked at T0 (Pre DC=7.54, p<0.001; Post DC=2.72, p=0.007). There was also a main effect of Mission Phase for cortisol at T20 (DC=2.12, p=0.36) and for lactate at T0 (DC=2.72, p=0.007). Both biomarkers showed decreased concentrations after the 3-day mission (Cortisol at T20: Pre = 4.30ng/mL, Post = 3.47ng/mL; Lactate at T0: Pre = 193745ng/mL, Post = 114346ng/mL). **CONCLUSION:** The present results reveal heightened acute stress responses through peaks in salivary cortisol and lactate following an acute tactical stressor (LFSS). Together, this suggests that the primary stress responses experienced by active-duty Soldiers are due to acute stress, rather than mounting stress. [1927 of 2000 characters]



1158 Board #284 May 27 1:30 PM - 3:00 PM
Comparison Of Body Composition Indices For Men And Women At Two Air Force Bases

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Assessment of body composition and its effect on the performance of military tasks is ongoing. Various branches of the military have relied on different techniques to assess

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body fat (%fat), fat mass (FM), and fat-free mass (FFM) in both men and women. A widely accepted technique is air displacement plethysmography (ADP), which using a mass-to-body volume ratio to determine %fat. Owing to the standard measurement procedures and accepted validity of this method, it would be beneficial to compare military personnel at different bases to evaluate continuity of FFM and %fat in Air Force personnel. **PURPOSE:** To compare body composition components among Air Force men and women at two different bases. **METHODS:** Men ($n = 604$) and women ($n = 343$) were evaluated using ADP to identify FM, FFM, and %fat. Participants were stratified into 4 age groups, determined by decade, with individuals <20 yrs ($n = 21$) combined with the 20-29 yr-old group. Self-appraised activity groups were denoted as sedentary, low active, active, and very active based on standard criteria. Height and weight were used to calculate BMI = kg/m². Fat-free mass index (FFMI) and fat mass index (FMI) were determined for each component relative to height (m²). **RESULTS:** A base x activity (2×4) MANOVA in men revealed weight, BMI, FFM, and %fat were not significantly different ($p > 0.21$) between bases, while active and very active groups were significantly better than sedentary and low activity groups. In women, BMI, FFM, and %fat were not significantly different ($p > 0.14$) between bases but active and very active groups were significantly better than sedentary and low activity groups. BMI had a significantly higher correlation ($p < 0.001$) with %fat in women ($r = 0.79$) than in men ($r = 0.68$). Discriminant analysis identified %fat as the best separator of activity groups, with a better success rate for discerning between sedentary (61%) and very active women (62%) than between low active and active groups (<40%). In men, %fat was better for identifying those in the very active group (72%) compared to those in the other 3 groups (<53%). **CONCLUSION:** Body composition indices do not appear to differ greatly among Air Force personnel at different bases.

1159 Board #285 May 27 1:30 PM - 3:00 PM
Characterization Of Energy Expenditure, Body Composition, And Androgen Status During Summer And Winter Marine Mountain Warfare Training

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BACKGROUND: Military operations occurring in austere environments result in declines of androgen status and physical performance, which has been associated with the severity of negative energy balance. However, whether negative consequences of military operations differ between environmental conditions has not been well described.

PURPOSE: To characterize energy expenditure, body composition, and androgen status during Marine mountain warfare summer and winter training.

METHODS: Sixty seven healthy US Marines taking part in summer ($18 \pm 3^\circ\text{C}$, $n = 46$) or winter ($2 \pm 4^\circ\text{C}$, $n = 21$) training at Marine Corps Mountain Warfare Training Center participated in this longitudinal observation study. Doubly labeled-water was used to determine energy expenditure throughout summer and winter training. Body composition (InBody 770) and blood draws were performed before and after 15 days of mountain warfare training. Data presented as mean \pm SD.

RESULTS: Energy expenditure was 3782 ± 688 kcal/d during summer and 4596 ± 688 kcal/d during winter Marine mountain warfare training. Summer training resulted in a decline ($P < 0.01$) in body mass (-2.7 ± 1.5 kg), fat mass (-1.1 ± 1.0 kg), lean mass (-1.6 ± 1.3 kg), total body water (-1.2 ± 1.0 kg), and dry lean mass (-0.5 ± 0.4 kg). Winter training resulted in a decline ($P < 0.01$) in body mass (-2.2 ± 1.1 kg), lean mass (-1.7 ± 1.1 kg), total body water (-1.3 ± 0.8 kg), and dry lean mass (-0.4 ± 0.3 kg). There was no difference in fat mass (-0.5 ± 1.2 kg) following winter training. Following summer training a decline ($P < 0.01$) in IGF-1 (-28 ± 27 ng/mL), but not testosterone (36 ± 124 ng/dL) was observed, while in both IGF-1 (-51 ± 38 ng/mL) and testosterone (-111 ± 135 ng/dL) declined ($P < 0.01$) following winter training.

CONCLUSION: Findings from this investigation indicate that both summer and winter mountain warfare training result in declines in body mass and dry lean mass, while only winter training results in a decline in both circulating IGF-1 and testosterone.

This material is based on the work supported by DHP JPC-5/MOMRP; authors' views not official U.S. Army or DoD policy.

1160 Board #286 May 27 1:30 PM - 3:00 PM
Effects Of Precooling On Recreationally Active Individuals During Loaded Carriage Foot Marches In Heated Conditions

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 (No relevant relationships reported)

Over the past 20 years, the literature has demonstrated that military members are prone to exertional heat illness due to a combination of heavy loads and physical exertion. Solutions such as Cold Water Immersion or Convective Cooling Vests help ease this physiological strain; however, these methods are not always practical for use. These methods require either time, space, equipment or are not cost efficient. A relatively new approach known as precooling, is when an individual either applies a cooling method or ingests a cold substance preemptively to lower core temperature before an activity.

PURPOSE: The aim of this study was to investigate the effects of a precooling protocol employing ice slurry ($0 \pm 1^\circ\text{C}$) vs. cold water (4°C) on core body temperature and time to exhaustion (minutes) during a simulated military full combat gear foot march in males aged 18 to 35 years. **METHODS:** This study consisted of 6 college aged males, (23.5 ± 1.0 y/o, 91.0 ± 9.3 kg, 183.3 ± 8.1 cm), who engaged in two separate simulated army ruck march trials in heated conditions ($33 \pm 2^\circ\text{C}$). The researchers used a precooling protocol of 7.5g/kg of bodyweight of both water (control) and ice-slurry (experimental) administered over a 30-minute period prior to activity. Following the precooling protocol, the participants self-selected a pace from 3.0-4.0 MPH and walked for up to 90 minutes or until volitional fatigue inside a heat tent while wearing full army combat gear. Core temperature, heart rate and RPE were collected every 5 minutes. Blood pressure was collected pre and post exercise. **RESULTS:** This is preliminary data of an on-going study. There was no significant difference in time to exhaustion ($p = 0.227$; $t = -1.37$), heart rate ($p = 0.763$; $f = 0.001$) or core temperature ($p = 0.876$; $f = 0.20$) between conditions. **CONCLUSION:** The precooling protocol was ineffective at lowering core temperature vs. control and thus did not increase time to exhaustion. Additional research on precooling with military equipment is needed to further elucidate the potential benefits of precooling on exercise performance and decreasing the risk of exertional heat illness.

1161 Board #287 May 27 1:30 PM - 3:00 PM
Simulated Military Operational Stress Negatively Impacts Psychomotor Vigilance And Neurocognitive Biomarkers In Men And Women

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Military operations often require sustained alertness in the presence of physical fatigue, caloric deprivation, and sleep restriction, stressors that may affect men and women differently. **PURPOSE:** To identify differences in psychomotor vigilance and neurocognitive biomarkers based on sex during simulated military operational stress (SMOS). **METHODS:** Forty-nine Soldiers (25.8 ± 5.2 years, 174.6 ± 9.5 cm, 80.0 ± 16.2 kg, 21.3 ± 7.0 BF%, 11 women) completed a 5-day/night SMOS protocol. Subjects completed physical and cognitive evaluations from 0900-2230. Nights 3 and 4 included restricted sleep from 0100-0300 and 0500-0700, with psychomotor evaluations between 0300-0500. Subjects were given 50% of caloric demands on Days 3-4. Fasted blood was drawn each morning at 0800, followed by psychomotor vigilance test (PVT). Concentrations of insulin-like growth factor I (IGF-1), α -Klotho, and brain-derived neurotrophic factor (BDNF) were analyzed using standard immunoassays. PVT performance was based on accuracy and response time correlated to a percentile position within a normative distribution. Two-way mixed ANOVA with Bonferroni correction for multiple comparisons were used appropriately ($p < 0.05$). Day 1 PVT was excluded from the analysis to account for learning effect. **RESULTS:** There were no sex*time interaction effects for PVT ($p = 0.950$), BDNF ($p = 0.285$), IGF-1 ($p = 0.103$), or α -Klotho ($p = 0.091$). Main effect of time was observed for PVT ($p < 0.001$), IGF-1 ($p < 0.001$), and α -Klotho ($p < 0.001$). PVT performance decreased from D2 to D3 ($D2 = 417.45 \pm 248.5$, $D3 = 302.0 \pm 252.5$; $p = 0.01$), and from D2 to D4 ($D4 = 261.6 \pm 256.2$; $p < 0.001$) and rebounded after one night of recovery sleep ($D5 = 482.0 \pm 257.3$). IGF-1 and α -Klotho decreased from D1 to D5 by 13.1% ($p < 0.001$) and 12.0% ($p < 0.001$), respectively. There was a main effect of sex for BDNF ($p = 0.020$). On average, BDNF concentrations were 4,368.5 pg/mL higher in women during SMOS. **CONCLUSION:** SMOS has a similar negative impact in men and

women on psychomotor vigilance and neurocognitive biomarkers IGF-I and α -Klotho. However, women demonstrate higher concentrations of BDNF in the presence of SMOS.

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1162 Board #288 May 27 1:30 PM - 3:00 PM
The Cardiopulmonary Effects Of Thoracic Load Carriage While Resting

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(No relevant relationships reported)

PURPOSE: To investigate the cardiopulmonary effects of thoracic load carriage (LC) while sitting and standing. **METHODS:** Eight males and one female (Age: 21.0 \pm 1.4 yr; Height: 178.9 \pm 5.8 cm; Mass: 86.1 \pm 13.2 kg; Body Fat: 20.2 \pm 7.2%) without LC experience participated in the study. On separate days, subjects completed four trials of sitting quietly for 5 minutes, and then standing quietly for 5 minutes without assistance. Testing sessions included an unloaded (UL) trial, which served as the control, and wearing a light load (LL; 24lb = 10.9kg), moderate load (ML; 48lb = 21.8kg) and heavy load (HL; 80lb = 36.4kg) weighted vest. The testing order of the weighted vest trials was determined by counterbalanced assignment. Vest weights were selected to approximate common gear of tactical populations: law enforcement (LL), firefighter (ML), and military personnel (HL). Minute ventilation (V_E), respiratory rate (RR), Tidal volume (T_V), oxygen consumption (VO_2), heart rate, and ratings of perceived exertion (RPE) were assessed during all trials. An average value from the last minute was calculated for V_E , RR, T_V , VO_2 , and heart rate and used in a repeated measures ANOVA for statistical comparison. **RESULTS:** While sitting, there were no differences observed across trials in any of the aforementioned variables. While standing, V_E was significantly higher during ML ($p = .013$) and HL ($p = .005$) compared to unloaded (UL = 12.6 \pm 3.2, LL = 12.2 \pm 1.9, ML = 14.8 \pm 3.7, HL = 14.9 \pm 4.1 l \cdot min⁻¹). RR, T_V and heart rate were not different during any of the standing trials. Relative VO_2 while standing was significantly higher for ML ($p = 0.038$) and HL ($p = 0.001$) compared to UL (UL = 4.3 \pm 0.6, LL = 4.6 \pm 0.6, ML = 5.0 \pm 0.7, HL = 5.3 \pm 0.8 ml \cdot kg⁻¹ \cdot min⁻¹). Standing RPE was significantly higher for ML ($p = 0.050$) and HL ($p = 0.014$), compared to UL (UL = 6.1 \pm 0.3, LL = 6.9 \pm 1.6, ML = 7.6 \pm 1.9, HL = 7.9 \pm 1.7). **CONCLUSION:** Sitting while under thoracic load carriage did not elicit any significant changes. While standing, ML and HL elicited an increase in V_E , although it is unclear if this response was due to RR, T_V , or a combination of both. ML and HL increased oxygen consumption by 16% and 23% respectively while standing, as well as increased the perceived effort.

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1163 Board #289 May 27 1:30 PM - 3:00 PM
Comparison Of United States Marine Corps Physical Fitness Test And Combat Fitness Test Results

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For active duty United States Marines physical and combat fitness is essential to be battle-ready and is necessary for day-to-day effectiveness. To help instill habits of self-discipline and maintain physical and combat fitness the United States Marines Corps (USMC) have installed a Physical Fitness Test (PFT) to measure physical fitness levels and a Combat Fitness Test (CFT) to assess a Marine's functional fitness as it relates to the demands and rigors of combat operations. The USMC PFT involves three events; pull-ups/push-ups (PU), two-minute timed abdominal crunches/sit-ups (AC), and a timed three-mile run (RUN). The USMC CFT also involves three events; Movement to Contact (MTC), two-minute timed Ammunition Lift (AL), and Maneuver-Under-Fire (MANUF). **PURPOSE:** The purpose of this study was to investigate relationships between PFT (PU, AC, and RUN) and CFT (MTC, AL, and MANUF) scores assessed by active duty Marines. **METHODS:** The PFT and CFT scores from 19,678 active duty enlisted USMC males (age 22.5 \pm 1.3 years, height 1.77 \pm 0.07 m, body mass 79.4 \pm 10.3 kg) were analyzed. Pearson correlation coefficients (r) were calculated between the PFT and CFT total scores as well as individual events. **RESULTS:** The PFT mean \pm sd scores were as follows: PU = 18.0 \pm 5.0 (pull-ups), AC = 111.2 \pm 9.0 (repetitions), RUN = 1377.0 \pm 131.4 sec, PFT total = 249.6 \pm 29.6. The CFT mean \pm sd scores were as follows: MTC = 172.5 \pm 16.3 sec, AL = 113.2 \pm 10.4 repetitions, MANUF = 138.3 \pm 17.2 sec, CFT total = 271.6 \pm 25.6. Moderate significant ($p < 0.01$) correlations were found between: the PFT total and MTC ($r = -0.47$), PFT total and MANUF ($r = -0.42$), PFT total and CFT total ($r = 0.50$), RUN and MTC ($r = 0.46$), RUN and CFT total ($r = 0.43$), & PU and CFT total ($r = 0.41$). All other correlations between variables yielded "no to low" association. **CONCLUSION:** Within the parameters

of this study, PFT and CFT event scores ranged from "no" to "moderate" correlations suggesting that different fitness aspects are being assessed and supports the need for both the PFT and CFT assessments.

1164 Board #290 May 27 1:30 PM - 3:00 PM
Abstract Withdrawn

1165 Board #291 May 27 1:30 PM - 3:00 PM
Performance Aspects Of Operational Preparedness Differ Between Marine Raider Operators And Support Personnel During Deployment Training

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The tactical demands of Marine Corps Forces Special Operations Command (MARSOC) personnel require high levels of physical performance. During combat deployments, Operators are supplemented with Combat Support personnel who specialize in mission specific tasks. Operators and Support personnel complete portions of tactical training and combat deployments together, often enduring similar training and tactical demands. Previous research comparing Operators and Support personnel has identified significant overall performance gaps, but research has yet to examine performance characteristics during a consistent training phase time point. **PURPOSE:** To examine performance characteristics of Marine Operators and Support personnel prior to completing unit deployment training together. **METHODS:** Operators (N: 39, Age: 28.8 \pm 3.11 years, Height: 1.78 \pm 0.08 m, Mass: 87.1 \pm 8.7 kg) and Support personnel (N: 16, Age: 27.9 \pm 4.6 years, Height: 1.77 \pm 0.07 m, Mass: 83.03 \pm 13.8 kg) completed agility, speed, lower/upper body power, anaerobic capacity, strength, aerobic power, and body composition assessments. Differences between groups were evaluated using independent samples t-tests, or Mann-Whitney U tests ($p \leq 0.05$). **RESULTS:** Operators demonstrated better performance in agility (4.85 \pm 0.21 s, 5.04 \pm 0.21 s; $p = 0.005$), anaerobic capacity (190.58 \pm 16.24 yd, 174.82 \pm 18.11 yd; $p = 0.006$), upper body power (185.03 \pm 23.52 cm, 172.26 \pm 27.39 cm; $p = 0.044$), strength (2,932.85 \pm 639.59 N, 2,443.75 \pm 706.99 N; $p = 0.019$), aerobic power (1,114.83 \pm 66.12 yd, 1,033.7 \pm 100.1 yd; $p = 0.001$) and significantly lower body fat (17.63 \pm 4.06 %BF, 21.01 \pm 7.09 %BF; $p = 0.035$). No significant differences were found in lower body power ($p = 0.069$) and speed ($p = 0.051$). **CONCLUSION:** Performance deficits in Support personnel during active deployment training could have deleterious effects on tactical training, leading to increased risk of injury and potentially affecting subsequent deployment status. The significant discrepancies in key performance outcomes suggest the need for Support personnel to incorporate additional performance training focused on improving overall strength, anaerobic and aerobic capacity, prior to unit training, in order to achieve adequate levels of operational preparedness, similar to their Operator counterparts.

1166 Board #292 May 27 1:30 PM - 3:00 PM
Pulmonary Capillary Blood Volume And Membrane Conductance In Iraq And Afghanistan Veterans With Deployment-related Exposures

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Purpose: We have previously observed an isolated reduction in diffusing capacity of the lung for carbon monoxide (DL_{CO}) to be a common pulmonary function pattern among symptomatic Iraq and Afghanistan Veterans. DL_{CO} measurement reflects both alveolar capillary membrane diffusion (DM_{CO}) and pulmonary capillary blood volume (V_C); therefore, additional techniques (i.e., simultaneous measurement of diffusion of nitric oxide [DL_{NO}]) are necessary to separately examine DM_{CO} and V_C components. The purpose of this preliminary study is to evaluate the utility of the double-gas diffusion technique in Iraq/Afghanistan veterans to better understand the physiological basis of reduced DL_{CO} . **Methods:** 20 Iraq/Afghanistan non-smoking veterans (90% male; Age: 36.65 \pm 7.3 years; BMI: 30.37 \pm 3.8 kg/m²) volunteered for this study. Complete pulmonary function testing was performed, including the double-gas diffusion technique (DL_{NO}/DL_{CO}) and forced oscillation technique (FOT). Combined reference equations for DL_{CO} , DL_{NO} , DM_{CO} , V_C from the ERS DL_{NO} Task Force were used to calculate predicted and lower 2.5th percentile (LLN). FOT-derived frequency dependence of resistance (R4-R20) and reactance area (AX) were calculated

to reflect distal airway function. Spearman's rank correlation was used to examine the relationship between DM and V_c with R4-R20 and AX. **Results:** Double-gas diffusion testing results are provided in the table. Reduced V_c (\leq LLN) was observed in 8 of 20 (40%) and DM_{CO} was reduced (\leq LLN) in 2 of 20 (10%) veterans. V_c (% predicted) was inversely associated with distal airway measures (R4-R20: $\rho = -0.72$, $p < 0.001$; AX: $\rho = -0.50$, $p = 0.03$), but DM_{CO} (% predicted) was not (R4-R20: $\rho = 0.45$, $p = 0.05$; AX: $\rho = 0.36$, $p = 0.13$). **Conclusion:** In our preliminary analysis, we observed that 40% of our sample demonstrated reduced V_c , which appears to be associated with distal airway dysfunction. Continued investigation in this population appears warranted. Funded by VA: I01CX001515-01.

	Observed Mean \pm SD [range]	Predicted (%) Mean \pm SD [range]
DL_{NO} (mL·min ⁻¹ ·mmHg ⁻¹)	148.5 \pm 24.5 [105.0 – 199.9]	88.9 \pm 12.6 [66.0 – 113.0]
DL_{CO} (mL·min ⁻¹ ·mmHg ⁻¹)	28.5 \pm 5.9 [16.3 – 39.0]	83.6 \pm 13.6 [58.0 – 108.0]
DL_{NO}/DL_{CO} ratio	5.3 \pm 0.6 [4.1 – 6.4]	-
DM_{CO} (mL·min ⁻¹ ·mmHg ⁻¹)	211.0 \pm 83.7 [103.4 – 478.6]	117.0 \pm 35.9 [59.0 – 222.0]
V_c (mL)	57.7 \pm 14.6 [30.0 – 85.0]	73.2 \pm 17.0 [47.0 – 110.0]

1167 Board #293 May 27 1:30 PM - 3:00 PM
Physiological Stress Response During Force-on-Force Training With Simunitions
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 (No relevant relationships reported)

PURPOSE: Close-quarters combat (CQC) engagements activate the “fight-or-flight” response; which activates the sympathetic-nervous system (SNS) and hypothalamic-pituitary-adrenal (HPA) axis to respond to the perceived threats. Currently, the objective assessment of a force-on-force CQC environment on the physiological response has not been quantified, nor has it been shown whether training will impact the physiological response.
METHODS: United States Marines and Army infantry personnel (n = 24; 26.3 \pm 0.3 yrs, 177.2 \pm 0.3 cm, 85.4 \pm 0.5 kg) participated in a 15-day CQC training program. The CQC program focused on increased lethality, including large amounts of force-on-force training with the use of simunitions. Data collections occurred on training Days 1 and 15, during a simulated force-on-force, hostage rescue scenario. Participants were instructed to clear the shoothouse, rescue the hostage, and only engage (shoot) hostile threat(s) with simunitions. Salivary alpha-amylase (sAA) and cortisol were obtained immediately prior to entering and exiting the shoothouse. A linear mixed effects model was used to determine the differences between time points and days. **RESULTS:** There was a main effect of day for cortisol indicating that cortisol was higher on Day 15 compared to Day 1 (0.121 \pm 0.075 vs 0.187 \pm 0.075 μ g/dL; $p < 0.0001$). However, there was no main effect of time points for cortisol ($p > 0.05$); nor were there any interaction effects of day and time point for cortisol ($p > 0.05$). There was no main effect of day for sAA ($p > 0.05$); nor was there an interaction between day and time point for sAA ($p > 0.05$). Nevertheless, there was a time point effect for sAA indicating that post-scenario sAA was higher than pre-scenario sAA (168.25 \pm 100.93 vs 118.95 \pm 90.25 U/mL; $p < 0.0007$). **CONCLUSIONS:** Cortisol increased stepwise across the pre- and post-scenario time points on Days 1 and 15; most likely indicative of the cumulative stress effects on the HPA axis. Conversely, sAA increased acutely in response to the stress of the hostage scenario, likely due to its association with norepinephrine and the acute SNS response. Despite training, there is still an increased SNS response during force-on-force drills; it remains to be seen if this response enhances or hinders performance in high-stress situations.

B-79 Free Communication/Poster - Concussion I

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

1168 Board #294 May 27 2:30 PM - 4:00 PM
Long Term Implications of Contact Football Head Trauma

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 (No relevant relationships reported)

Effects of head trauma experienced in contact football is a growing health concern. Limited research has been conducted to assess exposures to later concussion related symptoms among former college football players. **PURPOSE:** To quantify the amount of contact football participation, diagnosed concussions, non-diagnosed self-reported head trauma, and the frequency of symptoms associated with post-concussion syndrome among former college football players. **METHODS:** We surveyed 275 former college football players who were at least 10 years post competition. Respondents provided data on their youth, high school, and college playing experience, undiagnosed head injury, diagnosed concussions, and concussion related symptoms (CRSs). CRSs included cognitive impairment, impulsive behavior, depression, short term memory loss, difficulty planning, emotional instability, substance abuse, and suicidal thoughts, were combined into a frequency of symptoms score (range 0-8). A Poisson regression was conducted to examine the association between playing experience and reported head trauma with reported symptom count. **RESULTS:** The majority of participants reported no diagnosed concussions in college (80%), but a large number reported non-diagnosed football related head injuries (67%) that might have resulted in a concussion. A majority of participants (59%) reported no concussion related symptoms. After controlling for age, youth and high school football participation, playing time, non-football concussions, and participation in post-college football (pro, semi-pro), diagnosed concussions in high school or college did not significantly predict concussion symptoms later in life. However, non-diagnosed head injury significantly predicted concussion symptoms ($b = .47$, $p < .001$) as did post-college play ($b = .71$, $p < .001$). **CONCLUSIONS:** Diagnosed concussions were not associated with later self-reported concussion related symptoms. Non-diagnosed head injuries, which are less likely to be managed by a healthcare professional, were significantly associated with CRSs later in life. These findings suggest that proper identification and management of concussions may prevent later symptoms, but more data are needed to test this conclusion.

1169 Board #295 May 27 2:30 PM - 4:00 PM
Influence Of Demographic Factors On Concussion-related Decision-making By Certified Athletic Trainers

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PURPOSE: This study aimed to identify demographic variables relating to factors influencing concussion-related decision-making (CRDM) by certified athletic trainers (ATC). Understanding these factors will better inform interventions on improving the CRDM abilities of ATCs.
METHODS: A cross-sectional study of ATCs (n=1,029; age = 26.0 \pm 3.7) completed a validated questionnaire on demographic variables and theory-based (Integrated Behavior Model) factors about CRDM. Multivariable linear regression models (*a priori* alpha level = 0.05) estimated the effect of each independent variable (scales: knowledge – 25 to 100; attitudes – 14 to 98; perceived behavioral control – 3 to 21; self-efficacy – 2 to 14; intentions – -45 to 45). The predictive factors were: gender (male vs. female), race (non-Caucasian vs. Caucasian), years of experience as an ATC, employment setting (high school vs. college), and sport coverage responsibilities (non-collision vs. collision). Knowledge, attitudes, perceived behavioral control, and self-efficacy were also included as predictors in the model for intentions.
RESULTS: Most participants were female (n=724, 70.2%), Caucasian (n=874, 84.7%), and recent graduates (mean = 3.1 \pm 1.8 years of experience) and half were employed in high schools (n=519, 50.3%) and responsible for collision sport coverage (n=533, 51.6%). Demographic factors were not significantly related to factors associated with CRDM. However, safer attitudes were associated with better intentions to remove concussed individuals ($\beta = 0.17$; $p < 0.001$).
CONCLUSION: Intentions to make appropriate concussion-related decisions are a vital step in removing concussed individuals from play. ATCs may have diverse backgrounds and carry diverse professional responsibilities immersed in their own

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team cultures and experiences; however, these variables, as measured in this study, do not appear to impact their decision-making capabilities regardless of personal and professional background. There does not appear to be a need to develop specific initiatives for different types of ATCs. As such, it is important that educational initiatives focus on creating safer concussion-related attitudes and the need for appropriate decision-making of all ATCs.

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1170 Board #296 May 27 2:30 PM - 4:00 PM
Changes On ImPACT And ClearEdge In Women's Collegiate Soccer From Pre-season To Post-season

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Sports are the second most common cause of mild traumatic brain injury (mTBI) in young adults. Even when the athlete does not sustain mTBI, he/she may sustain subconcussive impacts, which are of unknown significance. Purdue University conducted a study in which half of the football players who did not display symptoms of mTBI showed changes in brain function on by the middle of the season impeding their ability to learn. None of these players had symptoms of mTBI. Therefore, subconcussive impacts may lead to neurocognitive decline and changes in balance.

PURPOSE

We hypothesized athletes who received a higher quantity and magnitude of impacts throughout the season would have increased symptoms, neurocognitive, and balance scores from pre- to post-season, as shown by ImPACT and ClearEdge testing.

METHODS

We examined 14 NCAA Division II Collegiate Women's soccer players at pre- and post-season using ImPACT and ClearEdge. Both tests assess neurocognitive function, and ClearEdge also examines balance. Subjects wore an accelerometer in their headband to record number and magnitude of impacts during all full contact practices and games throughout the season.

RESULTS

The data was analyzed by comparing the athletes' mean scores on ImPACT and ClearEdge testing and correlated with number of impacts, cumulative impact, and cumulative rotation. There were no significant correlations between the components of testing and the number or magnitude of impacts. From pre- to post-season, there was a statistically significant decrease in visual motor speed score, as measured by ImPACT from 42.5 to 39.5 (p value = 0.014). On ClearEdge testing, there was a statistically significant increase in multiple balance testing scores from pre- to post-season, including an increase in score on eyes closed standing side by side on foam 86.4 to 89.5 (0.013), eyes open tandem stance on foam from 87.6 to 89.4 (0.005), and aggregate stability measurement from 86.6 to 87.9 (0.009).

CONCLUSION

Neurocognitive and stability measures improved throughout the season on ImPACT and ClearEdge testing. These results do not support our hypothesis. The data could not be correlated accelerometer data, possibly due to an issue with compliance. The results of this study suggest further investigation in subsequent seasons is warranted.

1171 Board #297 May 27 2:30 PM - 4:00 PM
Rugby Union Concussions-recognize And Rugby Union Concussions-recognise Andremove:do We Over-call Suspected Concussions?

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PURPOSE: To determine if the World Rugby (WR) management guidelines of recognize and remove suspected concussions could lead to over-recognition of suspected concussion **METHODS:**

RESULTS: A retrospective analysis of head injuries in a cohort of Stellenbosch University collegiate rugby players ($n = 407$), age (mean \pm SD; 24.6 \pm 4.3), height (mean \pm SD; 1.83 \pm 0.07), weight (mean \pm SD; 90.7 \pm 14.4) and BMI (mean \pm SD; 26.5 \pm 5.7) for the period 2014-2018. All 407 players were removed from the field of play upon suspicion of a concussion according to World Rugby's "recognize and remove" guidelines. Indicators that a player might be concussed on the "recognize and remove" guidelines include seizure, loss of consciousness, confused, dazed, balance problems and behavioral changes. Each of the players with a suspected concussion returned for a clinical assessment performed using the Sports Concussion Assessment Tool (SCAT)-3 ($n = 362$) and/or SCAT-5 ($n = 45$) within 48 hours and was subsequently clinically diagnosed with or without a concussion by a qualified medical doctor. The SCAT questionnaire includes questions on red flags, mechanism of injury, symptom severity -, cognitive- and physical-evaluation, and neck examination,

balance, and standardized assessment of concussion (SAC) delayed recall and concussion injury advice. Out of the 407 suspected concussions, 90% were confirmed clinically within a 48 hours period, while 10% of suspected concussions were not clinically confirmed as a concussion. In addition, of the reported mechanism of injury ($n = 300$) the tackle was reported as the main mechanism of injury, accounting for over 70% of all concussion injuries.

CONCLUSIONS: It appears that World Rugby's "recognize and remove" guidelines is accurate in the eventual diagnosis of concussion. Therefore, we are not "over-calling" concussions in collegiate rugby in Stellenbosch. There is also a greater understanding by collegiate rugby medical staff as to how to diagnose and recognize concussion.

1172 Board #298 May 27 2:30 PM - 4:00 PM
Randomized Controlled Trial (RCT) Of A Precision Vestibular Treatment In Adolescent Athletes Following Sport-related Concussion

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Concussion care continues to evolve to incorporate more active treatments such as prescribed exercise (Leddy et al., 2019) and vestibular therapy (Broglio et al., 2015). Consensus statements advocate for randomized controlled trials (RCT) to determine the effectiveness of treatments. To date, there has not been an RCT of precision vestibular treatment in athletes following sport-related concussion (SRC) with vestibular symptoms/impairment. **PURPOSE:** To determine using an RCT the effectiveness of precision, vestibular treatment compared to standard of care for reducing recovery time, symptoms, and impairment in adolescent athletes with vestibular symptoms/impairment following SRC. **METHODS:** This study involved an RCT in 50 adolescent athletes with a diagnosed SRC with vestibular symptoms/impairment within 10 days of injury. Participants were randomized to vestibular treatment (i.e., gaze stability, visual motion habituation, dynamic balance, gait) (VEST) or control (i.e., behavioral management) (CTRL), and completed the Dizziness Handicap Inventory (DHI), Modified Balance Error Scoring System (mBESS), Vestibular/Ocular Motor Screening (VOMS), Post-concussion Symptom Scale (PCSS), Immediate Post-concussion Assessment and Cognitive Testing (ImPACT) at enrollment and 2- and 4-weeks post-enrollment. Recovery time was recorded using time of medical clearance for full return to activity. Compliance was monitored using daily text messaging. **RESULTS:** Groups were similar on demographics, initial injury characteristics/severity, and risk factors (all $p > .05$). mBESS total scores for VESTIB (-1.5) improved more from enrollment to 2-weeks than CONTROLS (-0.3) ($p = .04$). VESTIB was 8.6x (95% CI= 1.2 - 20.2) more likely to be recovered by 4-weeks than CONTROLS ($p = .01$). Survival analysis indicated that recovery for VESTIB (45 days) was significantly ($p = .04$) faster than CONTROLS (57 days). **CONCLUSION:** The current study provides the first RCT empirical evidence to support the effectiveness of a precision vestibular treatment in adolescent athletes following SRC. Future research should focus on determining the most effective frequency, intensity, and timing for vestibular precision treatments following SRC. Supported by a grant from the Chuck Noll Foundation.

1173 Board #299 May 27 2:30 PM - 4:00 PM
Oculomotor Fatigue Is Present In Some Adolescent Student-athletes Following Sport-related Concussion

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Upwards of 70% of adolescent concussion patients present with visual dysfunction. Total time on the King-Devick (K-D) Test or average distance on the near point of convergence (NPC) test contributes to clinical decision-making. However, performance deterioration across multiple trials or cards has not been previously reported and may require consideration for a targeted rehabilitation program.

PURPOSE: To determine if oculomotor fatigue (OMF) was present following a sport-related concussion (SRC) in adolescents. **METHODS:** 121 Student-athletes (15.3 \pm 1.4 years; 51 Female/70 Male) were administered Cards 1-3 of the K-D and then three trials of the NPC during their initial concussion evaluation (3.6 \pm 1.8 days post-injury). OMF was defined as exceeding the sample mean difference from Trial 1 to Trial 3

for the NPC and Card 1 to Card 3 for the K-D. Descriptive statistics, Mann-Whitney U tests, Independent-samples Median Tests, and Cronbach's α were performed using SPSS 25. **RESULTS:** 33% and 26% of the cohort presented with OMF on the NPC and K-D, respectively. The sample mean difference from Trial 1 to 3 for the NPC was 4.33cm and 4.72s for K-D Card 1 to 3. Using the cutoff of 4.33cm on the NPC, the OMF group exhibited worse median performance for all NPC trials ($p \leq 0.002$) and all K-D cards ($p \leq 0.029$), except Card 1 ($p = 0.52$). Internal consistency was high for the OMF group on the NPC (Cronbach's $\alpha = 0.967$) and K-D (Cronbach's $\alpha = 0.860$) and non-fatigue group for NPC (Cronbach's $\alpha = 0.987$) and K-D (Cronbach's $\alpha = 0.960$). **CONCLUSIONS:** It appears that there was a decline in performance on the NPC (33%) and K-D (26%) in a subset of our cohort. Interestingly, internal consistency remained high for the measures, even when OMF group performance was significantly worse. Future research is warranted to determine if OMF is a clinical biomarker for underlying attentional, cortical, cerebellar, or vestibular disorders. Our findings are specific to adolescent, sport-related concussion patients seen within a week of their injury using clinician-administered NPC and version 1 of the K-D plastic cards and should not be generalized.

1174 Board #300 May 27 2:30 PM - 4:00 PM
Dynamic Exertion Testing (EXIT): A New Approach To Inform Return To Play Following Sport-related Concussion

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A multifaceted assessment to inform clinicians of an athletes' readiness to return to play (RTP) following sport-related concussion (SRC) includes symptoms, and neurocognitive, vestibular, and ocular function. Athletes must also complete a progressive exertion protocol that systematically increases exercise intensity and sport-specificity. However, ambiguous exercise parameters and reliance on subjective symptom reports limit the current approach and there is a need for a brief, clinical assessment to better inform RTP decisions. A novel dynamic exertion test (EXiT) that incorporates ACSM exercise prescription recommendations to replicate physiological demands from a variety of sport types and provides objective criteria can address these limitations. A comparison of EXiT outcomes between athletes recently cleared to RTP (RTP-A) and matched healthy controls (CON) is warranted to determine the clinical feasibility and interpretation of EXiT. **PURPOSE:** Compare heart rate (HR), endorsed symptoms, rating of perceived exertion (RPE), and performance outcomes during the completion of a 1) aerobic treadmill protocol, and 2) 5 hand-timed agility tasks between RTP-A and CON groups completing EXiT. **METHODS:** Twenty-eight ($F=9$, 32.1%) athletes (ht.: 172.3 \pm 10.5 cm; wt.: 68.7 \pm 14.5 kg) completed the EXiT test at RTP evaluation and were age-, gender-, and sport-matched to healthy controls (ht.: 171.1 \pm 9.0 cm, wt.: 64.1 \pm 17.5 kg). Participants wore an Equivital Lifemonitor physiological monitoring system, reported symptoms and RPE, and were timed by independent raters during completion of Box drills, Zigzag, Pro-agility, and Arrow agility EXIT tasks. Independent samples t-tests were conducted to compare HR, symptoms, RPE, and EXIT agility task completion time between RTP-A and CON groups. **RESULTS:** RTP-A and CON groups had similar post-EXIT HR (176.7 \pm 22.5 vs. 184.7 \pm 12.4), symptoms (0.93 \pm 3.56 vs. 2.00 \pm 5.92), RPE (15.7 \pm 2.8 vs. 15.0 \pm 2.9), and agility task completion time across EXIT outcomes. ($p>.05$). **CONCLUSIONS:** EXiT clinical outcomes were similar to athletes recently cleared to RTP following SRC and matched healthy controls. The new EXiT provides a multidomain, ACSM exercise criteria-based evaluation to inform RTP clinical decision making.

1175 Board #301 May 27 2:30 PM - 4:00 PM
Concussion History And Contact Sport Participation Influence Post-concussion Psychological Distress: Active Rehab Study Findings

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Understanding how concussion history and contact sport participation influence perceived psychological distress may improve management and provide opportunities for early intervention.

PURPOSE: To examine how prior concussion history and contact sport participation influence college and high school athletes' change in perceived psychological distress following concussion compared to preseason baseline.

METHODS: Student-athletes ($n = 2629$) from 6 Canadian and US colleges and 8 US high schools completed a concussion baseline assessment including the Brief Symptom Inventory-18 item scale (BSI-18). The same battery was completed by 165 participants that suffered a concussion. The BSI-18 items were summed to create a total score (higher=greater psychological distress). BSI-18 change score (post-injury minus pre-injury) was the primary outcome. Primary predictors were concussion history and contact sport participation. Covariates included age, sex, and participation level (college vs. high school). The association between concussion history, contact sport participation, and BSI-18 change score was examined using linear regression models clustered on study site using generalized estimating equations (a priori $\alpha \leq 0.05$). **RESULTS:** Analysis included 145 participants with complete predictor, outcome, and covariate data [45 females (30.8%); median age = 18 years (IQR: 18-20); 66 (45.5%) with 1+ prior concussions; 121 (83.4%) played a contact sport]. Concussion history, when adjusting for all covariates was not statistically associated with BSI-18 change score ($p>0.05$). Participants in non-contact sports (6.0 \pm 8.0) compared to contact sport participants (2.1 \pm 7.4) reported a greater BSI-18 change score (Adjusted Mean Difference=3.1, 95%CI: 0.9, 5.4; $p=0.06$).

CONCLUSIONS: These data suggest individual participants in non-contact sports may have greater increases in reported post-concussion psychological distress. These findings highlight psychological distress measures as an important consideration in concussion management. Participants in contact sports may respond to concussion differently than those in non-contact sports. Future research should investigate how this relates to overall quality of life post-concussion.

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1176 Board #302 May 27 2:30 PM - 4:00 PM
How Do Concussions Affect National Basketball Association Player Performance Measurements?

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Following a concussion, athletes typically display increased reaction time, compensatory gait mechanics, and altered postural control. Although commonly studied in collegiate athletics, there is a lack in the literature regarding post-concussive effects in the National Basketball Association (NBA), and how they affect player performance outcomes. **PURPOSE:** The purpose of this study was to determine if NBA player performance statistics were different 28 days post-concussion compared to their pre-concussion metrics. **METHODS:**

NBA player performance statistics were obtained from a public website for thirty-six NBA players (age = 24.22 \pm 5.44 years, years in league = 4.08 \pm 3.38 years) who sustained a concussion between 2014 and 2018. Players were excluded if they played less than five games pre-injury, or if they did not return to play within four weeks post-concussion. Performance statistics included both attempted and made field goals, three-pointers, and free throws. Additional performance metrics included total points scored, turnovers, rebounds, gamescore and plus/minus scores. Within-subjects performance metrics were compared from 28-days prior to concussion to 28-days after the date of injury. All variables were normalized by seconds played per game to reduce variability between bench, rotational, and starting players. To compare differences in player performance measures before and after concussion, we utilized paired t-tests with alpha levels set to 0.05.

RESULTS: Our analyses produced mostly nonsignificant mean differences between groups ($p's > 0.05$), however, we found a decrease in mean attempted free throws post-concussion (mean difference: -0.37 \pm 0.36 free throws, $p=0.042$). Although the remainder of the performance metrics did not yield significance, a majority of the variables indicated a negative trend post-concussion. **CONCLUSIONS:** Our

results suggest player performance is not significantly affected up to 28-days post-concussion as compared to their pre-injury measures. Because we chose to compare 28-days before and after concussion, we potentially missed greater changes in player performance during the acute phase of recovery. Future analyses will stratify these findings by blocking time into seven day series to determine differences throughout typical recovery timelines.

1177 Board #303 May 27 2:30 PM - 4:00 PM
Concussion Management Among Speech-Language Pathologists: A Comparative Survey Of Placement And Practices

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 (No relevant relationships reported)

PURPOSE: The goal of this study was to examine the differences between medical and school-based Speech-Language Pathologists (SLP) knowledge, experience, and competence in pediatric concussion.

METHODS: A 34-question, anonymous web-based survey was sent to school and medically-based, practicing SLPs in the United States. Portions of the survey were adapted with permission from a preliminary study by Duff and Stuck (2015) which focused on pediatric concussion knowledge of school-based SLPs. The instrument consisted of six broad topics: demographics, concussion knowledge, referral, assessment, treatment, and clinical experience. Participants were recruited in three ways: (1) via posting the on-line message board for the American Speech-Language-Hearing Association; (2) sent to regional SLP associations or (3) via the "snowball" recruitment method. Descriptive statistics were used to analyze the data in SPSS.

RESULTS: The survey had 48 responses (46 females and 2 males). Out of the responders, 85% possessed a master's degree and 15% hold a doctoral degree (PhD or SLPD). Out of the 12 questions regarding concussion knowledge, SLPs had about an 85% correct response rate. Exceptions to this high accuracy were found regarding knowledge of minor concussion symptoms resolving in 14 days and injury to the brain occurring at the instant of contact. SLPs were noted to receive most of their concussion referrals from physicians (25%). 96% of SLPs agreed it was within their scope of practice to provide therapy to a concussed individual. However, 73% of these clinicians have never been involved in the assessment of pediatric concussion cases. In addition, only 50% received TBI education in school.

CONCLUSIONS: Concussion is an international public health concern that continues to receive increasing attention. A common theme of the results we reviewed suggests a recent interest in highlighting the value of SLPs in concussion care, although their role is not yet well understood. Results showed that both medical and school-based SLPs who work in concussion care are generally knowledgeable despite the vague guidelines for SLPs in concussion management. In order to further prepare SLPs for their role in concussion care, guidelines need to be developed to consistently incorporate concussion education in SLP graduate programs.

1178 Board #304 May 27 2:30 PM - 4:00 PM
Reliability Of The King-devick Test In Baseline Concussion Evaluations In A Mexican Professional Soccer Team

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There is a need for a reliable and quick method to help screen for concussions in professional soccer. The last 2014 and 2018 FIFA World Cups have demonstrated that concussions during soccer matches pose a challenge for team physicians to diagnose and treat in a timely manner. King Devick (KD) is a rapid sideline screening test used for concussion diagnosis that relies on individual's baseline measurement.

Purpose: To assess the test re-test reliability of the KD test in a cohort of professional soccer athletes. **Methods:** 24 professional soccer players from a Mexican First Division Professional Soccer League (Liga MX) team were evaluated. A baseline KD test as well as a SCAT3 Test was conducted before the 2017 season. The tests were repeated 1 year later as a baseline for 2018 season. 10 players transferred to other clubs after the first year were excluded from data analysis, 14 remaining athletes were included in the study. Correlations of year on year KD and SCAT3 measures of individuals were assessed. Statistical analyses were performed with IBM SPSS.

Results: Mean KD baseline test time for 2017 (KD1) = 41.71 seconds and for 2018 (KD2) = 41.66 seconds. KD1 and KD2 were strongly and positively correlated (0.93, p value <0.001). 1 player was evaluated for concussion during the season (KD1 = 41.7s, KD after trauma = 44.2s, KD2 = 41.4s). 5 players had slowing of KD2 without having history of concussion during the previous year. 1 player with a self-declared learning disability had significantly slower KD time in follow up test (KD1 = 69.4s, KD2 = 77s). 2017 and 2018 SCAT3 demonstrated positive and significant correlation

for balance scores (0.601, p = 0.023), and delayed recall scores (0.596, p = 0.024).

Conclusion: Mean KD baseline test results showed a significant correlation between first and second year evaluations. The high correlation suggests that KD testing has adequate reliability for use as a diagnostic test. Of note, 5 players had slower times despite not having a history of concussion during the previous year. It may not be useful when establishing baseline test results in players with learning disabilities due to the considerable variation from KD1 to KD2 in player we evaluated. Further studies need to be done with professional soccer athletes in order to establish quick and efficient methods of diagnosis and management of concussion.

1179 Board #305 May 27 2:30 PM - 4:00 PM
Documenting The Prevalence Of Symptom Exacerbation Following The Completion Of A Computerized Neurocognitive Testing Battery In Athletes With Concussion

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Symptom exacerbation following computerized neurocognitive testing (CNT) has been documented at the acute and subacute time points after concussion; however, the prevalence and indications of clinically significant symptom exacerbation following CNT is currently unknown.

PURPOSE: 1) To document the prevalence of symptom exacerbation following CNT in concussed athletes and 2) explore factors that may predict symptom increases associated with the completion of CNT.

METHODS: Two hundred and five concussed athletes ($M = 16.48 \pm 1.97$ yrs; 47% female) completed a standard clinical visit that included a health and injury history, CNT (The Immediate Post-concussion Assessment and Cognitive Testing: ImPACT), Post-Concussion Symptom Scale (PCSS), and the Vestibular and Ocular-motor Screen (VOMS) within 30 days of injury ($M = 7.73 \pm 5.54$ days). The PCSS was administered immediately before and after CNT, and changes on symptom total were used as outcome scores. To account for normal variation in symptom reporting, minimal clinically important differences (MCID) were calculated from the current sample. Two logistic regressions (LR) were used to explore the association between demographic (age, sex, history of SRC, migraine, anxiety, LD, ADHD) and injury-related factors that included vestibular/ocular motor impairment, symptom burden, time until first clinical visit, and removal from play status on post-CNT symptom exacerbation. Statistical significance was set at $p < .05$.

RESULTS: Approximately 33% (68/205) of concussed athletes exhibited clinically significant increases in total PCSS symptoms after CNT. The LR examining demographic variables and post-CNT symptom exacerbation was not significant ($\chi^2(7, 203) = 2.62, p = .92$), however the LR using injury-related predictors was significant ($\chi^2(7, 195) = 17.29, p = .02$). More specifically, a significant relationship between the ocular component of the VOMS and symptom exacerbation was revealed (adjusted OR= 0.43, $p = .04$).

CONCLUSIONS: The majority of the sample did not exhibit increased symptoms following CNT; however, the participants that do experience increases in post-concussion symptoms after completing CNT are more likely to have a co-morbid ocular impairment associated with their concussion. Clinicians should examine pre and post CNT symptom scores.

1180 Board #306 May 27 2:30 PM - 4:00 PM
Measuring Changes In Attention Task And Hemodynamic Oxygenation In Post-Concussion Patients Using Functional Near-infrared Spectroscopy

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(No relevant relationships reported)

Current concussion assessment protocols rely on clinical functioning and thus may not be sensitive to underlying neural deficits. **PURPOSE:** The purpose of this study was to measure hemodynamic response changes using functional near-infrared spectroscopy (fNIRS) in asymptomatic, post-concussion participants (CON) compared to healthy controls (CTL). **METHODS:** CON participants ($n=9$, age=18.44±1.51 years, sex=66% female) diagnosed with a concussion at a Midwestern emergency department were recruited from 2018-2019. CTL participants ($n=22$, age=23.63±4.55 years, sex=54% female) were recruited through electronic postings and classroom announcements. During the first study visit, participants completed a demographics questionnaire, pain

and symptom severity scores, and an attention task. Participants were then fitted for a silicon headband with two fNIRS diode arrays consisting of eight emitters and ten detectors over each hemisphere's temporal and frontal cortices, superior and middle temporal regions and the parietal cortex. The computerized behavioral attention task consisted of 144 trials spread over six 24-trial task blocks. Mean accuracy (%) and reaction times (s) were recorded, while the fNIRS device measured hemoglobin response. After the first visit, participants were monitored daily for symptom resolution, and completed a second lab visit once symptom count and severity scores reached normative baseline values. Behavioral and neuroimaging fNIRS data from the attention task were analyzed using independent t-tests, with alpha levels set to $p < 0.05$. **RESULTS:** Once asymptomatic, attention task analyses yielded no significant differences between CON and CTL groups for both mean reaction time (0.003 ± 0.040 s, $p = 0.953$) and accuracy ($-0.50 \pm 0.40\%$, $p = 0.47$). Analysis of fNIRS data indicated hyperactivity in the pre-frontal cortex, temporal lobe and frontotemporal region of the CON group's left hemisphere compared to the CTL group ($q < 0.05$, false discovery rate corrected). **CONCLUSIONS:** Our results suggest post-concussion participants may require additional cognitive resources during attentional tasks in order to maintain normative vigilance. Researchers should continue to evaluate hemodynamic changes, and how these effects may influence making a safe return to activity decision.

1181 Board #307 May 27 2:30 PM - 4:00 PM

Whole-body Reactive Agility Testing Reveals Modifiable Impairments Among Elite Athletes With Sport-related Concussion History

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(No relevant relationships reported)

PURPOSE: Assess the potential for training-induced improvement of whole-body reactive agility (WBRA) performance among elite athletes with a history of sport-related concussion (HxSRC).

METHODS: A cohort of 16 elite athletes (25.3 \pm 5.8 years; 10 males: 69.0 \pm 3.8 cm, 160.7 \pm 27.4 kg; 6 females: 63.8 \pm 2.0 cm, 144.47 \pm 28.7 kg) representing 5 Olympic sports participated in 12 training sessions over 26 \pm 9 days. A virtual reality motion analysis system measured whole-body responses to targets presented on the right and left sides of a monitor. A second dual-task (DT) trial simultaneously presented targets on both sides of the monitor, with correct response direction indicated by the center arrow of flanker test displays (<<<<<, >>>>>, <<<<, >>>>). Measures of WBRA included total distance of excursion, reaction time, speed, acceleration, and deceleration. Performance in right versus left directions was calculated for the latter 4 measures, as well as an average of asymmetries (Asym). Performance values were combined to create 3 training phases of 4 sessions each. The association of phase 1 measures with HxSRC status was assessed through ROC analysis. Repeated measures ANOVA was used to assess improvement from phase 1 to phase 3.

RESULTS: Self-reported HxSRC at 3.0 \pm 2.2 years prior to testing (range: 0.3 - 8.0 years) represented 56% of the cohort (9/16; 5 males, 4 females). Total distance \geq 27.3 m for DT demonstrated good discrimination between no SRC (NoSRC) and HxSRC cases (AUC = .714; OR = 7.5). A significant DT group X phase interaction effect was evident ($P = .038$) for total distance, with greater improvement for HxSRC (28.6 \pm 4.0 to 24.4 \pm 2.5; SRM = 2.06) than NoSRC (25.9 \pm 1.5 to 24.2 \pm 1.1; SRM = 0.93). Single-task (ST) WBRA Asym \geq 13.4% demonstrated good discrimination (AUC = 0.698; OR = 5.0), and thresholds of \geq 10% and \geq 15% demonstrated remarkable similarity to the results of our previous studies. Significant ST-WBRA Asym reduction was observed ($P = .049$; SRM = 0.57), but the magnitude was similar for HxSRC (15.7 \pm 4.7% to 12.6 \pm 2.4%) and NoSRC (12.9 \pm 3.7% to 10.2 \pm 2.5%).

CONCLUSIONS: Measures of WBRA may identify subtle impairments in brain network connectivity. The WBRA training appeared to induce a visual-spatial calibration improvement that was greater among HxSRC athletes, which may reduce injury risk.

1182 Board #308 May 27 2:30 PM - 4:00 PM

Between Trial Reliability Of The King Devick Test In Male High School Athletes

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(No relevant relationships reported)

The need for concussion-related safety programs in high-school athletics is well recognized. To that end, valid-baseline assessments are compulsory in order for medical staff to identify athletes suspected of having a concussion and best inform

appropriate medical-treatment protocols. **PURPOSE:** To determine the between-trial reliability of the King-Devick Test (KD) as part of a pre-season concussion-safety program in young-male high-school athletes. **METHODS:** KD baseline score data from high-school, male athletes ($n = 377$, aged 16 ± 1 years) were recorded on electronic tablets and later analyzed. The testing required participants to complete two, error-free trials, which were reported to the nearest 0.0 s. For both trials, descriptive data were reported, mean differences were examined via paired-samples t-tests, Cohn's d effect sizes were considered, and two-way mixed-effects intraclass correlations (ICC) were implemented. **RESULTS:** The KD test showed strong reliability between trials (Trial 1 = 56.0 \pm 15.2 s; Trial 2 = 53.3 \pm 13.8 s; single-measure ICC = 0.93; 95% CI 0.91 - 0.94). Furthermore, similar reliability was observed when KD scores were grouped by Best score and Worst score (Best = 52.8 \pm 13.6 s; Worst = 57.6 \pm 15.3 s; single-measure ICC = 0.95; 95% CI 0.94 - 0.96). Paired-samples t-test identified small-differences between both pairings (Trail 1 vs. Trial 2, $p < 0.001$, $d = 0.25$; Best vs. Worst, $p < 0.001$, $d = 0.33$). Most participants (78.5%) recorded their Best score on Trial 2. **CONCLUSIONS:** The KD test showed excellent reliability between trials in this population of young-male athletes. However, additional research is warranted with respect to how many valid baseline attempts are needed to acquire a stable KD score to best support safe-monitoring practices.

1183 Board #309 May 27 2:30 PM - 4:00 PM

Changes In Trait Anxiety Throughout Concussion Recovery

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Trait anxiety is the predisposition to perceive situations as threatening and higher levels lead individuals to frequently experience anxiety. Although concussion recovery is individualized, post-injury anxiety is an indicator of prolonged recovery. Therefore, high levels of trait anxiety following concussion may alter recovery trajectories by increasing the likelihood of developing post-injury anxiety.

PURPOSE: To examine the level of trait anxiety in concussed athletes throughout recovery compared to healthy controls.

METHODS: Eighty-five high school and college-aged individuals (concussed [Cx]: age = 18.56 \pm 2.55 years; healthy controls [HC]: age = 18.10 \pm 2.56 years) were enrolled. The State Trait Anxiety Inventory (STAI) measures trait anxiety using a 20-item inventory scored on a 4-point Likert scale (score range: 20-80), where higher scores indicate a greater level of trait anxiety. All concussed participants were administered the STAI within 72 hours of injury (day 0), 5 days post-injury (day 5), and at the time they received full medical clearance (FMC). Healthy controls were tested at similar time points. A 2 x 3 repeated measures analysis of variance was used to compare the level of trait anxiety between each group across recovery. A prior p value was set at 0.05.

RESULTS: There was no significant group x time interaction ($F_{(1,79,82)} = 1.20$, $p = 0.31$). Although, significant main effects for time ($F_{(1,79,82)} = 29.10$, $p < 0.001$, $\eta^2 = 0.26$) and group ($F_{(1,82)} = 29.10$, $p = 0.02$, $\eta^2 = 0.07$) were observed. Specifically, scores decreased across time (day 0: Cx = 38.81 \pm 11.17, HC = 32.74 \pm 10.00; day 5: Cx = 36.95 \pm 11.83, HC = 31.24 \pm 10.23; FMC: Cx = 34.65 \pm 11.37, HC = 29.98 \pm 9.05), and concussed athletes had higher trait anxiety (Cx = 36.81, SE = 1.61; HC = 31.32, SE = 1.63).

CONCLUSIONS: Concussed participants experienced the highest levels of trait anxiety at day 0 and declined as recovery progressed. This indicates that initial post-injury anxiety may be a result of increased trait anxiety. Healthcare professionals should be aware that concussed individuals may be more susceptible to anxiety immediately following injury which could negatively influence recovery outcomes.

1184 Board #310 May 27 2:30 PM - 4:00 PM

Concussion History's Impact On Instrumented Bess Scores In Division I Contact-Sport Athletes

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Purpose: The purpose of this study was to determine if concussion history has an impact on sway velocity. A concussion injury can disrupt proper functioning of the vestibular system, and chronic disruption of this system can increase the chances of subsequent musculoskeletal or concussive injury. Athletes with a history of concussion injury who present with balance deficits, should be targeted for interventions to decrease the risk of sustaining a musculoskeletal or concussive injury.

Methods: 175 healthy Division I football & men's lacrosse players (age = 19.8 \pm 1.2; ht = 71.9 \pm 2.2"; wt = 202.1 \pm 33.9 lbs) participated in this study. Players were provided with a brief, 1-on-1, concussion discussion and then answered the questions "have you ever sustained a concussion? If yes, how many?". All players underwent a

balance assessment as part of their preseason screening and were medically cleared to participate in sports. Players performed the BESS test (double leg, single leg, & tandem) on firm & foam surfaces while standing on the VSR Sport™ force plate by NeuroCom®. **Results:** No difference was found between those with and without a previous concussion injury on any of the instrumented BESS stances (Table 1). To further analyze the data, a Spearman Rho correlation determined there was a smaller than typical correlation between number of concussions sustained and sway velocity measurements; double leg firm ($r_s = 0.02$), single leg firm ($r_s = 0.09$), tandem firm ($r_s = 0.08$), double leg foam ($r_s = 0.01$), single leg foam ($r_s = 0.01$), tandem foam ($r_s = 0.02$), & composite ($r_s = 0.06$).

Conclusion: Concussion history does not appear to have an impact on sway velocity measurements in contact sport athletes. The vestibulospinal system may be resilient to long-term deficits associated with concussion injury. In the absence of individualized baseline data, normative data may be used to determine balance deficits in those with a suspected concussion, regardless of previous concussion history.

Stance	Mean ± SD		p Value	Effect Size
	(+) Concussion Hx	(-) Concussion Hx		
Double Leg, Firm	0.69 ± 0.20	0.69 ± 0.18	0.924	0.01
Single Leg, Firm	2.31 ± 1.28	2.55 ± 1.45	0.243	0.18
Tandem, Firm	1.67 ± 1.19	1.81 ± 1.35	0.444	0.12
Double Leg, Foam	1.85 ± 0.46	1.86 ± 0.53	0.878	0.02
Single Leg, Foam	5.25 ± 2.02	5.45 ± 1.9	0.495	0.10
Tandem, Foam	5.02 ± 3.42	4.93 ± 3.14	0.863	0.03
Composite Score	2.80 ± 0.97	2.86 ± 0.94	0.710	0.05

B-80 Free Communication/Poster - Medical Management of the Athlete

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

1185 Board #311 May 27 2:30 PM - 4:00 PM Injuries And Injury-related Pain Relationships To NSAID Use And Abuse In Collegiate Athletes

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Non-steroidal anti-inflammatory drugs (NSAIDs) are commonly used by athletes to treat musculoskeletal pain and injuries. The relationship between NSAID use and current pain and injuries in collegiate athletes is unknown. Understanding this relationship is important due to the potential for athletes to improperly obtain and abuse NSAIDs.

PURPOSE: To investigate how pain and injury effects current collegiate athlete NSAID use during both in and out of season.

METHODS: Athletes from all 3 NCAA Divisions self-reported data on in and out of season NSAID use, purchase, and dosage. The Oslo Sports Trauma Research Center Overuse Injury Questionnaire (OSTRC) was used to evaluate current level of participation and pain. Logistic regressions were used to assess the relationship between current NSAID use and OSTRC total score. Models were adjusted for age, gender, NCAA division, history of orthopaedic surgery, and history of major injury, with unadjusted and adjusted Odds Ratios (OR) with 95% confidence intervals (95% CI). χ^2 and Kruskal Wallis tests assessed the relationship between NSAID use and OSTRC overuse and substantial overuse injuries in and out of season.

RESULTS: 252 athletes (age of 19.43 ± 1.2 years; Male: 28%; D1: 101, D2: 74, D3: 77) completed the survey. 33% currently used NSAIDs, 48% self-purchased, and 53% took two pills per dose. 36% did not answer where NSAIDs were obtained and 34% did not answer what dosage was taken. The OSTRC median score was 0 (IQR: 0-22). 53% had overuse injuries, while 20% had substantial overuse injuries. Current NSAID users had greater odds of having increased OSTRC scores (1.03 (95% CI: 1.02, 1.04), $p < 0.001$). OSTRC overuse and substantial overuse injured athletes were more likely

to use NSAIDs (over use: $\chi^2 = 34.0$, $p < 0.001$; substantial overuse: $\chi^2 = 28.2$, $p < 0.001$) and use them out of season (over use: $\chi^2 = 24.4$, $p < 0.001$; substantial overuse: $\chi^2 = 21.4$, $p < 0.001$) as compared to non-overuse and non-substantial overuse injured athletes.

CONCLUSION: NSAID use is high and the majority of athletes purchase their own NSAIDs, instead of receiving them from a medical professional. Injured athletes are more likely to use NSAIDs both in and out of season. Sports medicine professionals needs to monitor NSAID use and abuse in order to mitigate potential NSAID-related negative health impacts.

1186 Board #312 May 27 2:30 PM - 4:00 PM Division 1 Football Players And Metabolic Syndrome Risk Factors: A Three Year Observational Study

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Professional football players, especially linemen are at increased risk for early Metabolic Syndrome (MetS) leading to cardiovascular disease and death. There are no longitudinal studies examining MetS to determine if risk factors are present during college and if the risk factors change over time. **PURPOSE:** The purpose of this longitudinal study was to follow MetS risk factors in Division 1-FCS players over three years. MetS is defined by the NCEP ATP III standards. **METHODS:** Players were tested in the fall prior to the start of each season. Of the 39 players tested the first fall, eight players completed all tests every year of the study. Testing included waist circumference (WC), systolic blood pressure (SBP), diastolic blood pressure (DBP), fasting blood glucose (BG), high density lipoprotein (HDL), and triglycerides (TG). Descriptive statistics and comparisons were analyzed. A repeated measures ANOVA was used to compare the means of each dependent variable across the three years. A Bonferroni correction was used to adjust for multiple comparisons. **RESULTS:** One participant met the criteria for MetS during all three years with the same risk factors, low HDL, elevated TG and WC. Another participant met the MetS criteria during the second year (low HDL, elevated TG and WC), but not during the first and third years. Both players were offensive linemen. There were no significant differences in SBP, DBP, BG, or HDL across the three years. There was a significant difference in TG over time ($F [1.122, 7.852] = 6.355$, $p = .034$). Pairwise comparisons indicated a significant difference between year one-two, one-three, and two-three ($p = .001$, $p = .001$, $p = .05$; respectively). **CONCLUSIONS:** These findings suggest that nonskill football positions have a higher incidence of MetS risk factors. Additionally, TG varied across the three years, indicating that nutrition may be a primary influencing factor as players maintain fitness training year-round. A primary limitation of this study was the small sample size based on players completing testing all three years. Pre-season evaluation for early detection of MetS with follow up for early intervention is recommended. Further research should explore the nutrition practices of collegiate football players.

1187 Board #313 May 27 2:30 PM - 4:00 PM EVALUATION OF BIOMARKERS OF MUSCLE DAMAGE AND BONE FORMATION IN BALLET DANCERS DURING THE NUTCRACKER

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There is evidence that rehearsals and performances among ballet dancers induce physiological stress. However, few studies have attempted to quantify muscle damage or changes in bone metabolism. **PURPOSE:** The present study was a cross-sectional examination of changes in biomarkers of muscle damage and activity of osteoblasts from the beginning of dress rehearsal to the final performance during the Nutcracker season. **METHODS:** Professional and amateur male and female dancers, ages six and up, were recruited from two ballet companies that participated in the Nutcracker series. The cohorts were divided into three age groups: 6-12yrs (n=6), 13-18yrs (adolescents n=7), >18yrs (adults n=24). Blood draws were performed in the morning prior to the beginning of rehearsals and the day after the last performance. Blood samples were analyzed for creatine kinase MM isoform (CKM) and bone-specific alkaline phosphatase (BAP). Individuals with pre-existing medical conditions (i.e. juvenile idiopathic arthritis) and non-dance participants were excluded from this study. **RESULTS:** CKM significantly increased ($t=3.2$, $p < 0.001$) from baseline to post performance (Pre: 34.3 U/L ± 5.5, Post: 39.0 U/L ± 8.1). When examined by age group, both the adolescents ($t=2.99$, $p=0.024$) and adults ($t=2.55$, $p=0.018$) showed significant elevations, however no differences were noted in the youngest performers. No differences were noted in (BAP) concentrations across all groups ($t=-1.0$, $p=0.318$). However, a trend in the data was noted in the youngest performers ($t=-2.17$, $p=0.08$) with decreased concentrations post performance (Pre: 3.81 ng/ml ± 2.2, Post: 2.02 ng/ml ± 1.3). **CONCLUSIONS:** The data from the study demonstrate an increase in

muscle damage and a trend towards decreased bone formation activity of osteoblasts among young performers. Dancers and choreographers should be aware of these changes and implement appropriate periodization techniques and nutritional strategies to avoid overtraining these performing artists.

1188 Board #314 May 27 2:30 PM - 4:00 PM
Body Fat In Short And Tall: Comparisons Of The 3D-Infrared Vs. DXA Scanner

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Three-dimensional (3D) infrared scanners, which estimate body composition via measurements of circumference, are gaining popularity. Since participants rotate 360° on a scale in front of a full-length mirror, visual changes in body shape are quickly assessed while numerical values are generated. **PURPOSE:** The aim of this study is to compare total body fat percentage (BF%) in participants using both the 3D-infrared and dual energy x-ray absorptiometry (DXA) scanner. **METHODS:** Non-pregnant individuals were invited to participate in total body composition measurements using both the 3D-infrared and DXA scanners within the laboratory. Participants wore the same compression clothing and scanned within 30 minutes of each other. After height and weight were obtained, a whole body DXA scan was performed and analyzed by trained technicians. For the 3D-infrared scan, participants stood on a rotating scale in a standardized position in front of a full-length mirror. Data are expressed as mean±SD, with significance set at $p < 0.05$. **RESULTS:** Seventy participants (4 females; age=21±5years; weight=96±21kg; height=1.80±0.07m) successfully completed both scans, in a randomized order. Significant difference was noted between the DXA vs. 3D-infrared scans in BF% (23.7±5.1 vs. 19.5±8.6%; $p < 0.0001$). A significant positive correlation was noted between the DXA versus 3D-infrared scan for BF% ($r = 0.93$; $p < 0.0001$). However, the slope of the regression line was not in alignment with the line of identity, with the 3D-infrared scanner underestimating BF% at low levels (<30%) while overestimating BF% at high levels of BF%. The mean difference (Bland-Altman) was 4.2%, with the limits of agreement (LOA) between -4.3% to 12.7%. **CONCLUSION:** Although the correlation between the 3D-infrared versus DXA scan for BF% was high (87% of variance), the underestimation of BF% in smaller individuals and overestimation of BF% in larger individuals makes the 3D-infrared scanner not suitable for individuals outside of the normal range for BF% (~30%). Therefore, we do not believe the 3D-infrared scanner is a surrogate measure of BF%, compared with the DXA, for lean or obese persons.

1189 Board #315 May 27 2:30 PM - 4:00 PM
Geographic Disparity Of Female Athlete Triad Awareness And Access To Resources In The NCAA

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The Female Athlete Triad is a pervasive, multifactorial morbidity among college athletes. The geographic disparity of female athlete triad awareness and access to resources in NCAA is unknown. **PURPOSE:** To determine geographic disparities in awareness of Triad components and resource access in the National Collegiate Athletic Association (NCAA).

METHODS: Division I-III NCAA compliance officers were sent an email containing a request to disseminate a web-based survey to cross country coaches in their respective conferences. The web-linked instrument included: a study synopsis; an informed consent statement, and; the IRB-approved survey tool. Respondents were grouped geographically based upon conference headquarters location, regions included; Northeast, Midwest, South, and West. Statistical analysis, using JMP software, included frequency distributions and chi-square tests for categorical association.

RESULTS: Coaches (n = 143; age = 40.7 ± 11.9 years; coaching experience = 14.1 ± 10.3 years) from 45 conferences participated. Location impacted coaches' awareness of the term "female athlete triad" ($p = 0.0183$), which was highest in the West (90%), and lowest in the South (74%). Geography did not influence Triad component recognition ($p = 0.3907$) (i.e. low energy availability, amenorrhea, low bone mineral density), however; only 54% of coaches correctly identified all Triad components. Coaches who had Triad awareness were more likely to possess understanding that menstrual irregularities are not a normal result of exercise ($p < 0.001$). No relationship was identified between location and access to body composition technology ($p = 0.2031$), or; a registered dietician ($p = 0.4869$). However, only 30% and 53% of coaches had

access to these biometric and dietetic resources, respectively. Western cross-country athletes ($p = 0.0276$) had the highest access to sport psychologists (50%); lowest access was in the Midwest (20%).

CONCLUSIONS: Triad awareness and geographic resource disparities exist: Western coaches have a higher level of Triad awareness and superior access to psychological counseling, whereas; the South and Midwest had the lowest, respectively. Greater uniform access to resources amongst NCAA schools, regardless of geographic region, may positively impact Triad prevalence and outcomes.

1190 Board #316 May 27 2:30 PM - 4:00 PM
Refinement Of Breathing Reserve Estimates In Fit Individuals

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Breathing reserve as a cardiopulmonary exercise test metric has been used to ascertain a pulmonary mechanical limit to exercise. In athletes, breathing reserve estimates are often found to be abnormal (<10% or negative) and are typically attributed to enhanced effort and a desire to achieve peak performance.

Purpose: The purpose of this study was to determine how to accurately measure breathing reserve in fit individuals, like athletes, during a cardiopulmonary exercise test (CPET). **Methods:** Using prospectively collected information, CPET data from over 1,200 patients was analyzed to refine breathing reserve estimates in fit individuals. Fit individuals were defined as having a peak oxygen consumption (VO_{2peak}) greater than 120% predicted based on normative data. CPET results of 680 fit individuals ($VO_2 > 120\%$) were compared to findings from the general population ($PP < 120\%$). **Results:** A third of fit individuals (33%) are labeled with abnormal breathing reserve without overt lung disease as compared to the general population (4.6%). This finding is likely due to the fact that fit individuals achieve a significantly greater ventilatory rate with average respiratory rates of 50 b/min as compared to 38 b/min in the general population ($p < 0.0001$). **Conclusion:** The results demonstrate that current algorithms used to predict exercise breathing reserve need to be refined to distinguish health from disease in fit individuals.

1191 Board #317 May 27 2:30 PM - 4:00 PM
Using EVH Challenges To Objectively Monitor The Long Term Management Of Elite Swimmers With EIB

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Eucapnic voluntary hyperpnoea (EVH) challenges can provide objective evidence to support the diagnosis and long term management of athletes exercise-induced-bronchoconstriction (EIB). However, the repeatability of the EVH challenge has been questioned.

PURPOSE: To investigate the use of EVH challenges to objectively monitor the long-term management of elite swimmers with EIB. **METHODS:** Twenty-seven elite-international swimmers (14 males, 13 females; 20±2yrs) completed EVH challenges, separated by a calendar year. Following initial assessment, EIB^{positive} athletes were prescribed appropriate inhaler therapy in accordance to greatest fall in FEV₁ (FEV_{1max}) and asked to maintain therapy throughout the year. Athletes were grouped dependent on adherence to inhaler therapy (Non-adherent = EVH¹→EVH²; n=15; adherent = EVH_{OFF}→EVH_{ON}; n=12). Differences between screening visits were analysed using paired sample *t*-tests and presented as mean ± SD. The test-retest repeatability between EVH¹ and EVH² was expressed as mean bias with 95% limits of agreement (LOA) and Pearson's correlation coefficient (r). **RESULTS:** FEV_{1max} was significantly lower in EVH_{ON} (-11.8 ± 3.8%) than EVH_{OFF} (-24.0 ± 11.3%; $p < 0.01$). Baseline FEV₁ was greater in EVH_{ON} than EVH_{OFF} ($p = 0.04$). EVH¹→EVH² FEV_{1max} did not differ significantly between screening visits (EVH¹: -13.1 ± 4.6% and EVH²: -12.3 ± 5.6%; $p = 0.32$). There was agreement between FEV_{1max} in EVH¹→EVH² (mean bias 0.6%, 95% LOA = -5.9, 7.1), and significant strong positive correlation ($r = 0.813$, $p < 0.001$). **CONCLUSION:** Elite swimmers with EIB adherent to inhaler therapy increased baseline FEV₁ and reduced FEV₁ fall post-EVH. The EVH challenge demonstrated acceptable long-term test-retest repeatability in elite swimmers. EVH challenge is clinically useful to assess elite swimmers for EIB, and as a follow-up assessment to evaluate the effectiveness of inhaler therapy.

1192 Board #318 May 27 2:30 PM - 4:00 PM
Sexual Behaviors And Birth Control Use In Collegiate Student-athletes

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In 2017, the Center for Disease Control reported 2.3 million new cases of sexually transmitted diseases in the United States. Specifically, in sports medicine, collegiate student-athletes (SA) are considered an at-risk population due to the risk-taking behaviors associated with athletics.

Purpose: To describe birth control (BC) methods used by female and male collegiate SA.

Methods: As part of a larger 5-year study, collegiate SA (n=862; females: n=552; males: n=310; 17-23 years old) from a NCAA Division I institution completed a web-based survey containing a 30-item tool exploring sexual health behaviors. Partial data were used for all descriptive analyses.

Results: Over half (n=314, 57.4%) of females reported currently taking oral contraceptives or female hormones prescribed mostly for irregular menses (n=78, 14.3%) or pregnancy control (n=106, 12.3%). Participants reported having vaginal (females=172, 36.8%; males=143, 59.1%), oral (females=191, 40.2%; males=155, 63.3%), and anal (females=5, 1.1%; males=6, 2.7%) intercourse in the past 30 days. Interestingly, many participants reported never using condoms or other protective barriers during oral (n=490, 82.1%) or anal (n=376, 78.3%) sex; however, 33.3% of participants (n=203) stated they always used protection for vaginal intercourse. When exploring their most recent sexual encounter, 60.2% (n=429) of participants reported using a form of BC to prevent pregnancy. The most frequent types of BC included oral contraceptive pills (n=345), male condom (n=327), and "pull out" (n=152). Finally, 10.7% (n=77) of participants reported using emergency contraceptives. Despite the lack of consistent BC use, only 2 individuals reported a pregnancy in the last 12 months, both unintentionally.

Conclusions: Participants reported using oral contraception to prevent pregnancy, but mainly for menstrual dysfunctions. Female SA should be educated on all their BC options as it can affect sport performance. While many of the participants are engaging in sexual activity, the use of protective barrier is less for oral and anal intercourse which could be due to sexual education in the United States. However, the infrequent use of protective barriers, regardless of intercourse type, does pose a threat to a SA health for sexually transmitted infections.

1193 Board #319 May 27 2:30 PM - 4:00 PM
Sleep Problems As A Predictor Of Gastrointestinal Symptoms During Endurance Competition

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PURPOSE: Gastrointestinal (GI) disorders like irritable bowel syndrome and functional dyspepsia are more common in people with sleep problems. No research, however, has examined the relationships between sleep problems and GI disturbances in endurance athletes, particularly symptoms that occur during competition.

METHODS: Within 24 hours of finishing an endurance race (minimum of 1-hour duration), 73 participants (27 men, 46 women; 39.2 ± 11.0 years) completed the Medical Outcomes Study Sleep Scale (MOSSS) and reported the amount of time (min) slept the night before the race. In addition, participants reported the severity (0-10 scale) of four upper (nausea, regurgitation/reflux, fullness, bloating) and three lower (abdominal cramps, flatulence, urge to defecate) GI symptoms experienced during the races. Individual symptom scores were added together to obtain overall, upper, and lower GI symptom scores. Spearman's rank-order correlations were used to examine whether scores on the Sleep Problems Index-(SPI)-I of the MOSSS were associated with GI symptom scores. Partial correlations were also calculated to control for age, gender, body mass index, race duration, and trait anxiety levels.

RESULTS: There were significant correlations between scores on the SPI-I and total GI symptom scores (rho = 0.24, p = 0.045) as well as upper GI symptom scores (rho = 0.30, p = 0.011). Lower GI symptoms were not significantly correlated with SPI-I scores (rho = 0.14, p = 0.135). Only the correlation between upper GI symptoms and SPI-I scores remained significant (rho = 0.24, p = 0.049) after controlling for age, gender, body mass index, race duration, and trait anxiety levels. Sleep duration from the night before the race was not significantly correlated with any of the GI-symptom variables.

CONCLUSIONS: These results suggest that chronic sleep problems, but not acute pre-event sleep duration, is modestly associated with the severity of upper GI symptoms during endurance races.

1194 Board #320 May 27 2:30 PM - 4:00 PM
Association Between Sleep Complaints And Musculoskeletal Injuries In Adolescent Athletes

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(No relevant relationships reported)

Sleep is a physiological process that plays a crucial role in human metabolic functions, being fundamental in muscle recovery.

PURPOSE: To associate sleep complaints with musculoskeletal injuries in adolescent track and field athletes. **METHODS:** The sample consisted of 30 athletes, who are part of the athletics team of the Sports Training Center, aged between 13 and 22 years and average BMI of 21.21 ± 1.37 kg / m². Participants completed the Sleep Complaints Questionnaire and retrospective data were collected on musculoskeletal injuries in the team's Physical Therapy sector (last six months). Spearman's correlation coefficient was used to obtain the association between the variables of the Sleep Complaints Questionnaire and the injuries. Finally, the linear regression model was used. The adopted significance level was $\alpha \leq 5\%$. **RESULTS:** The results showed that 23.3% of athletes reported having bad sleep, 40% reported good sleep and 36.7% reported very good sleep. The average total sleep time of participants was 07h22min ± 63.55 min (recommended 9 to 10h sleep for athletes) and the average severity of injuries was 1.47 ± 1.24 AU (1=no clearance and 5=severe or withdrawal over 28 days). Significant negative correlations were found between the variables sleep complaint and total sleep time (r=-0.438; p=0.016), sleep complaint and sleep quality (r=-0.472; p=0.009) and significant positive correlation between sleepwalking and injury severity (r = 0.577; p=0.006). Linear regression data showed that sleep complaints influence 45% of total sleep time (R=0.456; β =-0.456; p=0.011); that sleep complaints have a 49% influence on sleep quality (R=0.494; β =-0.494; p=0.006); and that sleepwalking has a 64% influence on the severity of injury (R=0.646; β =0.646; p=0.002). **CONCLUSION:** The presence of sleep complaints has negative implications on the duration and quality of sleep of the adolescent athlete, as well as increasing the severity of injury. Supported by CTE/EEFFTO/UFMG, FAPEMIG, CAPES and CNPQ.

1195 Board #321 May 27 2:30 PM - 4:00 PM
A Qualitative Assessment Of Return To Sport In Elite Athletes: The Impact Of Gender

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(No relevant relationships reported)

PURPOSE: Participation of female athletes in Division I sports continues to rise, but there remains a significant underrepresentation of this growth in the literature. Our goal was to explore differences in how collegiate female and male athletes perceive and approach injury and return to sport.

METHODS: Semi-structured, open-ended interviews were conducted with Division I varsity athletes from a single institution who underwent orthopaedic surgery following injury with at least 2 years follow-up. Athletes were asked about factors influencing recovery, rehabilitation, and their return to or retirement from sport. Codes, categories, and themes were derived within and across genders.

RESULTS: Fifteen athletes (6 females and 9 males) were interviewed individually. Athletes shared similar experiences following injury, citing similar motivations, supportive factors, and difficulties. Athletes stressed the importance of the athlete role to their identity regardless of gender. Our analysis revealed two gender-related challenges: male athletes commonly felt weight gain/loss was a barrier to successful recovery and often led to self-consciousness; while females expressed frustrations in lack of empathy from those they turned to for support.

CONCLUSIONS: Female and male athletes shared common motivating, enabling, and challenging factors in return to sport following injury, though some challenges did differ by gender: females found difficulty with interpersonal relationships, while males experienced greater internal struggles. This qualitative study provides a nuanced look at the experience of varsity athletes returning to sport following surgery and adds understanding of the historically under-investigated perspective of female athletes.

1196 Board #322 May 27 2:30 PM - 4:00 PM
Effects Of Aerobic Exercise On Leptin, Sex Hormone In Rats With Polycystic Ovary Syndrome
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(No relevant relationships reported)

PURPOSE: To investigate the influence of aerobic exercise in rats with polycystic ovary syndrome (PCOS).
METHODS: 32 23-day-old SD female rats were randomly assigned into 4 groups, i.e. normal control group (NC, n=8), exercise control group (EC, n=8), PCOS control group (PC, n=8) and PCOS exercise group (PE, n=8). PC group and PE group were modeled by injecting DHEA. EC group and PE group simultaneously implemented Masashi exercise intervention (unloaded free swimming, 20 min/time, 6 d/week for 15 d). Measure the serum testosterone (T), estradiol (E₂), follicle-stimulating hormone (FSH) and leptin (LP) of rats by ELISA. Observe ovarian histological changes through the hematoxylin-eosin stain, the P450arom expression (optical density, OD) in ovarian by immunohistochemistry.
RESULTS: There were obvious cystic dilated follicles in the ovarian tissue of the PC group, and compared with the, there are many normal follicles in the ovary of the PE group. The PC group exhibited a higher serum level of FSH, T, E₂ and the P450arom expression in ovarian than NC group (*P* < 0.05). Compare with the PC group, the serum level of LP, T, E₂ were decreased in the PE group (*P* < 0.05). However, compared with the NC group, the EC group showed no difference in the serum level of FSH, T, E₂, and the P450arom expression in ovarian (*P* > 0.05). Besides, the PE and PC group showed no difference in the serum level of FSH and the P450arom expression in ovarian (*P* > 0.05). The serum LP level in rats was positively correlated with T (*r*=0.893), E₂ (*r*=0.612), FSH (*r*=0.620) level and the P450arom expression(*r*=0.501) in ovarian.
CONCLUSION: Aerobic exercise can reduce the LP levels of PCOS rats, relieve leptin resistance, alleviate high estrogen blood disease and abnormal P450arom expression in ovarian, but cannot eliminate the sex hormone disorder.
The Changes of T, FSH, E₂, LP, And OD among 4 groups(x̄±SD)

Group	Sample	FSH (mIU/mL)	T (pg/mL)	E ₂ (pmol/L)	LP (ng/ml)	OD
NC	8	3.349±0.421	26.507±0.856	4.414±0.234	2.239±0.069	0.1812±0.0036
EC	8	3.113±0.272	25.829±0.823	4.603±0.421	1.981±0.005*	0.1822±0.0073
PC	8	4.252±0.591*	31.549±1.475*	5.582±0.789*	3.446±0.639*	0.1922±0.0090*
PE	8	4.104±0.056	29.462±0.894*	4.899±0.487*	2.474±0.802*	0.1866±0.0074

* *P* < 0.05, compared to NC; # *P* < 0.05, compared to PC

1197 Board #323 May 27 2:30 PM - 4:00 PM
Self-reported Sleep Habits Of Adult Athletes, A Comparison Between Sports And Competitive Level.
 Rebecca K. Randell¹, Rosie Anderson¹, Ian Rollo¹, Melissa Anderson². ¹*GSSI, Leicester, United Kingdom.* ²*GSSI, Bradenton, FL.*
Reported Relationships: R.K. Randell: Salary; PepsiCo International: The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc.

PURPOSE: The purpose of this study was to quantify self-reported current sleep habits in a range of athletes, and to compare these with self-reported ideal sleep habits. In addition, to determine any differences in sleep duration and sleep quality, depending on the sport type and competitive level.
METHODS: 313 athletes (243 males, 70 females; age 27 ± 8 y), competing in a variety of sports and competitive levels (recreational to elite), completed the Pittsburgh Sleep Quality Index (PSQI), and a questionnaire which assessed current and ideal sleep habits. Sleep quality was calculated using the PSQI global score, with a score of ≥ 5 indicative of poor sleep quality. A paired t-test was used to compare current and ideal sleep duration. A one-way ANOVA test was performed to determine differences in sleep duration and quality between sports (sports with N ≥ 20) and competitive level.
RESULTS: Mean sleep duration was 7 h 34 min ± 1 h (range 4 h - 11 h), with 19% of athletes achieving < 7 hours of sleep, and 50% achieving < 8 hours. The average global PSQI score was 5.0 ± 2.4, with 55% of athletes having poor sleep quality. Mean ideal sleep duration was 9 h 26 min ± 58 min, which was significantly more than current sleep duration (*p* < 0.001, 95% CI (-2.0, -1.7) h). Sleep duration differed between sport types, with runners sleeping significantly less than basketball, soccer and rugby players (*p* < 0.05). Furthermore, recreational athletes slept significantly less (7 h 08 min ± 54 min) than competitive (7 h 32 min ± 1 h), national (7 h 50 min ± 1 h) and elite level athletes (7 h 49 min ± 51 min). At all competitive levels and sport types, ideal

sleep duration was significantly greater than current sleep duration (*p* < 0.001). No differences in sleep quality were found between athletes competing at different levels or sport.
CONCLUSIONS: Half of the athletes failed to achieve 8 hours of sleep per night. Runners appear to sleep less than team sports athletes. Recreational athletes sleep less than athletes who compete at higher levels however, sleep quality does not seem to be compromised. Regardless of competitive level and sport type all athletes reported a higher ideal sleep duration compared to current duration.

B-81 Exercise is Medicine®/Poster - EIM: EIM Programs, Vital Signs, and Medical Knowledge
 Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

1198 Board #324 May 27 1:30 PM - 3:00 PM
Exercise Is Medicine On Campus (EIM-OC): State Of The Literature
 Renee Jeffreys Heil¹, Neil E. Peterson², Connie L. Tompkins³, Megan Rothermel⁴, Shelby Mandla⁵, Zainab Shirazi⁶, Robyn Stuhr⁵, Carena Winters, FACSM⁷. ¹*FMB Wellness Project, FORT MYERS BEACH, FL.* ²*Brigham Young University, Provo, UT.* ³*University of Vermont, Burlington, VT.* ⁴*Delaware State University, Dover, DE.* ⁵*American College of Sports Medicine, Indianapolis, IN.* ⁶*University of Illinois at Chicago, Chicago, IL.* ⁷*Jacksonville University, Jacksonville, FL.* (Sponsor: Carena Winters, FACSM)
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Exercise is Medicine - On Campus (EIM-OC) was created in 2009. Over the last 10 years, the number of registered schools has risen to 267. At the Annual Meeting in 2019, there were 139 schools recognized for the work they performed on their campus. Purpose: In an effort to determine the scope of EIM-OC grant and research projects, the EIM-OC committee members have undertaken a meta-analysis and systematic review of the EIM-OC literature. Methods: Data was collected using multiple methodologies to ensure a complete capture of the work in this area. This included an email to EIM-OC registered schools to request publication, poster, and oral presentations titles, dates, and authors. As well as request to ACSM journal and meeting coordinators to review published and unpublished abstracts. Members of the writing team performed independent literature searches across 10 databases using defined keywords (“Exercise is Medicine” or EIM and campus* OR University* OR college* OR academ*). Search results returned 772 articles. Two members then reviewed all abstracts to ensure it contained information on methods, program analysis, or outcome data related to EIM-OC. The bibliography of each of the included manuscripts and posters was reviewed to capture articles not found in the original search. Results: To date, no article of this type have been published in the area of EIM-OC, even though EIM-OC is one of the most robust EIM program initiatives. This important research will document what has been done in this area and highlight gaps in the literature. Conclusion: The data collected will be used by EIM Staff, Committee Members, and Registered Schools to obtain internal and external research support. Schools looking to develop EIM-OC programs will also benefit from this research.

1199 Board #325 May 27 1:30 PM - 3:00 PM
Exercise Is Medicine Day On Campus: A Survey Of Physical Activity And Nutrition Habits
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(No relevant relationships reported)

Exercise is Medicine (EIM) is a global joint initiative between the American Medical Association and the American College of Sports Medicine (ACSM). West Chester University (WCU) was recognized by the ACSM in 2018 as an EIM-On Campus Gold Campus, indicating that WCU actively attempts to engage the campus community in physical activity. **PURPOSE:** The purpose of this study was to assess opinions related to the second WCU EIM Day. This event was hosted by the College of Health Sciences (CHS) at WCU and included participation from all six departments in the CHS, student groups, faculty and staff, alumni, and community stakeholders. **METHODS:** Sixty-five participants (19 M, 46 F), (77% 18-21 years old, 15% 22-25 years old, 8% 26 years or older) that visited the event responded to an 8-question program evaluation survey. **RESULTS:** The data did not have a normal distribution due to the

small sample size. Therefore, non-parametric data analyses were applied. Spearman non-parametric correlations were utilized to determine the relationship between enjoyment levels and perceived helpfulness of the event for increasing physical activity (PA) and improving nutrition habits (NH). Results indicated a significant positive strong association between enjoyment levels and perceived helpfulness of the event for increasing PA ($r(46)=.66, p<.05$). There was a medium association between enjoyment levels and perceived helpfulness of the event for improving NH but this association was not significant, ($r(25)=.30, p>.05$). To examine differences between male and female participants, the Mann-Whitney U-test was applied for enjoyment levels, perceived helpfulness for PA and for NH items. Results indicated differences in enjoyment levels between males and females, ($U=-2.02, p<.05$) but no significant differences in perceived helpfulness of the event for PA and for NH items between females and males, ($U_{PA}=-2.04, p=.09$ and $U_{NH}=-1.9, p=.08$). **CONCLUSIONS:** These results suggest that participants that attended EIM Day found it beneficial for increasing PA habits. This may be due to activities throughout the day that included yoga, boot camp fitness, and Tai Chi. While there were food stands and information disseminated by nutrition students, in the future it will be important to provide more offerings related to proper nutrition habits.

1200 Board #326 May 27 1:30 PM - 3:00 PM

Assessing EIM-On Campus Physical Activity Programs: Lessons Learned

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Assessing campus physical activity programs (CPAPs) is important for making decisions regarding their benefits and value. However, determining the most reliable and cost-effective assessment tools is challenging. **Purpose:** To evaluate the usefulness of specific health and wellbeing assessment tools for evaluating the benefits of CPAPs. **Methods:** Health and wellbeing information were collected from participants in two CPAPs (Active Aggie Mobile (AAM) [N=165] and Fit Break (FB) [N=65 in one session, 40 in another]) over approximately 6 months. AAM brings physical activity (PA) instructors to campus neighborhoods twice a week for one hour to facilitate PA engagement of students, staff and faculty in those neighborhoods. FB provides 15 minute exercise sessions (breaks) twice a week to non-represented staff in departments with high workers' compensation claims and absenteeism. AAM and FB attendance was recorded. Participants completed an SF36 survey (a set of generic, coherent, and easily administered quality-of-life measures) at the start and end of each program. Sick leave and Worker's Compensation claims were compared between FB participants and controls. **RESULTS:** There was a significant ($p<0.05$) improvement in energy/fatigue in one AAM group, but no other changes were observed in either AAM group. FB participants had an increase in their perceived health in 8 categories surveyed (energy/fatigue, physical functioning, role limits due to physical health, role limits due to emotional health, emotional well-being, social functioning, pain, and general health), but these changes were only significantly different ($p<0.05$) from controls in emotional well-being. There were no significant differences in sick leave hours between FB participants and controls. Testimonials were favorable for both programs. **CONCLUSIONS:** It is difficult to show improved health and well-being outcomes through surveys of perceived health during short duration programs of this nature. Long-term health metric tracking systems are needed to thoroughly assess the cost to health benefit associated with various CPAPs. We are exploring the feasibility of collecting more specific information such as flexibility, balance, weight, resting heart rate, blood pressure and even blood panels from controls and participants in CPAPs.

1201 Board #327 May 27 1:30 PM - 3:00 PM
Implementation Of Exercise Is Medicine On Campus At California State University, Monterey Bay

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PURPOSE Exercise is Medicine On Campus (EIM-OC) aims to establish physical activity (PA) as a vital sign & integrate PA into the lifestyle of university campuses. The EIM-OC initiative was launched at Cal State University, Monterey Bay (CSUMB) in Fall 2019 with the goal of integrating PA into the campus lifestyle. EIM-OC at CSUMB aimed to achieve this by providing exercise classes for employees & offering peer health consultations (PHC) for students. The purpose of this project is to discuss the implementation of EIM-OC & identify the successes & challenges.

METHODS The launch of EIM-OC at CSUMB included exercise classes, student PHC program & additional campus events. Circuit Training (CTC) and Resistance

Training (RTC) classes for employees took place in September and October 2019 respectively. Participants for the CTC were 15 females (average age 43.80 + 12.66) & 14 females (average age 40.71 + 10.51) for the RTC. The EIM-OC provided PHC which involved a group of Health Mentors providing education & support to students looking to improve health behaviors. Participants were 7 males & 11 females (average age 21.61 + 4.54). The EIM-OC Run Walk and Roll Club (RWRC) provided an opportunity to be physically active in a group atmosphere. The team provided free Otter Sports Center orientations, yoga & resistance training classes during October's EIM-OC Week.

RESULTS The inaugural semester of EIM-OC was successful in launching these programs for CSUMB. The launch gained support in the form of social media following via Instagram and participation from University employees & students in the programs. The program encountered challenges including the retention of students in the PHC and gaining participation/interest from the campus during the EIM-OC week. **CONCLUSIONS** The most successful part of EIM-OC at CSUMB were the employee exercise programs & will continue to be a major part of EIM-OC. Marketing of the RWRC & other events could be stronger to gain more participation. Strategies to improve retention for the PHC program are necessary. Based on recommendations, an afternoon RWRC will be added in the future. Overall, the first semester of EIM-OC at CSUMB was successful in making PA a part of the campus culture. Improving the programmatic efforts & troubleshooting challenges encountered, will ensure a sustainable EIM-OC program on campus.

1202 Board #328 May 27 1:30 PM - 3:00 PM

Exercise Is Medicine On Campus: Employee Circuit Training Course Increases Physical Activity

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PURPOSE: Exercise Is Medicine On Campus (EIM-OC) is a global health initiative with over 200 participating college campuses. EIM-OC was implemented at California State University, Monterey Bay in Fall 2019, with offerings for both students and employees. Employee programming included exercise classes, including a four week circuit training course. The purpose of this pilot study was to evaluate physical activity participation among employees participating in the EIM-OC circuit training course.

METHODS: The research design was pre-post and tracked participants in the EIM-OC circuit training course. Twelve female employees who were participating in the class volunteered for the study. The Godin Leisure Time Physical Activity Questionnaire was administered online before and after the course. Paired sample t-tests were performed on Godin Scale Score, and number of strenuous, moderate, and light intensity activity days per week. Significance was set at $\alpha = 0.05$.

RESULTS: There was a significant increase ($t=-1.787, df=11, p=.05$) in Godin Scale Score following the course ($M=38.50\pm 16.9; M=49.17\pm 23.95$). There was a significant increase in moderate physical activity days per week ($t=-2.419, df=11, p=.02$) following the course ($M=2.5\pm 1.17; M=3.33\pm 1.30$). There were increases in strenuous physical activity days and light physical activity days per week, although they were not statistically significant.

CONCLUSIONS: The inaugural EIM-OC circuit training class was effective in increasing physical activity among female employees. Future EIM-OC programs should work to expand their offerings to increase participation among employees, especially those who are inactive. Larger and longer studies could also be helpful to the growing body of knowledge on the EIM-OC initiative.

1203 Board #329 May 27 1:30 PM - 3:00 PM

Exercise Is Medicine® On Campus: evaluating Self-efficacy Levels Through An Employee Circuit Training Course

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PURPOSE: The American College of Sport Medicine created the Exercise is Medicine® (EIM) initiative to improve health through the promotion and prescription of physical activity. The EIM-On Campus (EIM-OC) initiative uses physical activity as a vital sign for promoting healthy behaviors among students and employees on a college campus. The EIM-OC initiative was launched at California State University, Monterey Bay (CSUMB) in Fall 2019. The purpose of this pilot study was to evaluate exercise self-efficacy levels among employees participating in a EIM-OC circuit training course.

METHODS: The research design was pre-post and tracked participants in the four week EIM-OC circuit training course. Fifteen female employees who participated in the circuit training course volunteered for the study. The Self-Efficacy for Exercise (SEE) scale was administered online through an intake form before and after the employee circuit training course. A dependent t-test was performed to test for differences in exercise self-efficacy pre and post participation in the circuit training course. Significance was set at $\alpha = 0.05$. We hypothesized to see significant improvements in exercise self-efficacy among participants.

RESULTS: Average age was 43.80 ± 12.66 years, 93.3% of the participants were University staff. There was a significant increase ($t=2.87$, $df=11$, $p=.008$) in self-efficacy for exercise score ($M=52.33 \pm 20.63$; $M=62.75 \pm 17.34$) following the EIM-OC circuit training class.

CONCLUSIONS: The inaugural EIM-OC circuit training class was effective in increasing exercise self-efficacy among participants. University employees felt more efficacious about exercising after the four week circuit training course. Larger and longer studies could be conducted to better understand how and why participation in a campus offered circuit training course influences participants' self-efficacy to continue exercising and if participants continue to exercise independent of the course offering. Evaluating exercise self-efficacy in EIM-OC exercise related programs could provide valuable insight into the adherence to and maintenance of exercise in University employees.

1204 Board #330 May 27 1:30 PM - 3:00 PM
**Influence Of Aerobic Fitness And Obesity Status On
 Cardiometabolic Risk In College Students**

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Little examination of cardiometabolic risk in college students has occurred; the number of studies exploring the influences of aerobic fitness and percent body fat on this topic are fewer still. **PURPOSE:** The purpose of this study was to determine the impact of aerobic fitness and obesity status on cardiometabolic risk in college students separately by gender. **METHODS:** Undergraduate students ($n=5,986$) completed an assessment battery which included an estimate of cardiorespiratory fitness (VO_2max), BMI, percent body fat, blood lipids and glucose and blood pressure. **RESULTS:** In males ($n=3634$) low aerobic fitness (LAF) and elevated percent body fat (FAT) increased odds of dyslipidemia (LAF OR: 1.6 95%CI 1.4-1.9, FAT OR: 3.4 95%CI 2.5-4.5), low high-density lipoprotein (HDL) cholesterol (LAF OR: 1.7 95% CI 1.4-2.0; FAT OR: 3.4 95% CI 2.6-4.5), elevated low-density lipoprotein (LDL) cholesterol (LAF OR: 1.6 95% CI 1.3-2.0; FAT OR: 3.0 95% CI 2.2-4.3), elevated total cholesterol (LAF OR: 1.7 95% CI 1.2-2.4; FAT OR: 1.5 95% CI 1.2-1.9), elevated triglycerides (LAF OR: 1.8 95% CI 1.4-2.2; FAT OR: 2.7 95% CI 1.9-3.6), and hypertension (LAF OR: 1.6 95% CI 1.4-1.8; FAT OR: 3.0 95% CI 2.2-4.0). Odds of prediabetes (OR: 2.1 95% CI 1.4-3.2) were only higher in FAT. Among females ($n=2352$), LAF and FAT were associated with increased odds of dyslipidemia (LAF OR: 1.5 95% CI 1.2-1.8; FAT OR: 1.4 95% CI 1.1-1.7), and hypertension (LAF OR: 1.3 95% CI 1.1-1.6; FAT OR: 2.2 95% CI 1.7-2.7). Odds of low HDL (OR: 2.1 95% CI 1.3-3.5), elevated LDL (OR: 2.2 95% CI 1.4-3.4) and total cholesterol (OR: 1.7 95% CI 1.3-2.2), and prediabetes (OR: 1.6 95% CI 1.0-2.4) were significant only in females with FAT. Odds of elevated triglycerides (OR: 1.6 95% CI 1.3-2.0) were significant only in those with LAF. **DISCUSSION:** Although the consequences of obesity and low aerobic fitness in young adulthood may not lead to clinical symptomatology for decades, both increase the likelihood that an individual will meet cardiometabolic risk factors. The odds are higher in those with elevated percent body fat compared to the unfit. **CONCLUSION:** Interventions in this population should focus on lowering body fat percentage, not on improving fitness, for the most health benefits.

1205 Board #331 May 27 1:30 PM - 3:00 PM
**The Effect Of A Four Week Walking Intervention On
 Faculty And Staff At The University Of Arkansas**

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 (No relevant relationships reported)

The Exercise is Medicine On Campus initiative promotes physical activity (PA) on campus. Although faculty and staff are campus role models, limited research has been performed on the importance of PA promotion in this population. Unique strategies are needed to promote PA in faculty and staff. Social support is an evidence-based behavioral strategy for increasing PA intervention adherence. Technology removes the need for in-person interaction by allowing virtual communication. **PURPOSE:** (1) Assess the feasibility and acceptability of a virtual social walking group and an in-person social walking group (2) Determine preliminary effects of both walking interventions on faculty and staff fitness.

METHODS: This is a sub-study of the Exercise is Medicine initiative on the University of Arkansas campus in an effort to track PA and its association with health, student success, and work satisfaction. Twenty-nine faculty and staff members (47.3 years ± 12.6) walked for 150 minutes per week for 4 weeks. The virtual group ($n=16$) used a fitness tracker to log PA and virtual messaging for group interaction. Research staff provided little facilitation of virtual group interaction. The in-person group ($n=13$) met 5 days per week, walked for 30 minutes, and was encouraged to perform walking tasks when unable to attend. A research aide led each walk and facilitated conversation.

RESULTS: Three participants were excluded due to missing data. At baseline, BMI for males ($n=5$) was 28.9 ± 3.7 and was 31.5 ± 8.1 for females ($n=21$). 50% of participants were classified as obese. The average aerobic capacity (VO_2 max) of males was 28.5 ± 6.1 ml/kg/min, and average VO_2 max of females was 24.2 ± 6.9 ml/kg/min. On average, virtual participants walked 177.1 ± 46.7 (range 101.4 to 267.3) minutes per week. 37.5% of participants met recommendations all 4 weeks. In-person participants attended an average of 82% (range 60 to 100%) of walking sessions. A paired t-test showed VO_2 max of participants significantly improved ($p=0.035$) after intervention. Participants reported high satisfaction with the program.

CONCLUSIONS: Both walking groups were feasible and acceptable among university faculty and staff, and aerobic fitness improved. Future research should assess long-term effects of PA interventions on all components of fitness of faculty and staff.

1206 Board #332 May 27 1:30 PM - 3:00 PM
**Medical Student Knowledge Of The Federal Physical
 Activity Guidelines**

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 (No relevant relationships reported)

PURPOSE: The purpose of this study is to assess medical student knowledge of the 2008 Health People Federal Physical Activity Guidelines.

METHODS: 254 Medical Students completed a voluntary survey assessing knowledge of the 2008 Healthy People Federal Physical Activity Guidelines.

RESULTS: Of the 254 respondents, 38% of respondents correctly knew the adult aerobic PA guidelines, 72.44% correctly identified the adult muscle strength PA guidelines, 31.10% correctly identified guidelines for pediatric aerobic PA guidelines, 55.12% correctly identified the pediatric muscle and bone strength PA guidelines and 24.80% of respondents correctly identified a form of vigorous physical activity amongst a list of moderate physical activities. Amongst the 254 survey respondents, 201 gave examples of how they incorporate physical activity into their lives, 26% of the responses included solely exercise examples. Walking to work/class was the most common non-exercise response.

CONCLUSIONS: Medical student knowledge of federal physical activity guidelines and the difference between physical activity and exercise is lacking. More emphasis on PA guidelines in medical education curriculum could enhance medical student knowledge and ultimately influence future patient education, health and wellness.

1207 Board #333 May 27 1:30 PM - 3:00 PM
**Evaluating Physician Assistant Student Knowledge
 And Application Of "Exercise Is Medicine" And Follow-
 up In Practice**

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Methods of educating healthcare professionals on the principles of "Exercise is Medicine" (EIM) is challenging. Seminars are an efficient means of educating students about EIM. However, their effectiveness in translating EIM to clinical practice is unknown. **PURPOSE:** This present study assessed the effectiveness of an EIM educational seminar on improving knowledge and attitudes about prescribing exercise of student Physician Assistants. A secondary purpose was to compare the use of EIM between graduates who received EIM seminars with graduates who have not received training. **METHODS:** Second year Physician Assistant students from the classes of 2017-2019 were given a 45-minute EIM seminar focusing on the evidence for the prevention and treatment for chronic diseases as well as exercise prescription based off the FITT Principle. A pre- and post-survey was administered to evaluate the effectiveness of the seminar. To evaluate the translation to clinical practice, an email survey was sent to the classes of 2017-2019, who received EIM seminars, and the classes of 2014-2016, who did not. **RESULTS:** There was a 27% increase in the number of students that believed exercise is a part of their daily career. Following the EIM seminar, there was a 32% increase in student's confidence to prescribe exercise. Additionally, their ability to correctly prescribe exercise increased by 31% when evaluated with a case study. With respect to the follow-up of clinicians, only 64% of the respondents asked about their patient's physical activity habits (vital sign) with no difference between groups. While all respondents felt that physical activity can

prevent chronic diseases, there was no difference between trained (67%) and untrained (63%) groups in respects to believing that Physician Assistants should know how to prescribe exercise to their patients. **CONCLUSION:** A short seminar presentation can increase the knowledge and attitudes of Physician Assistants students with respect to EIM practices. When students who received EIM seminars were compared to students who did not, there were very few differences. Therefore, a 45-minute presentation is not enough to translate to an increase in physical activity counselling and exercise prescription.

1208 Board #334 May 27 1:30 PM - 3:00 PM
Exercise Is Medicine Greenville®: Blood Pressure And Body Weight Outcomes From The First Two Years

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 (No relevant relationships reported)

Many non-communicable chronic diseases (NCD) such as cardiovascular disease are largely mediated by lifestyle behaviors which include physical activity (PA). Exercise is Medicine Greenville® (EIMG®) is a clinic-to-community, experiential lifestyle behavior change model that partners physicians with qualified community exercise professionals for optimal patient care. Patients not currently meeting national PA guidelines and/or have or are at-risk for NCDs are physician-referred to the EIMG® program. Of particular interest for this pilot study were patients with elevated body weight and/or blood pressure (BP > 130/80) upon referral.

Purpose: To investigate the effect of the EIMG® program on body weight and systolic and diastolic BP (SBP and DBP, respectively) in referred patients.

Methods: Patients not meeting PA guidelines or at-risk for or with a controlled NCD were referred to the 12-week EIMG® exercise training program. Each patient followed a supervised, personalized exercise training program developed and facilitated by an EIMG® certified professional. A single group pre-test, post-test experimental design was utilized when collecting body weight and BP measurements before and after the exercise training program. A paired sample t-test was utilized to determine statistically significant changes (p<0.05) in each variable due to the exercise intervention.

Results: To date, a total of 150 patients have graduated from the 12-week intervention with complete pre-and post-intervention measurements. Fifty-nine percent (n=89) of the patients were hypertensive upon referral. Analysis of the whole group resulted in a significant decrease in body weight (2.6 kg, p<0.000) with no significant decrease in SBP or DBP. The 89 hypertensive patients lost 1.4 kg (p=0.001) and significantly decreased SBP by 8 mmHg (p<0.000) and DBP by 3 mmHg (p=0.003).

Conclusions: EIMG® may be beneficial in assisting patients with or at-risk for NCD by improving body weight and decreasing BP. Greater cardiovascular benefit may be recognized in those referred to the program with hypertension by decreasing both SBP and DBP. Since previous research indicates that exercise does not account for body weight loss, further research is needed to better understand the results of body weight loss observed during the EIMG® program.

1209 Board #335 May 27 1:30 PM - 3:00 PM
Implementing Exercise Medicine Tools In Primary Pediatric Care - A Call To Action

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PURPOSE: Despite the demonstrated health benefits of physical activity for children and adolescents, surprisingly few primary care pediatricians discuss, evaluate or prescribe physical activity (PA) for children and their families. The aim of this study was to examine pediatricians' views on child PA in order to inform the development of tools and resources to be implemented in the pediatric primary care clinics. **METHODS:** 27 pediatricians participated. The Consolidated Framework for Implementation Research was used in a mixed-method design combining qualitative and quantitative data. Qualitative data were collected through focus groups, addressed pediatricians' current approaches to PA for their patients as well as factors facilitating practice change. Quantitative data were collected (online questionnaire) to explore perceptions implicated in the implementation of PA tools, approaches, or guidelines.

RESULTS: Analyses of the qualitative data highlighted that pediatricians and patients and their families strongly believe that PA is important and beneficial. However, there is wide practice variability in current approaches to initiating PA discussions and promotion and identified barriers that included: lack of knowledge and training; managing time and multiple demands; the need for team approach in implementation and adherence; and the need for simple tools and resources. Quantitative data highlighted additional factors including evidence-based, cost-effective tools; tailoring the message to patient needs and resources; access to knowledge and information;

and champions to engage, advocate and help implement PA best practices.

CONCLUSION: Together, the qualitative and quantitative results begin to facilitate a strategic plan to improve the implementation of PA best practices in pediatric practices. While it is encouraging that both pediatricians and families strongly believe that PA is important for good health across the lifespan, the following key elements are needed: 1) rigorous training in exercise science at the medical school and residency level; 2) effective tools to assess and discuss PA as well as implement and follow up adherence to PA prescription; 3) further, these tools must be inexpensive, minimally burdensome and conform to the time constraints faced by busy pediatricians.

1210 Board #336 May 27 1:30 PM - 3:00 PM
Validation Of Exercise Vital Sign (evs) Questions In A Pediatric Population

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Purpose: The purpose of this study was to determine which factors were associated with increased weekly moderate to vigorous physical activity (MVPA) measured by Exercise Vital Sign (EVS) questions. **Methods:** Patients presenting to a sports medicine clinic between the ages of 5-18 were asked "On average, how many days per week did you participate in MVPA" and "On average, how many minutes per day did you participate in MVPA". Weekly physical activity, age, sex, BMI percentile, as well as history of asthma, attention deficit hyperactivity disorder, depression and diabetes were recorded. A linear regression analysis was utilized in those who reported any physical activity to determine which factors were associated with increased MVPA. **Results:** Data were recorded on 14,440 subjects. Average age was 13.91±2.49 years and average BMI percentile was 65.50±27.74 percent. Females made up 54.1%. Asthma was reported by 2340 (16.2%), ADHD was reported by 818 (5.7%), depression was reported by 308 (2.1%), and diabetes was reported by 92 (.6%). Overall, 45.6% of subjects reported 420 minutes or more of weekly MVPA. Those who reported any physical activity (n=13,708) averaged 424.14±287.45 minutes per week of MVPA. Those with a history of depression had almost 60 minutes/week less MVPA when controlling for age, sex, BMI percentile, asthma, ADHD, and diabetes (p>.001). Females reported 45 minutes less MVPA than males when controlling for age, BMI percentile, asthma, ADHD, depression and diabetes (p>.001). **Discussion:** Physical activity is an important health determinant in children's current and future health. The majority of youth do not meet current physical activity recommendations. Children suffering from depression should be screened for MVPA to encourage meeting physical activity recommendations. As females continue to obtain significantly less MVPA than males, targeted interventions need to be developed for this population. Regular screenings of MVPA levels should be implemented for children to help identifying and counsel those who are insufficiently active.

1211 Board #337 May 27 1:30 PM - 3:00 PM
The Influential Factors Of 'Exercise Is Medicine' Initiative And Its Implementation In China Since The Publication Of Healthy China 2030

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PURPOSE: The study aims at unveiling key influential factors of the EIM in China and investigating the relationship among the factors through employing Interpretative Structural Model (ISM). **METHODS:** Twelve semi-structured interviews were conducted with experts (9male,3 female) with medical, sport and government background. Matrix questionnaires were also completed by the interviewees. **Data Analysis:** 1) Interpretative Structural Model (ISM) was designed following a consultation process with expert group, and key factors were selected to construct adjacency matrix $1)A=[a_{ij}]_{i,j=1,2,3}$ (R indicates S_i and S_j related); $A=[a_{ij}]_{i,j=1,2,3}$ (R indicates S_i and S_j related); 2) Calculate the reachability matrix by Boolean Calculation, $M=(A+I)^{n-1}+(A+I)^{n-2}+\dots+(A+I)^2+(A+I)$; 3) Decompose reachability matrix, $L_i=\{S_j|R(S_j)\cap A(S_j)=R(S_i)=R(S_j),i=0,1,2,k\}$, and then delete rows and columns corresponding to elements in L_i , the reachability matrix is obtained; 4) Establish multi-level directed graph and analysis SIM. **RESULTS:** The first level contains $R(S_2)\cap A(S_2)=R(S_3);R(S_3)\cap A(S_3)=R(S_1)$, so the factors are $\{S_2, S_3, S_1\}$, and then delete the row and column S_2, S_3, S_1 , in the matrix, we can get the second level of the factors, the second level is $\{S_7, S_8, S_{13}\}$, and so on, The third level is $\{S_2, S_8, S_{13}\}$, The fourth level is $\{S_1, S_3, S_9\}$; The fifth level is $\{S_2, S_{10}\}$. These factors of Exercise is Medicine in China can be divided into three layers by ISM analysis, including the surface factors, the middle factors and the decisive factors. **CONCLUSIONS:** As decisive factors, the policy system and economic environment, which are the significantly influential to the policy related to EIM, could be regarded as important contextual factors for the design

and implementation of EIM policy. The middle factors mainly focused on Governance capability and collaboration between sports and medical administration. Relatively, surface factors contains more but pays less attention.

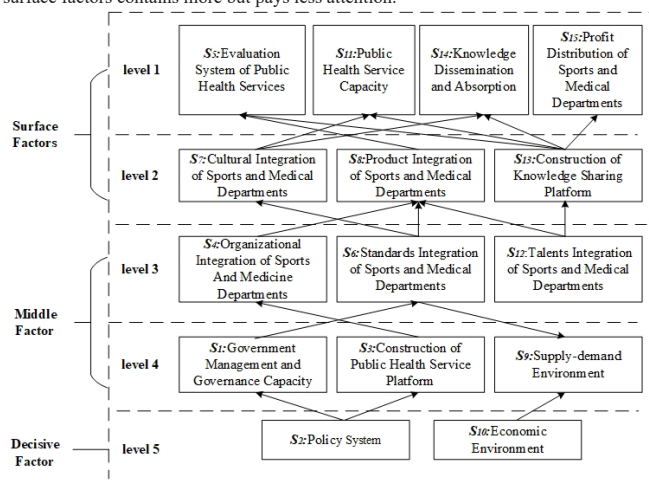


Chart1. The ISM of influencing factors of 'Exercise is Medicine' in China

PURPOSE: To understand key characteristics of ERSs and observe how schemes are currently designed, delivered, and evaluated across the UK.

METHODS: Across the UK, a total of 29 schemes with 73,000 patients were asked to complete a Consensus on Exercise Reporting Template (CERT)-guided questionnaire. The questionnaire evaluated exercise provider's qualifications, materials, delivery, location, tailoring, dosage, and compliance. Data collected were used solely for observations of scheme characteristics across the UK at the present time.

RESULTS: Schemes were typically 12 weeks in length (76%), offered patients two unsupervised exercise sessions in fitness gyms per week (79%), and used a combination of cardiovascular, resistance, free weights, and body weight exercises. Determining progression for resistance exercises was based upon the number of reps and sets completed (76%); for cardiovascular exercises progression was based upon the rating of perceived effort (38%); and for other exercises progression was based upon performance (45%). Just over half of schemes offered a variety of home based exercise components (52%), whether it was just advice or a full exercise programme. Adherence was typically measured through attendance (55%). Common motivational strategies used were goal setting (72%), goal achievement (69%), and acknowledgement of success (62%).

CONCLUSION: This research provides useful insights of schemes' characteristics across England and Scotland. This evidence can support the development of a larger-scale mapping exercise to review further schemes across the whole of the UK, which to date has been lacking. This research has also been insightful in providing initial evidence of what schemes offer and potentially how they can be improved over time.

1212 Board #338 May 27 1:30 PM - 3:00 PM
Molecular Mechanisms For Exercise Intervention On Health Promotion: Interpretation From Autophagy And Target Product Development
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PURPOSE: Exercise is a publically recognized and effective intervention strategy for a series of metabolic or aging-related diseases to accomplish health promotion. However, its molecular mechanisms for the beneficial prevention and rehabilitation of these diseases and health promotion are not explored and elucidated systematically.
METHODS: The animal models with metabolic or aging-related diseases or specific knockout of genes associated with autophagy were established to evaluate exercise intervention efficacy for these diseases, and explore underlying molecular mechanisms through HE staining, Western blotting, RT-PCR and TSM techniques, as well as RNA sequencing and microRNA screening analysis.
RESULTS: Our studies have clarified that appropriate exercise intervention as an inducer of autophagy can rescue the dysfunctional status of autophagy and abnormal mitochondrial energy metabolism under the conditions with these metabolic or aging-related diseases. Exercise-induced autophagy or exercise-mediated microRNAs regulates insulin sensitivity and promotes mitochondrial quality control, thereby executing the prevention and rehabilitation of these metabolic or aging-related diseases, even health promotion.
CONCLUSIONS: Exercise-induced autophagy or exercise-mediated microRNAs is benefit for the prevention and rehabilitation of these diseases and health promotion. The identified signal pathways and microRNAs can be used as the potential targets for the development of novel drug candidates, nutritional supplements, or mimic exercise nutrients for the prevention and treatment of metabolic or aging-related diseases, and health promotion.

1213 Board #339 May 27 1:30 PM - 3:00 PM
Observing Key Characteristics Of Exercise Referral Schemes In The United Kingdom.
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Exercise referral schemes (ERSs) within the United Kingdom (UK) offer individuals an opportunity to take part in an exercise prescription in a non-clinical environment, yet gain clinical health benefits. ERSs at present are heterogeneous in design, implementation, and evaluation; hence limited evidence of their effectiveness exists. Additionally, there has been no concerted effort to map program characteristics until very recently.

1214 Board #340 May 27 1:30 PM - 3:00 PM
The Health, Quality Of Life And Physical Activity Of Older Laos: A Pilot
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In the past decades the urbanization of the Lao people has been dramatic. All-cause mortality is shifting to chronic diseases. Social changes have exacerbated the challenges of caring for a growing elderly population. Little is known about Health Status, Quality of Life, Physical Activity, and Fall Risk/Falls of this population.
PURPOSE: This study (ASEAN Fulbright Scholarship) explored the feasibility of working with the Rural Development Agency (RDA) to collect survey data on health determinants of elderly Lao.
METHODS: Eight volunteers from the RDA were trained and solicited elders to be surveyed in Vientiane province (Demographic and Health Status Questionnaire, SF36, IPAQ & Thai-FRAT - fall risk).
RESULTS: During the 1-month effort, 399 (aged 55+) individuals were surveyed. Highlights include: Of the interviewees, 98.3% were ethnic Lao, 43% were men and 57% were women, with 60% living in urban settings, 31% suburban and 9% in a rural community. On average all age groups were classified as overweight, except men 71-80 yrs. Just over 20% were smokers with a large majority consuming alcohol on a regular basis. About 1/3 reported having high blood pressure; evenly distributed across age and gender. Type II diabetes was reported in 18% of the women and 8% in men. Over 40% experienced depression. On average a majority of women and men over 70 in the urban and suburban settings did not meet the ACSM minimum of 150 min/week of moderate/vigorous physical activity, while those in the rural setting exceeded this goal. Pain was a significant issue for younger urban men and all those living in the suburban setting. The lowest pain levels were reported by those living rurally. The domain of physical functioning showed those in the rural setting being the most active and healthy. Eighty participants reported having at least 1 fall in the past 6 months. No significant differences in fall rates were found between genders. All but 1 of the falls occurred in the urban or suburban environments. The vast majority of the falls occurred in those over 71 years of age.
CONCLUSION: This study was the first of its kind in Laos. While the sample size was beyond expectations, rural areas and those with health and mobility issues were underrepresented. Those approached to complete the surveys were eager to participate. The goal is to expand this study throughout Laos.

WEDNESDAY, MAY 27, 2020

B-82 Exercise is Medicine®/Poster - EIM: Exercise and Various Diseases and Health Conditions

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

1215 Board #341 May 27 1:30 PM - 3:00 PM High Intensity Inspiratory Muscle Training In Individuals With Chronic Disease: A Systematic Review With Meta-analysis

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Inspiratory muscle training (IMT) is a strategy of treatment of patients with poor inspiratory muscle performance, with dyspnea, low exercise tolerance, and low functional status. Moderate loads are currently used (30 - 50% of maximal inspiratory pressure, MIP) and high-intensity IMT (HI-IMT) with 60% or more of MIP is being studied in randomized clinical trials. **PURPOSE:** To determine the effect of high intensity inspiratory muscle training (HI-IMT) on respiratory muscle strength in individuals with chronic diseases.

METHODS: For this meta-analysis, the sources were conducted in PubMed, Scopus, SciELO and Bireme, using different keywords and operators. The review was recorded in the systematic review registration base PROSPERO, under registration number CRD42019131984, and follows the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. Two researchers carried out the search independently in July of 2019. The outcomes were the effect and characteristics of interventions with high intensity inspiratory muscle training in individuals with chronic diseases. The variables were inspiratory muscle strength (Pimax) before and after intervention or the difference between this, training load, number of sessions, numbers of sets, and number of repetitions chosen for the control and intervention groups.

RESULTS: Were found 166 studies in initial source. After excluded of duplicates (n=30) and reading of title and abstracts, five studies were included on meta-analysis. Populations analyzed included chronic pulmonary disease, cystic fibrosis and cancer patients. As characteristics of interventions, the mean duration was 8.8±5 weeks, 4.5±1.15 sessions per week, the most common effort intensity was 60% of MIP with 15.3±12.8 repetitions, 4.75±1.9 sets and 1.5±0.5 min of recovery between them. The results indicated that HI-IMT increases in 15.58 cmH₂O [CI95% = 2.40 - 28.75] the strength on inspiratory muscle when compared to control group (p=0.02)

CONCLUSIONS: High intensity inspiratory muscle training is able to increase the respiratory muscle strength of patients with chronic pulmonary disease, cystic fibrosis and cancer.

1216 Board #342 May 27 1:30 PM - 3:00 PM Exercise To Treat Women With Pulmonary Lymphangioleiomyomatosis (LAM)

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(No relevant relationships reported)

Lymphangioleiomyomatosis is an interstitial, cystic lung disease that destroys the lung parenchyma, ultimately leading to respiratory failure. This disease affects females almost exclusively. Only two long-term treatment options exist: 1) single or bilateral lung transplant, which only slows the disease as the newly-transplanted lungs will soon succumb to the disease, and 2) rapamycin (Rapamune), a costly mTOR inhibitor that may result in multiple side effects and is not always tolerated by users. We sought to examine if moderate- to high-intensity exercise could slow or reverse the pulmonary decline seen with LAM. **PURPOSE:** To determine if a three-month exercise intervention had a positive impact in women with LAM. **METHODS:** Eight women with LAM (aged 27-60) were recruited to participate in an in-person exercise training intervention consisting of moderate- to high-intensity aerobic and anaerobic exercise. Prior to the study VO_{2max} was assessed, as well as pulmonary function (FEV₁, FVC, FEV₁/FVC, and peak flow) and bone mineral density (BMD). After three months these measures were again tested. **RESULTS:** After three months of training, VO_{2max} increased 12% from baseline (p=0.06). FEV₁ improved by 4%. While this was not statistically significant (p=0.19) this is nonetheless substantial, as this is the primary clinical measure used to assess a decline in pulmonary function. This is also the first non-pharmaceutical study to demonstrate an increase, rather than a decline, in lung function. Peak flow also improved by 11% (p=0.18). BMD also slightly improved

over three months (p=0.12), also significant as LAM patients have been shown to demonstrate a loss of BMD at a five-fold increase compared with healthy females. Though underpowered, this is the first non-pharmaceutical intervention study to show improved exercise tolerance, lung function, and bone health in women with LAM.

1217 Board #343 May 27 1:30 PM - 3:00 PM Whole-body Vibration Exercise Improve Lumbopelvic Proprioception For Patients With Nonspecific Low Back Pain

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(No relevant relationships reported)

Purpose: Nonspecific low back pain (NSLBP) accounts for a large proportion of low back pain cases. The present study aimed to investigate the effect of the whole-body vibration (WBV) exercise on lumbar proprioception in NSLBP patients. It was hypothesized that WBV exercise enhances lumbar proprioception.

Methods: Forty-two patients with NSLBP performed an exercise program 3 times a week for a total of 12 weeks of WBV. The lumbar proprioception was measured by joint position sense. Outcomes were lumbar angle deviation and visual analogue scale (VAS) score.

Results: After the 12-week WBV exercise, lumbar flexion angle deviation was reduced from 3.65±2.26° to 1.90±1.07° (P=0.0001), and extension angle deviation was reduced from 3.06±1.85° to 1.61±0.75° (P=0.0001), significantly lower than baseline. After participating in the 12-week WBV exercise, a significant pain reduction was observed (P=0.0001). Men in the whole group (n=32) indicated significantly lower angle deviations in flexion and extension, whereas women (n=10) indicated significantly lower flexion angle deviation (P=0.037), and no significant difference was found in extension angle deviation (P=0.052). However, by subdividing the entire group (n=42) into poor and good proprioceptive groups, WBV exercise presented significant enhancement of lumbar proprioceptive ability in the poor flexion proprioception subgroup, poor extension proprioception subgroup, and good extension proprioception subgroup (each P=0.0001), but not in the subgroup with good flexion proprioceptive ability (P=0.165).

Conclusions: Lumbar flexion and extension proprioception as measured by joint position sense was significantly enhanced and pain was significantly reduced after 12-week WBV exercise in NSLBP patients. However, the patients with good flexion proprioceptive ability had limited proprioceptive enhancement.

Source of support: Fok Ying-Tong Education Foundation of China (161092); Shanghai Municipal Commission of Health and Family Planning (201840346); Shanghai Key Lab of Human Performance (Shanghai University of Sport) (11DZ2261100); the scientific and technological research program of the Shanghai Science and Technology Committee (19080503100).

1218 Board #344 May 27 1:30 PM - 3:00 PM Road To Zero Percent Low Back Pain At Work - 23-years Progress

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Background and Objective: Low back pain is approximately 80% of cause of job-related disability in Japan. Risk factors for developing low back pain have been well documented, which include occupational risk factors, types of job requiring heavy lifting, pushing, pulling, one's fitness levels, and mental health factors. In this long-term project, we have focused on these secondary risk factors of low back pain. We have designed and implemented *dynamic, comprehensive low back pain workshop*. The objective of this study was to examine how the company-based workshop has offered and reached to 0% low back pain at work.

Methods: The project period was from 1982 to 2004. In 1982, about 1,100 male workers at a soft-drink company participated in the project. Their mean age at the starting of the project was 29 ± 5.3 years. All healthy participants took the modified Kraus-Weber test measuring their strength and flexibility of key postural core muscles. The test was graded for each movement. Also, the participants took questionnaire survey on low back pain. The *dynamic, comprehensive low back pain workshop* included endurance exercise, strength training, stretching, safe work-related movement practices, lectures on low back pain, good posture, and implementing preventive workplace events.

Results: The total number of participants in this project was 24,289. The mean age of participants in 2004 was 42.6 ± 9.7 years. The results of the questionnaire survey revealed that low back pain which hinders work, decreased from 44.6% in 1982

to 0.2% in 2004. The number of absenteeism due to low back pain decreased from 480 days to 0 day a year. The perfect score of Kraus-Weber increased from 35.4% to 83.7%. A negative correlation was observed between low back pain and the Kraus-Weber test.

Conclusions: This study demonstrated that company-based *dynamic, comprehensive low back pain workshop* improved physical fitness and work movements over a long-term. The workshop was effective reducing low back pain at work. Further research is required to be assessed whether the reduction in low back pain at work is related to a range of key health and work-related outcomes, and how the *dynamic, comprehensive low back pain workshop* can be further improved.

1219 Board #345 May 27 1:30 PM - 3:00 PM

Association Between Physical Activity With Bone Mineral Density And Handgrip In Children With Osteogenesis Imperfecta

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(No relevant relationships reported)

Purpose: To evaluate the association between physical activity with bone mineral density and handgrip in children with osteogenesis imperfecta. **Methods:** The sample consisted of 8 children of both sexes (8.2±1.3) years old, with osteogenesis imperfecta (I, III and IV type), body weight (24.0±7.9) kg, height (116.9±14.1)cm, cycle of intravenous pamidronate therapy (7.2±4.9). These patients are linked to the Reference Center for Osteogenesis Imperfecta in Santa Casa Medical School. Weight (kg), height (cm), handgrip (kg) were evaluated by CELAFISCS standardization. Physical activity (MET's) [Barros et al., 1993], total bone mineral density (g/cm²), total body less head TBLH (g/cm²) lumbar bone mineral density (g/cm²) [Bishop et al., 2008] and bilateral handgrip (Matsudo, 2005). **Statistical Analysis:** Pearson's correlation (r) was used for association between usual weekly physical activity and the following variables: total bone mineral density (g/cm²), total body less head TBLH (g/cm²), lumbar bone mineral density (g/cm²), and bilateral handgrip (kg). It was used a significant level of p ≤ .05. **Results:** There was a positive and significant high intensity correlation between physical activity with lumbar bone mineral density, but not with total bone mineral density, total body less head TBLH, and bilateral handgrip (see table below). **Conclusion:** it seems that physical activity exert a positive effect on the lumbar bone mineral density. However, physical activity was not significantly associated with total bone mineral density, total body less head TBLH and handgrip in children with osteogenesis imperfecta.

Weekly Physical Activity n=8 (: 55,0 ± 32,7) MET's		r	p
Total Bone Mineral Density	(g/cm ²)	.199	.636
Lumbar bone mineral density	(g/cm ²)	.916*	.001
Total Body Less Head TBLH	(g/cm ²)	.109	.797
Right Handgrip	(kg)	-.240	.567
Left Handgrip	(kg)	-.136	.749

*p≤.05: Pearson Correlation

1220 Board #346 May 27 1:30 PM - 3:00 PM

The Effect Of Baduanjin Exercise On University Students With Neck/shoulder Muscle Strength Imbalance

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(No relevant relationships reported)

Muscular strength imbalance (MSI) on shoulder and neck is often a detonate for shoulder and neck postural diseases, for this reason, improving the neck/shoulder muscle imbalance could be a good method to prevent neck and shoulder problems. **PURPOSE:** This study tested the efficacy of Baduanjin exercise (BDJ), a traditional Chinese mind-body exercise, on shoulder and neck muscle strength imbalance, and see if it is possible through this method provide a new idea of sports rehabilitation for shoulder and neck diseases problems. **METHODS:** 40 sedentary university students, with either forward head posture and/or round shoulder posture were randomized to the BDJ intervention group (n=20) and control group (n=20), the same evaluation protocol was used before and after

the intervention. During six weeks of training, The BDJ group was given Baduanjin training combined with a basic health education program, and the control group was treated only with a basic health education program. Baduanjin training was conducted three times a week, every time 50 minutes. The contents of health education program include healthy lifestyle tips, postural education and muscle stretching method. **RESULTS:** Significant changes were found within the BDJ group, specially on Forward Head Angle test, Maximal Internal/External Rotation test and upper quarter Y-balance test. **CONCLUSIONS:** this randomized control trial provides some evidence to support the positive effect of BDJ exercise as a new method of sport therapy for rehabilitation among people with shoulder/neck MSI.

1221 Board #347 May 27 1:30 PM - 3:00 PM

Racerunning Training For 12 Weeks Improves Physical Fitness And Promotes Skeletal Muscle Hypertrophy In Adolescents And Young Adults With Cerebral Palsy

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PURPOSE: Individuals with cerebral palsy (CP) typically lead sedentary lives, predisposing this patient group to metabolic dysfunction and cardiovascular disease. There are currently not many exercise options for individuals with severe disabilities. A novel addition is the RaceRunner, a tricycle propelled forward by stepping on the ground. The purpose of this study was to investigate training adaptations following a 12-week Racerunning training protocol in individuals with CP. **METHODS:** Fifteen adolescents/young adults (mean age 16, range 9-29, 8 males/7 females) with CP (GMFCS I-IV; 1-3-4-7) completed 12 weeks, 2 times per week, of RaceRunning training. Measurements of physical fitness (6-min RaceRunning test, average and maximum heart rate), passive range of motion (pROM) of hip, knee and ankle joints and skeletal muscle thickness in the thigh and lower leg were collected before and after the training period. **RESULTS:** Distance covered during the 6-min RaceRunning test increased on average 36% (pre 576 ± 325 m vs. post 765 ± 428 m, p<0.001). Average and maximum heart rate during the 6-min RaceRunning test was not different pre vs. post training. Muscle thickness of m. gastrocnemius increased in response to training (p<0.05) on the more affected side. Dorsiflexion pROM in the more affected ankle decreased (p<0.05), while hip-flexion pROM in the less affected side increased (p<0.05). **CONCLUSIONS:** Twelve weeks of RaceRunning training improves physical fitness in individuals with CP. Moreover, RaceRunning stimulates skeletal muscle hypertrophy of the calf muscle. These results speak in favor of RaceRunning as a powerful and effective training modality in individuals with CP promoting both central and peripheral adaptations.

1222 Board #348 May 27 1:30 PM - 3:00 PM

Supervised Physical Activity Is Important To Counteract Negative Impacts Of Cancer On Physical Activity Behavior

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PURPOSE: The theory of planned behavior (TPB) is used to document children's psychological parameters linked to their physical activity practice to better understand their physical activity behavior. The TPB model evaluates the informational and motivational parameters that contribute to the practice of physical activity. This study aimed to assess the evolution of children's physical activity levels (MVLPA) during the first months of their cancer, in addition to document the evolution of TPB measures, self-reported fitness and self-esteem in the physical domain to better understand children's physical activity behavior. **METHODS:** A total of 16 children (8 boys and 8 girls) with cancer were recruited in the context of the VIE (Valorization, Implication and Education) study. Patients answered psychosocial questionnaires at their diagnosis of cancer (time 1), six to eight weeks following their diagnosis (time 2) and six weeks after the physical activity program (time 3). The physical activity program was composed of two physical activity sessions (≈45min) per week for six weeks at moderate intensity. The integration of the family in the physical activity process was taken into consideration.

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RESULTS: A significant decrease of 41.2min/day of daily MVLP was observed between the time at cancer diagnosis (50.5±32.8min/day) and six to eight weeks after the first interview (9.3±9.1min/day). After the physical activity program (23.1±10.8min/day), we observed a significant increase of 13.8 min/day of daily MVLP. We found that time after the diagnosis of cancer negatively impacted children's TPB measures (mean in attitude, injunctive norms, identity, facilitating factors, self-confidence and intention) and MVLP levels, while that the time after the physical activity program positively impacted children's TPB measures (mean in attitude, injunctive norms, identity, facilitating factors, self-confidence and intention) and MVLP levels.

CONCLUSIONS: This study highlights the need to provide children with physical activity support as soon as the cancer is diagnosed and shows the importance of familial support by injunctive norms to improve children's physical activity behavior. These findings help to better understand the effect of cancer diagnosis on children's physical activity behavior

1223 Board #349 May 27 1:30 PM - 3:00 PM
Impact Of A Free-living Activity Intervention On Real-time Fatigue In People With Multiple Myeloma Treated With Autologous Hematopoietic Cell Transplantation

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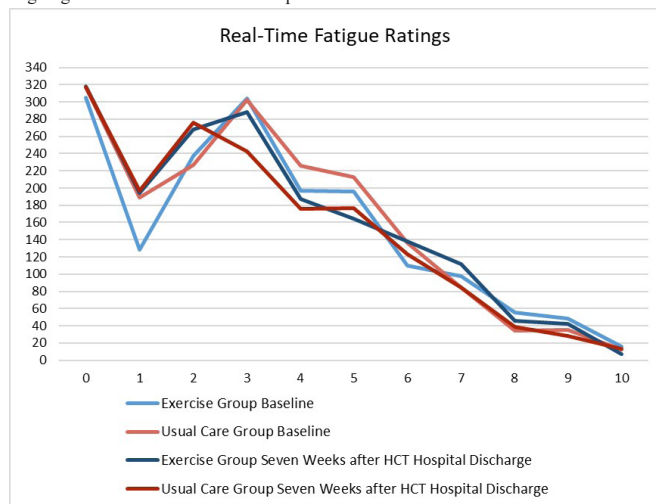
(No relevant relationships reported)

PURPOSE: Autologous hematopoietic cell transplantation (HCT) is commonly used to treat multiple myeloma (MM). Moderate to severe fatigue is associated with the treatment. Sustainable physical activity incorporated in daily activities may reduce fatigue. This study evaluated the impact of a free-living physical activity intervention (STEPS) compared to usual care on real-time fatigue.

METHODS: A two-group, randomized block, repeated measures design (n = 32) was used. The six-week STEPS intervention aimed to increase physical activity by 10% weekly through education, goal-setting, daily step tracking using wearable technology, and guided integration of physical activity into daily routines following HCT hospital discharge. Real-time fatigue was measured with a one-item fatigue intensity scale using computerized ecological momentary assessment eight times per day over seven days. Participants rated their fatigue intensity on a 0 (no fatigue) to 10 (worst fatigue) scale.

RESULTS: Participants provided 6906 ratings of real-time fatigue (3469 prior to HCT and 3437 seven weeks following HCT discharge). Prior to HCT, the STEPS group reported fatigue as mild (57.5%, n = 974 ratings), moderate (29.7%, n = 503 ratings) or severe (12.8%, n = 217 ratings). Following the intervention, the STEPS group reported fatigue as mild (60.5%, n = 1068 ratings), moderate (27.7%, n = 409 ratings) or severe (11.7%, n = 207 ratings). The usual care group reported fatigue as mild (58.3%, n = 1035 ratings), moderate (32.3%, n = 575 ratings) or severe (9.2%, n = 165 ratings) and mild (61.7%, n = 1033 ratings), moderate (28.5%, n = 476 ratings) or severe (9.8%, n = 164 ratings) after the intervention period.

CONCLUSIONS: Although preliminary, differential improvement in real-time fatigue following the STEPS intervention did not occur in the STEPS. Between 35% and 40% of real-time fatigue ratings were classified as moderate or severe demonstrating ongoing need for intervention development.



1224 Board #350 May 27 1:30 PM - 3:00 PM

The Influence Of A 12-week Home-exercise Program On Physical Fitness And Physical Functioning In Childhood Survivors Of Acute Lymphoblastic Leukaemia: Results Of A Randomised Clinical Trial

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PURPOSE: Positive effects of home-exercise programmes on physical fitness have been reported in studies with childhood malignancy. However, conclusive evidence on the impact of home-exercise programmes for physical fitness indicators or functional capacity during daily life activities outcomes in leukaemia is yet to be established. Therefore, the research question for this randomised controlled trial was: Does home-exercise programme improve the physical fitness and physical functioning outcomes more than usual care among children survivors of ALL? **METHODS:** A parallel-group, assessor-blinded, pilot randomised controlled trial was conducted at the Santa Creu i Sant Pau Hospital in Spain (NCT03005392). Twenty-four survivors of ALL were assigned to usual care (control group, n=12, 11.0±3.7 years) or to a home-exercise programme (intervention group, n=12, 11.8±4.3 years). Peak oxygen uptake (VO_{2peak} ml/kg/min), minute ventilation (VE L/min), output of carbon dioxide (VCO₂ L/min), respiratory exchange ratio (RER), peak heart rate (beats/min), maximal load (W), VO₂ at anaerobic threshold (VO₂ at AT, ml/kg/min), pulse oxygen (PO₂ ml/beat), heart rate at anaerobic threshold (beats/min), handgrip test (pounds), flexibility (cm), Timed Up & Go test TUG (s), and Timed Up and Down Stairs test (TUDS s) were measured at baseline and over 16 weeks of intervention.

RESULTS: Adjusted mixed linear models revealed a significant group-time interaction +6.7 (95% CI = 0.6-12.8 ml/kg/min; η² partial = 0.046, P=0.035) for VO_{2peak}. Similarly changes in mean values was observed after the home-exercise programme compared to baseline for VE (L/min) -8.8 (3.0) (P=0.035), VCO₂ -0.23 (0.08), (P=0.041), maximal load (W) -35.5 (12.8) (P=0.024), TUDS (s) 0.8 (2.6) (P=0.010), and TUG (s) 0.60 (0.1) (P=0.001), however the group-time interaction were not significant. **CONCLUSIONS:** The home-exercise program resulted in changes in measures of VO_{2peak}, VE, VCO₂ and functional capacity during daily life activities (TUDS and TUG test). This is an interesting and important study that surely adds to the current body of knowledge/ literature on the safety of exercise interventions, especially in children with haematological cancer.

1225 Board #351 May 27 1:30 PM - 3:00 PM

The Practice Of Physical Activity Protects The Lung Function And Mechanics In Hypertensive Elderly

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PURPOSE: Hypertension is still a growing problem in public health, presenting higher rates among elderly. Recent studies have pointed out that hypertension may be an independent factor impairing the lung function. In addition, several studies have demonstrated that physical activity promotes beneficial effects in hypertensive individuals, but never before the impact of physical activity on lung function and mechanics in hypertensive and non-hypertensive elderly have been evaluated.

METHODS: 110 physically active hypertensive elderly (ActH; 69.39 ± 5.49 years old) and 187 sedentary hypertensive elderly (SedH; 70.09 ± 7.51). The inclusion criteria: no respiratory diseases, unable to perform spirometry test, no respiratory infections in the last 30 days. Lung function (spirometry) and lung mechanics (by impulse oscillometry) was evaluated according to American Thoracic Society recommendations by using IOS Masterscreen Jaeger (Germany). Graph Pad Prism 5.0 was used to perform statistical analysis and p<0.05 were considered significant.

RESULTS: The analysis of lung function revealed that physical activity preserved the lung function (forced vital capacity - FVC) as demonstrated by comparison between ActH versus SedH group (3.65 ± 0.05 x 2.79 ± 0.07; p<0.01). Similarly, the forced expiratory volume in the first second (FEV1) was higher in ActH when compared with SedH elderly (2.96 ± 0.04 x 2.12 ± 0.05; p=0.02) as well as the FEV1/FVC relation (84.06 ± 0.77 x 75.99 ± 0.57; p=0.03). Concerning the lung mechanics, the results

revealed that physical activity was able to preserve the impairment of distal lung elastance (X5), when compared ActH with SedH elderlies (-1.60 ± 0.19 x -1.47 ± 0.10 ; $p < 0.02$) and also the impairment of proximal airways resistance (R20Hz), (2.58 ± 0.06 x 3.12 ± 0.09 ; $p < 0.0001$). **CONCLUSIONS:** Physical activity preserves the lung function and mechanics in elderlies in hypertensive elderlies.

1226 Board #352 May 27 1:30 PM - 3:00 PM
Hypertension Treatment And The Amount Of Physical Activity And Sitting Behaviour - First Blood Pressure Then Exercise Complain

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Physical inactivity is associated with many chronic diseases and premature mortality and increasing evidence also suggests that high levels of sedentary time may increase the risk of chronic diseases and mortality. All intensities of physical activity, including light intensity, are associated with a substantially reduced risk of death in a dose-response manner. A statistically significantly higher risk of death was observed for sedentary times of 9.5 or more hours daily.

PURPOSE: By conducting a pilot survey among people interested in sports concerning physical activity and sedentary lifestyle, we analyse the need to conduct a nationwide educational campaign on the risks of sedentary behaviours in Poland. **METHODS:** The survey was conducted during the largest fitness fair in Poland, "Go Active Show", bringing together people associated professionally and amateurically with sport. 1,000 questionnaires were conducted, including questions based on the IPAQ Short Form questionnaire and NATPOL 2011 survey. Demographic data, number of minutes per day of moderate and intensive physical activity and number of hours per day spent sitting were assessed. For the first time in Poland we asked a question about the number of minutes of exercise and time spent on sitting. **RESULTS:** The study involved 1000 people, 58% of whom were women and 42% men, 55% people with higher education and 44% living in large cities. 62% of the participants had normal body weight. Sitting - 256 people (25.6%) declared 9.5 or more hours of sitting per day. On average, they spend 41.8 minutes a day on moderate physical activity and 29 minutes a day on intensive exercise. **CONCLUSIONS:** The study group was highly aware of the healthy lifestyle, as the majority of people with higher education and living in large cities with more than 500,000 citizens. They also presented a high level of physical activity. However, they are still not aware of the risks of sedentary behaviours and increased risk of premature death. Therefore, it is necessary to launch a nationwide educational campaign in this area in Poland.

1227 Board #353 May 27 1:30 PM - 3:00 PM
Exercise Is Medicine For Hypertension: But What's The Prescription?

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PURPOSE: Exercise is an important therapy option for patients with chronic diseases. For the example of arterial hypertension, the study assessed the reporting quality of exercise-based interventions included in the latest meta-analysis on that topic in order to evaluate the transferability of findings into clinical practice.

METHODS: Reporting quality of 24 randomised controlled trials from a meta-analysis assessing blood pressure lowering effects of endurance training in 1,195 hypertensive patients was evaluated using TIDieR (Template for Intervention Description and Replication) and CERT (Consensus on Exercise Reporting Template) guidelines. Associations between reporting quality, publication year and impact factor of the publishing journals were examined.

RESULTS: None of the studies described all intervention components completely. On average 61% (95%CI: 52-69) (TIDieR) and 57% (95%CI: 49-64) (CERT) of core items required for replication were reported. Frequent shortcomings were the reporting of adherence, intervention provider, and adverse events. Details about exercise dosage were missing in 22% (95%CI: 4-40). Publication year was related to the adherence to TIDieR ($r = -0.549$, $P = 0.007$) but not to CERT. No associations with journal impact factor were found. **CONCLUSIONS:** Further work is required to establish the replicability and uptake of exercise interventions in clinical practice for common chronic diseases. Researchers should apply, and review authors, journal editors and reviewers should check adherence to reporting guidelines. To ensure an adequate quality of reporting of exercise interventions for different diseases, it might be useful to

develop guidelines which integrate indication-specific exercise-related parameters such as blood sugar for patients with diabetes, oxygen saturation for COPD, pain scales for musculoskeletal diseases.

1228 Board #354 May 27 1:30 PM - 3:00 PM
Sex Differences In Leptin And Cardiometabolic Profile After Exercise Intervention In Obese And Hypertensive Adults

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PURPOSE. To analyse the change on leptin, body composition, blood pressure (BP), cardiorespiratory fitness (CRF) and some biochemical parameters in overweight/obese and physically inactive women (W) and men (M) with primary hypertension (HTN), and to evaluate the potential sex differences in the change after intervention. **METHODS.** Participants (n=37 women, n= 40 men, 52.9±6.9 yrs) from the EXERDIET-HTA study were randomized into attention control group (physical activity recommendations) or one of three supervised aerobic exercise groups (two days/week). All participants received the same hypocaloric diet. All variables were assessed pre and post-intervention. A blood sample (12.5 mL) was collected from each participant following an overnight fast to determine the biochemical profile and leptin values. 24-h ambulatory BP monitoring was used to analyze systolic and diastolic BP. A cardiopulmonary exercise test was performed to determine peak oxygen uptake (VO_{2peak}). **RESULTS.** Following the intervention, there were significant increments ($P < 0.01$) in CRF by VO_{2peak} ($W = 21.1 \pm 3.7$ vs. 24.6 ± 4.4 mL·kg⁻¹·min⁻¹, $M = 26.3 \pm 6.0$ vs. 33.1 ± 10.2 mL·kg⁻¹·min⁻¹) and decreases ($P < 0.05$) in leptin ($W = 49.5 \pm 23.0$ vs. 41.8 ± 19.9 ng/mL, $M = 20.5 \pm 14.8$ vs. 12.9 ± 18.6 ng/mL), body mass ($W = 84.7 \pm 12.1$ vs. 80.3 ± 11.5 kg, $M = 97.9 \pm 14.4$ vs. 91.5 ± 13.3 kg), waist perimeter ($W = 97.3 \pm 10.7$ vs. 94.3 ± 10.9 cm, $M = 107.9 \pm 8.7$ vs. 101.5 ± 7.9 cm), fat mass ($W = 42.3 \pm 5.1$ vs. 38.6 ± 8.4 %, $M = 31.2 \pm 5.0$ vs. 28.0 ± 4.4 %), systolic BP ($M = 136.5 \pm 12.1$ vs. 129.3 ± 12.5 mmHg), diastolic BP ($W = 76.2 \pm 8.9$ vs. 74.1 ± 8.7 mmHg, $M = 79.3 \pm 7.2$ vs. 75.0 ± 8.2 mmHg), total cholesterol ($M = 216.1 \pm 44.5$ vs. 196.1 ± 35.0 mg/dL), insulin ($W = 13.4 \pm 7.9$ vs. 9.4 ± 4.2 mU/L) values. There were significant between-sex differences in body mass ($W = 5.2$ %, $M = -6.5$ %, $P = 0.023$), waist circumference ($W = -3.1$ %, $M = -5.9$ %, $P = 0.004$), and VO_{2peak} ($W = 14.2$ %, $M = 20.5$ %, $P = 0.036$). **CONCLUSIONS.** Aerobic exercise along with a hypocaloric diet is an effective non-pharmacological intervention to induce beneficial changes in W and M in BP and leptin as a mediator of obesity-induced HTN, and other regulatory mechanisms such as body composition, CRF and biochemical profile. The found sex-related differences could confirm the need for individual non-pharmacological strategies.

1229 Board #355 May 27 1:30 PM - 3:00 PM
Correlation Of Functional Capacity And Impact On Life Quality Of Type II Diabetes Patients

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Diabetes mellitus (DM) is a chronic progressive disease characterized by high blood glucose levels and stands out as an important and growing health problem worldwide, which can lead to reduced functional capacity (FC) and the quality of life (QOL). However, the association is still poorly studied. **PURPOSE:** To evaluate FC through Shuttle Walking Test Endurance (SWTE) and its association with QOL of type II diabetic (T2D) patients. **METHODS:** This is a cross-sectional study. Patients aged ≥18 years, sedentary, with medical diagnosis of T2D were included. Information such as gender, age, glycated hemoglobin and body mass index (BMI) were collected during an interview prior to the application of the physical test. The QOL was assessed by the Medical Outcomes Study 36 - Item Short - Form Health Survey (SF36) questionnaire, highlighting the "Pain", "Emotional Aspects" and total score domains. **RESULTS:** Forty-one patients (24 women/17 men) participated in the study, with a mean age of 57 ± 10 years. Most of them were overweight individuals with a BMI of 29.5 ± 3.8. The average distance achieved by patients in SWTE was 1020 (360-2200) meters. The mean scores on the SF36 questionnaire were 40 (2-100), 83 (0-100) and 543 (105-704) respectively for the "Pain", "Emotional Aspects" and Total Score domains. Significant correlations were found between the distance covered in SWTE and the domain "Pain", the domain "Emotional aspects" and the total score of the SF36 questionnaire, respectively ($R = 0.4$; $R = 0.4$ and $R = 0.4$; $p < 0.01$). Significant correlation was also

found between the distance covered in SWTE and age $R = -0.4$; $p < 0.01$ of T2D patients. **CONCLUSION:** The findings of the present study suggest that SWTE may be a simple and useful tool in clinical practice for FC measurement and performance in this field test may be strongly associated with QOL of T2D patients.

1230 Board #356 May 27 1:30 PM - 3:00 PM
Preparing For A Behavioral Physical Activity Intervention In Women With Gestational Diabetes Mellitus

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PURPOSE: In preparation for a behavioral physical activity (PA) intervention promoting walking/stepping in place in women diagnosed with gestational diabetes mellitus (GDM), this study sought to assess the accuracy of the Fitbit Charge 3 in recording steps during walking and stepping at three cadences in pregnant women. The study also sought to elicit women's thoughts and feelings on the proposed walking/stepping intervention.

METHODS: Women diagnosed with GDM (N=15) were recruited in the third trimester. Participants wore a Fitbit Charge 3 on the non-dominant wrist and completed a total of six 2-minute bouts that varied by mode (walking vs. stepping in place) and cadence (67, 84, and 100 steps/minute). Bout sequence was randomized. Actual steps were determined by hand-tally, the criterion, in duplicate. One-way and two-way ANOVA were used to examine differences in the mean percentage of steps recorded, by mode and cadence. Participants also completed a 20-minute semi-structured interview with questions on opportunities for PA, challenges to PA, PA preferences, and use of a FitBit to track steps and set goals during walking/stepping. Interviews were audio-recorded and transcribed, then analyzed using descriptive and interpretive coding to identify themes.

RESULTS: There was a statistically significant difference in the percentage of steps recorded by cadence ($p < .01$), but not by mode ($p = .23$); no interaction was detected between mode and cadence ($p = .17$). Analyses of cadence only suggested that 67 steps/minutes (lowest) may differ significantly from the other cadences (67 steps/minute = 113%, 84 steps/minute 97%, 100 steps/minute = 95%; $p = .05$). In the interviews, most reflected on the complexity of their lives making daily PA difficult, and indicated preference for three 10-minute bouts of walking/stepping over one 30-minute bout per day.

CONCLUSIONS: The Fitbit Charge 3 may overestimate steps at lower cadences. However, step count did not differ with respect to mode at the cadences examined. Results suggest that the Fitbit Charge 3's step count is suitable for use in a behavioral PA intervention promoting walking/stepping by tracking and goal setting. Interview data additionally suggested that walking/stepping interventions for women with GDM should afford convenience and flexibility to participants.

1231 Board #357 May 27 1:30 PM - 3:00 PM
The Cross-sectional Effect Of Abnormal Glucose Metabolism On Balance Ability, Muscle Strength, And Body Composition In Men

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PURPOSE: To investigate the association between balance ability, muscle strength, and body composition, and fasting blood glucose **METHODS:** 1) Subjects: 2693 men (aged 19-73 years old) were recruited from three health management central of hospitals in China, without any diagnosed diseases other than diabetes. 2) Measurements: People's grip strength was measured 3 times in dominant hand in a standing position and read the highest value; balance ability was measured by one-leg standing time with both eye-closed; body composition was measured by BIA; fasting venous blood was taken for blood glucose test. All subjects were divided into normal blood glucose group (Normal: < 6.1 mmol/L), impaired fasting glucose group (IFG: $6.1-7.0$ mmol/L), and diabetes group (DM: ≥ 7.0 mmol/L). 3) Statistics: Multivariate analysis of variance was used for comparison among groups; Pearson test was used for correction analysis; the significance level (α) for hypothesis testing was set to 0.05. **RESULTS:** Normal glucose men were significantly younger than those in the IFG and DM group (38.76 ± 9.45 vs. 44.57 ± 9.09 vs. 45.87 ± 4.79 yrs, $P < 0.05$). Normal glucose

men had significantly lower body weight and lower percent body fat than those in the IFG and DM group (BW: 70.70 ± 11.29 vs. 75.68 ± 10.40 vs. 77.23 ± 11.66 kg, $P < 0.05$; BF%: 15.55 ± 6.38 vs. 18.97 ± 5.82 vs. 25.12 ± 5.62 , $P < 0.05$). Balance ability, relative grip strength, and muscle percentage [(body muscle/ body weight)*100] were different in three groups ($P < 0.05$). There were inverse linear associations between incremental level of blood glucose and lower values of balance ability, relative grip strength, and muscle percentage ($r = -0.067$, $r = -0.158$, $r = -0.171$, $P < 0.05$ for each). After adjusted age, the blood glucose level was still correlated with balance ability ($r = -0.035$, $P = 0.068$).

CONCLUSIONS: The men's balance ability decreases with the increase of blood glucose level. There are inverse linear associations between muscle strength and muscle percentage and blood glucose level. **Acknowledgement:** 1) China Health Foundation Project "Multi-Center Application Research on Fitness Fitness Test and Exercise Management" (CHPF2014-FITEX); 2) National Key Research and Development Program Major Prevention and Control Research on Chronic Non-communicable Diseases (2016YFC1300202).

1232 Board #358 May 27 1:30 PM - 3:00 PM
Comparative Study Of Resistance And Aerobic Exercise In Pre-diabetes: An Rct

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PURPOSE: Although the benefit of aerobic exercise in IGR is proven, the impact of resistance exercise on IGR is still unclear. Therefore, the differences between aerobic and resistance exercise on IGR was analyzed to provide a theoretical and practical basis for DM prevention and IGR management.

METHODS: Single-blind RCT. IGR participants were divided into 3 groups randomly: aerobic exercise (A, n= 26), resistance exercise (R, n= 23), and control (C, n=21). The effect of aerobic and resistance exercise on IGR was analyzed and the relationship with obesity was investigated after 12-weeks intervention.

RESULTS:

(1) FPG in groups A and R was decreased significantly by 6.17% and 4.81%, and OGTT 2h PG was also decreased significantly by 20.39% and 16.50%. 69.2% in group A showed a decrease in blood glucose level to normal value with a significant difference compared with group C. (2) HOMA2-IR in groups A and R was significantly decreased by 8.34% and 18.31%, with a significant difference compared with group C. (3) A significant decrease of BMI (3.1 ± 3.2 kg/m², showed a moderately positive correlation with the decreased FPG) and waist (3.1 ± 2.7 cm) was found in group A with a significant difference compared with group C. BMI (1.1 ± 2.9 kg/m²) and waist (1.5 ± 3.8 cm) also decreased significantly in group R, but no significant difference between groups. The change of body composition showed in figure 1.

CONCLUSION:

(1) Both resistance and aerobic exercise lowered blood glucose and decreased blood glucose to normal level in a large percentage of IGR. (2) Both aerobic and resistance exercise improved IR in IGR. The effect of resistance exercise on IR improvement was superior to that of aerobic exercise. (3) Aerobic exercise lowered weight and waist significantly in IGR, and decreased blood glucose through weight loss. But the improvement of IR by both aerobic and resistance exercise might not be related to the control of obesity.

Supported by SGA China (2014B007), Sun Yat-sen University (1709089).

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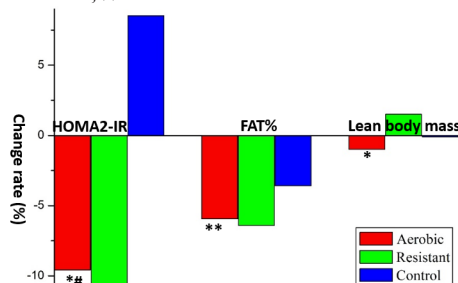


Figure 1 Change rate of HOMA2-IR, FAT%, lean body mass in 3 groups in IGR * $P < 0.05$, ** $P < 0.01$, compared with pre-intervention within group; # $P < 0.05$, ## $P < 0.01$, compared with group C

1233 Board #359 May 27 1:30 PM - 3:00 PM
Extreme Duration Low Intensity Exercise Not Cause Additional Weight Loss For Patients With Metabolic Syndrome

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 (No relevant relationships reported)

Common medical advice for patients with obesity and metabolic syndrome (MS) is weight loss through negative energy balance: eat less and do more physical activity. Guidelines suggest that moderate to vigorous intensity physical activity (MVPA) is better than low intensity physical activity (LPA). However, patients with morbid obesity and metabolic syndrome have difficulties to achieve MVPA level, particularly when they take beta-blockers. **PURPOSE:** To monitor long-time weight loss of a patient with morbid obesity and MS who underwent regular exercise and energy-restricted diet. **METHODS:** This case study followed a male patient (age 65y, baseline weight 131,0kg, BMI 43,8) with MS (obesity, high blood pressure, dyslipidemia, prediabetes) for 12 months. He took medication for every disease and also beta-blockers. His program was assisted by medical doctor, nutritionist and exercise therapist, has regular blood tests. All the trainings (1628 sessions) were monitored by heart rate activity tracker (POLAR A300). **RESULTS:** In the first 7 months the patient's weight loss was variable but permanent (23,1kg, BMI decrease to 35,8). His energy intake was consistently 1800 kcal/day, training hours of the week increased from 13,3 hours to 22,6 hours, from which he spent in MVPA activity 182 minutes a week at the baseline, and 469 on the peak which resulted increase in energy expenditure. There were positive changes in resting heart rate, blood pressure, blood sugar, HgA1c, cholesterol levels. In the months 8-12 the bodyweight was constant despite of the extreme increase in training to 37 hours a week but with moderate decrease in MVPA to 195 minutes. Statistic analysis of weight loss and time spent in intensity zones shows positive significant correlation in case of MVPA ($r=0.52$, $p<0.001$) and negative in case of LPA ($r=-0.47$, $p<0.01$). **CONCLUSIONS:** The energy-restricted diet and exercise therapy caused large weight loss but the LPA (<60% max hr) exercise had no effect. It seems that after achieving higher fitness level, extreme duration of LPA is not capable of long term weight loss although it plays a huge role in negative energy balance. MVPA would be more effective for patients with metabolic syndrome, but beta-blockers and the risk of heart attack or hypoglycaemia make the intensity-increase difficult. Supported by TUDFO/51757/2019-ITM

1234 Board #360 May 27 1:30 PM - 3:00 PM
Cardiometabolic Benefit Of A Family-Oriented Exercise And Nutrition Intervention On Overweight And Obese Children

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One third of U.S. children are overweight or obese. Without intervention, they experience an elevated risk of developing type 2 diabetes and cardiovascular disease as adults. Poor blood glucose and lipid profiles are indicators of adult onset, and early intervention can reduce the likelihood of future diagnosis. Thus, it is important to identify programs capable of improving these parameters in at-risk children. **PURPOSE:** To examine the effect of a family-oriented exercise and nutrition intervention on blood glucose and lipid profiles in overweight and obese children. **METHODS:** 12 children (age 7-16 yr) were referred to a weight loss intervention by their primary care physician; 6 males and 3 females completed the program. They performed biweekly sessions of structured exercise (45 min) and nutritional counseling (30 min) for 18 weeks. At baseline and follow-up, blood samples were drawn, measuring triglycerides (TG), total cholesterol (TC), high-density lipoproteins (HDL), low-density lipoproteins (LDL), and blood glucose (BG). Paired-samples t-tests compared pre to post differences in these variables. **RESULTS:** At baseline, subjects were 12.3±2.4 years old with a body mass index of 29.8±4.5 kg/m². Blood samples revealed TG of 118.4±50.1 mg/dL, TC of 172.0±21.2 mg/dL, HDL of 52.6±10.2 mg/dL, LDL of 97.8±24.9 mg/dL, and BG of 117.25±5.4 mg/dL. From baseline to follow-up, non-significant improvements were detected in TG ($p=0.104$), TC ($p=0.085$), and LDL ($p=0.132$). Significant changes were detected in HDL (increased 6.8±2.2 mg/dL, corresponding to a 13.1% improvement; $p=0.009$) and BG (decreased 17.7±5.0 mg/dL, 14.8% improvement; $p=0.026$). **CONCLUSION:** Despite the absence of external incentives, the program's retention was 75% over 18 weeks. Children who completed the full duration of exercise training and nutritional counseling experienced significant improvements in HDL and BG. These findings support the growing evidence that earlier cardiometabolic interventions are warranted.

1235 Board #361 May 27 1:30 PM - 3:00 PM
COMBINED TRAINING IMPROVES LUNG MECHANICS AND LUNG INFLAMMATION IN OVERWEIGHT WOMEN

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PURPOSE: The prevalence of obesity has grown over the years around the world. The accumulation of fat in the abdominal region is strongly associated with changes in pulmonary function and mechanics, as well as pulmonary inflammation that can lead to the development of respiratory diseases. Several studies have evidenced that aerobic exercise and resistance training promote numerous benefits in the respiratory system. However, no study have evaluated the effects of combined training program (aerobic + resistance) on lung mechanics and inflammation of overweight women. **METHODS:** 100 overweight women were recruited, according to the classification of body mass index (BMI) proposed by the World Health Organization. The combined training protocol (aerobic + resistance) was performed 3x/week for 12 weeks, 1 hour/session. Inclusion criteria: no respiratory diseases, nonsmokers, no pyramidal infections in the last 30 days, without musculoskeletal diseases. Nitric oxide levels in exhaled air were evaluated using the NOBreath portable nitric oxide monitor. Lung mechanics (by impulse oscillometry) was evaluated according to American Thoracic Society recommendations by using IOS Masterscreen Jaeger (Germany). Graph Pad Prism 5.0 was used to perform statistical analysis and $p<0.05$ were considered significant. **RESULTS:** The data shown here are from 15 women, as the program is still ongoing. Combined training resulted in reduced pulmonary inflammation, as measured by the levels of exhaled nitric oxide (pre: 16.67±7.66 ppb; post: 8.27 ± 4.54 ppb; $p=0.0014$). In addition, combined physical training significantly improved the pulmonary mechanics of these obese women, as improvements in the impedance of the respiratory system (Z5 Hz, pre: 4.35 ± 1.41, post: 0.55 ± 0.15, $p<0.0001$), total resistance of respiratory system (R5 Hz, pre: 4.03 ± 1.28, post: 0.52 ± 0.14, $p<0.0001$) and proximal airway resistance (R20 Hz, pre: 3.00 ± 1.08, post: 0.41 ± 0.12, $p<0.0001$) were observed. In the distal region of the lung, the combined training protocol significantly reduced the elastance (X5, pre: -1.55 ± 0.67, post: -0.18 ± 0.05, $p<0.0001$) and the resistance of the small airways (R 5 Hz - R20 Hz, pre: 1.03 ± 0.45, post: 0.11 ± 0.06, $p<0.0001$). **CONCLUSIONS:** Combined training improved lung mechanics and inflammation of overweight women.

1236 Board #362 May 27 1:30 PM - 3:00 PM
Anti-Inflammatory Effects Of Different Types Of Physical Exercises In Adults

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A link between physical inactivity, central obesity, and inflammation likely exists suggesting physical activity and inactivity as critical regulators of systemic inflammation. **PURPOSE:** To investigate the responsiveness of a systemic inflammatory marker to different types of physical exercises. **METHODS:** A sample of 302 individuals from both genders was taken among (2013-2016) participants of the dynamic cohort "Move for Health", a lifestyle-modification program (LiSM) with supervised physical exercises and dietary counseling. The evaluation instruments were: IPAQ (long form-version 8); anthropometric, plasma analysis of high-sensitive C-Reactive Protein (hs-CRP) and physical fitness. After the clinical trial, the groups were assembled voluntarily in any of the exercise-protocols: hydro-gymnastics (HYD, 240min-400MET/week, $n=50$), high intensity interval training (HIIT, 240min-496MET/week, $n=63$), strength training in gym (ST, 360min-545MET/week, $n=43$) and mixed walking-strength (MIX, 30 min of walking 60-80% HRmax and ST, 540min-743MET/week, $n=146$). All groups received similar dietary counseling. Assessments were undertaken at baseline and after 10 weeks of supervised intervention. Continuous and categorized data were evaluated at 5% significance level. **RESULTS:** The 55.5 ± 10.8 years old sample, 88% females, 80.5% overweight, 91% reporting at least 150min/wk, 63% with good cardiorespiratory fitness, 78% good hand-grip strength but 73% presenting poor flexibility. At baseline, groups were similar and after intervention, all protocols incremented the baseline values of $\dot{V}O_{2max}$; flexibility (except in the HIIT) and muscle strength (only in ST and MIX). The level of physical activity increased only in MIX. Waist circumference (WC) reduced 1.3cm (HYD) to 2.2cm (ST), significantly in all but HIIT group. Us-CRP decreased

significantly from 0.54(0.04-3.00) to 0.35(0.01-1.43) mg/dL, leading to a reduction of inflammatory stress (IS:CRP > 0.30mg/dL) from 44.7% to 29.8%. Except HYD, hs-CRP decreased in all other groups, while only HIIT reduced significantly(23%) the IS. CONCLUSIONS: The 10-wk LiSM was effective in reducing systemic inflammation, being more effective in HIIT and less in HYD, dissociable from WC changes and specific fitness improvements. Supported by CNPq and CAPES.

B-83 Free Communication/Poster - Measurement Studies in Exercise Oncology

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

1237 Board #363 May 27 2:30 PM - 4:00 PM Myocardial Fibrosis Impairs Exercise Capacity By Limiting Cardiac Output Among Anthracycline-treated Women With Breast Cancer

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PURPOSE: Physiologic reserve, the capacity for augmented function between rest and peak exercise, declines in organs and biological systems with aging. Chemotherapy can rapidly accelerate this decline, as noted by substantially lower exercise capacity in survivors of breast cancer (BC). We assessed cardiac function reserve and myocardial tissue characteristics and determined their contribution to exercise capacity reserve (VO_{2R}) in 16 anthracycline treated BC survivors and 16 age- and BMI-matched controls (CON). **METHODS:** Participants performed a maximal cardiopulmonary test on an upright cycle ergometer and also inside a 3T magnetic resonance imaging scanner using a horizontal, resisted, stepping device. Real-time, free-breathing, ungated cine images were acquired at rest and peak exercise. Left ventricular (LV) volumes and ejection fraction (EF) were calculated from a biplane model of 2- and 4-chamber long axis views. The reserve of LV volumes, EF, cardiac output, and VO₂ were calculated as peak minus rest values. Native T₁ mapping, a measure of myocardial fibrosis, was performed using the SASHA method. Groups were compared with independent t-tests and linear regression was performed between cardiac variables and relative VO_{2R}.

RESULTS: VO_{2R} was 25% lower in BC versus CON (18±7 vs 25±7 mL/kg/min, p=0.02). Hemoglobin, LV mass, resting LV volumes, cardiac output, and EF were similar between groups. Myocardial T₁ times were elevated in BC compared to CON (1535±32 vs 1503±28 ms, p=0.002). The reserve in heart rate, LV volumes, and EF did not differ between groups. A trend toward lower stroke volume reserve (14±8 vs 19±7 mL, p=0.08) resulted in lower cardiac output reserve in BC versus CON (+8.5±2.5 vs +10.3±2.4 L/min, p=0.05). As predicted by the Fick equation, indexed cardiac output reserve (β=3.0, 95% CI=1.2 to 4.8, R²=48%, p=0.003) was an independent predictor of VO_{2R} in the BC group, as was myocardial T₁ (β=-0.18, 95% CI=-0.25 to -0.10, R²=65%, p<0.001). Mediation analysis demonstrated that the relationship between cardiac output and VO_{2R} is mediated by the extent of myocardial fibrosis. **CONCLUSIONS:** Exercise intolerance following anthracycline treatment for breast cancer can be partially explained by reduced ability to augment cardiac output due to myocardial fibrosis.

1238 Board #364 May 27 2:30 PM - 4:00 PM Self-selected Walking Cadence After Light-intensity Physical Activity Intervention For Older Cancer Survivors

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PURPOSE

The MY Health randomized controlled trial evaluated the effectiveness of a wrist-worn activity monitor and health coaching to replace sedentary behavior with bouts of light-intensity physical activity among older cancer survivors. Participants were asked to 1) increase average daily steps ≥ 3000 above baseline and 2) disrupt sedentary

behavior at least twice per hour. No specific recommendations regarding intensity or minimum bout duration were provided. In this secondary analysis, we hypothesized that participants would self-select to walk faster to meet their daily step goal.

METHODS

Average daily steps and free-living walking cadence were measured in 41 participants (age 69±3.1 yr), using an ActivPAL activity monitor for 7 days pre- and post-intervention. Step accumulation patterns associated with intensity of ambulatory behavior were sorted in cadence bands of 20 steps/min from 40-59 (incidental movement) to ≥120 steps/min (fast locomotor movement). Repeated measures ANOVA was used to evaluate intervention induced changes in walking cadence; Wilcoxon rank-sum tests were used to highlight group differences within cadence bands. Medians and interquartile range are reported.

RESULTS

Intervention (n=24) and Waitlist Control (n=17) participants exhibited similar characteristics at baseline. The Intervention group increased average daily steps by 976 (IQR: -388 to 3532) from pre- to post-intervention; the control group increased by 354 steps/day (IQR: -658 to 1300); p=.19). There was a significant interaction of the intervention on cadence bands (p<.001). Steps taken in cadence bands denoting moderate intensity physical activity (MPA; 100-119 steps/min) increased by 478 (IQR: -121 to 1844) steps/day in the intervention group, compared to a decrease of 92 (IQR: -510 to 181) steps/day in the control group (p<.01).

CONCLUSION

While only 29% of intervention group participants met the daily step goal, there was a displacement of steps taken from cadence bands associated with lower to those of higher intensity of stepping, i.e., participants self-selected to walk faster. These findings may have important clinical implications as both duration and intensity have shown to offer cardioprotective and other health-related benefits.

1239 Board #365 May 27 2:30 PM - 4:00 PM Relative Reliability Of A CT-Based Measurement System To Assess Body Composition In Colon Cancer Patients

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Body composition is associated with important clinical and functional outcomes in colon cancer patients. Colon cancer patients often undergo computed tomography (CT) in routine clinical care. These images may then be used to assess body composition to potentially identify individuals who may benefit most from physical activity (PA) intervention. Developing reliable and accurate ways to measure body composition is a prerequisite to using CT-generated body composition to inform disease management. **Purpose:** To determine inter- and intra-rater relative reliability of CT to measure body composition in colon cancer patients in a randomized controlled trial (PA vs. usual care). **Methods:** 25 CT scans were randomly selected from 10 men and 8 women (59.1±9.7yrs), all post-primary treatment for stage II-III colon cancer. Manual image analysis was conducted for each single CT image slice using SliceOmatic software (Tomovision, Montreal, Canada) to mark the third lumbar vertebra and segment/quantify muscle (MUS), intramuscular adipose tissue (IMAT), visceral adipose tissue (VAT), subcutaneous adipose tissue (SAT), and the muscle attenuation coefficient (MA). Inter-rater reliability was assessed by estimating the agreement between measures from a) 2 trained manual analysts and b) a manual analyst and automated software (Voronoi Health Analytic ABACS L3 Module), respectively. Intra-rater reliability was evaluated by estimating the agreement between measures by the same manual analyst one month apart. Inter- and intra-class correlation coefficients (ICCs) were calculated with ICC ≥ 0.9 deemed excellent reliability. **Results:** ICCs were excellent for both measures of inter-rater reliability (analyst 1 vs. 2: MUS=0.999, IMAT=0.928, VAT=1.000, SAT=0.999, MA=0.999; manual vs. automated: MUS=0.981, IMAT=0.710, VAT=0.997, SAT=0.992, MA=0.992), and intra-rater reliability (MUS=1.000, IMAT=0.971, VAT=1.000, SAT=0.999, MA=1.000) (all p<0.01). **Conclusion:** Body composition analyses using clinical CT scans, SliceOmatic software, and a trained analyst is feasible for a single analyst across time, between two separate analysts, and between a manual analyst/automated software. Relatively reliable CT analyses of body composition is possible in stage II-III, post-primary treatment colon cancer patients.

1240 Board #366 May 27 2:30 PM - 4:00 PM
Evaluating The Suitability Of A Graded Exercise Test In Patients With Acute Leukemia Or Lymphoma

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Several studies demonstrate the beneficial effect of exercise on side effects and well-being during high dose/induction chemotherapy in patients with acute leukemia. Nevertheless, not only the chosen intervention and the exercise intensity vary between these studies but also the operationalization of exercise intensities differ. Although advices to use a graded exercise test in cancer patients exist, the suitability of this exercise testing in this specific group of patients has not been examined yet as far as the author knows.

Purpose: Investigate whether maximal effort of the participants has been generated during the graded exercise test.

Methods: As part of a bigger randomized controlled trial, 53 participants took part at the graded exercise test after being hospitalized to start high dose/induction chemotherapy treating acute leukemia or aggressive lymphoma. A graded exercise test starting at 20 watt increasing 10 watt per minute was performed. The ACSM criteria for a maximal exercise test were reviewed to determine whether the effort was maximal. These criteria are (1) a plateau in $\dot{V}O_2$ with increased workload, (2) failure of heart rate to increase with increases in workload (3), a post-exercise venous lactate concentration > 8.0 mmol/l, (4) a rating of perceived exertion at peak exercise > 17 on the 6-20 scale (Borg-Scale), and (5) a peak RER \geq 1.10.

Results: Criteria one and five could not be tested, due to the study design. Only one participant fulfilled the first criteria. Lactate concentration was measured right after the test and three minutes later. 15.4% (6 participants) and 21.4% (9 participants) respectively, reached a lactate concentration > 8.0 mmol/l and thus fulfilled the third criteria. A higher value than 17 on the Borg-Scale was stated by 66.0% (35) of the participants fulfilling the fourth criteria. Five (16.7%) and seven (23.3%) participants respectively met both the third and fourth criteria simultaneously.

Conclusion: Following the ACSM criteria, this investigation states that the majority of the participants did not reach the limit of exhaustion, suggesting that the graded exercise test might not be suitable for this group of patients.

1241 Board #367 May 27 2:30 PM - 4:00 PM
Comparison Of The Cancer And Modified Bruce Treadmill Protocols To Measure $\dot{V}O_2$ Peak In Cancer Survivors

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INTRO: The physical decrements associated with cancer and its treatments can be attenuated with exercise. For this reason, exercise testing is essential to purposeful and individualized exercise prescriptions. Currently, the only treadmill protocol validated in cancer survivors is the University of Northern Colorado Cancer Rehabilitation Institute (CANCER) Treadmill Protocol. The Modified Bruce Treadmill Protocol (MB) is widely used for exercise testing in clinical settings and has been validated in healthy populations, but not cancer survivors. It is unknown whether the MB is an appropriate assessment tool compared to the validated cancer treadmill protocol. Multiple peak oxygen consumption ($\dot{V}O_{2peak}$) predictive equations for the MB exist, however the accuracy of these equations in cancer survivors is unknown. **PURPOSE:** To determine whether the MB yields as accurate $\dot{V}O_{2peak}$ values as the CANCER protocol in cancer survivors. The secondary purpose was to examine which MB predictive equation, if any, most accurately estimated $\dot{V}O_{2peak}$ in cancer survivors. **METHODS:** Twenty-two cancer survivors completed two $\dot{V}O_{2peak}$ treadmill tests, the CANCER and the MB protocol. One protocol was performed once per week in a randomized order. $\dot{V}O_{2peak}$ values were obtained via gas analysis using a research-grade metabolic cart. A paired samples t-test was performed to determine if differences occurred between the CANCER and MB $\dot{V}O_{2peak}$ values. A repeated measures ANOVA was performed to determine differences between four MB predictive $\dot{V}O_{2peak}$ equations. **RESULTS:** Due to its difficulty, one subject could not complete the MB, but completed the CANCER protocol. There were statistically significant differences between $\dot{V}O_{2peak}$ values ($\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) found between the MB (26.38 \pm 7.90) and CANCER protocol (28.65 \pm 7.91) ($p = 0.037$). Furthermore, the American College of Sports Medicine (ACSM) walking/running equation from the last completed stage was the only predictive $\dot{V}O_{2peak}$ equation that was not statistically different than actual $\dot{V}O_{2peak}$ ($p = 0.930$) for the MB. **CONCLUSION:** Findings from this preliminary

data suggest the MB underestimates $\dot{V}O_{2peak}$ in cancer survivors and may be too difficult for some to complete. This data proposes the MB may not be suitable to determine $\dot{V}O_{2peak}$ in cancer survivors.

B-84 Free Communication/Poster - Observational Research in Exercise Oncology

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

1242 Board #368 May 27 2:30 PM - 4:00 PM
Correlates Of Exercise Behavior In Korean Cancer Patients: KNHANES 2014-2016

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PURPOSE: Most Korean cancer patients do not participate in sufficient physical activity. Understanding the determinants of exercise behavior is important to improve their physical activity level. The purpose of this study was to examine the correlates of meeting exercise guidelines in Korean cancer patients.

METHODS: Data were obtained from the Korea National Health and Nutrition Examination Survey 2014-2016. We included 640 cancer patients who had been diagnosed with any type of cancer. Moderate and vigorous physical activity time and frequency of resistance exercise were assessed. Participants were categorized as meeting (1) aerobic only, (2) resistance only, (3) combined, or (4) neither exercise guideline based on the American College of Sports Medicine's aerobic and resistance exercise guidelines for cancer survivors. Correlates included demographic, medical, and health-related fitness/quality of life variables. Univariate and stepwise multinomial logistic regression were used for statistical analyses.

RESULTS: The percentage of participants meeting the combined, aerobic only, resistance only, and neither guideline were 7.5%, 11.4%, 13.0%, and 68.1%, respectively. In univariate analyses, age ($p < 0.001$), sex ($p = 0.030$), region ($p = 0.011$), marital status ($p = 0.003$), education level ($p < 0.001$), and income ($p < 0.001$) were associated with meeting the exercise guidelines among demographic variables. Time since cancer diagnosis ($p = 0.027$) and the number of comorbidities ($p = 0.030$) were associated with meeting the exercise guidelines among medical variables. Hand-grip strength ($p < 0.001$), quality of life for mobility ($p < 0.001$), quality of life for self-care ($p = 0.047$), quality of life for pain/discomfort ($p = 0.004$), and total quality of life index ($p < 0.001$) were associated with meeting exercises guidelines among health-related fitness/quality of life variables. In stepwise multivariate multinomial logistic regression, younger age, higher education level, more hand-grip strength, and better quality of life for mobility independently predicted exercise behaviors.

CONCLUSION: Physical activity level is insufficient in Korean cancer patients and their exercise behaviors were correlated with age, education level, muscular strength, and quality of life.

1243 Board #369 May 27 2:30 PM - 4:00 PM
Exercise Recommendations For Adults With Bone Metastases: Outcomes Of A Delphi Consensus Process

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PURPOSE: To understand the current views of an expert panel on exercise screening, assessment, and prescription in adults with bone metastases.

METHODS: Medical doctors, researchers, and exercise professionals with expertise in providing medical and/or exercise advice to cancer patients with bone metastases were identified. A 3-round modified online Delphi survey was used to establish consensus with a priori consensus set to 70%.

RESULTS: Response rates were 68% (73/107), 81% (59/73) and 97% (57/59) for each round. Key consensus points were: (a) as part of pre-exercise screening, information should be collected on the number, location, and type of bone lesion(s), level of bone pain, and any other bone-related symptom (100% consensus); (b) medical guidance (i.e. communication and medical information from a Physician) is recommended for patients with the following: bone lesions that are unstable (or unknown stability), bone pain, past medical treatment for bone pain, or history of disease-related fractures (90%

consensus); (c) exercise testing and prescription in lower risk patients is thought to be safe provided caution is used with any protocol that results in stress on the bone lesion site (74% and 93% consensus, respectively); (d) exercise can be prescribed to higher risk patients but caution is recommended with exercises that place significant load on lesion sites and additional considerations may be required (77-82% consensus, varying by exercise type); (e) for patients classified as 'unsafe to exercise', advice on safe activities of daily living was seen as appropriate (91% consensus); (f) professionals best suited to prescribe exercise to lower and higher risk patients with bone metastases were exercise physiologists and Physiotherapists, who have additional cancer exercise training (>70% consensus). Consensus was not reached on the need for medical guidance in lower risk patients, suitable exercise testing protocols for higher risk patients, and the need to limit any specific exercise prescription practices for higher risk patients.

CONCLUSIONS: This represents the current views of a range of professionals who provide medical and exercise advice to adults with bone metastases and will inform the guidance document of the International Bone Metastases Exercise Working Group (IBMEWG).

1244 Board #370 May 27 2:30 PM - 4:00 PM
A Scoping Review Of Cardiac Rehabilitation Use By Adults With Cancer

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Purpose: Cardiac rehabilitation (CR) improves recovery from cardiac events and may aid in the recovery from cancer. We conducted a scoping review to systematically describe research on CR use by adults with cancer and examined acceptability and benefits of CR for adults with cancer.

Methods: We searched 4 databases through September 16, 2019. Studies were required to have enrolled adults with cancer into CR or into a CR-based rehabilitation program.

Results: We identified 780 articles. Ten articles from 9 studies met inclusion criteria. Studies occurred in the United States (n=3), Canada (n=4), and the United Kingdom (n=2). Five studies used a quasi-experimental pre-post design, 3 used a retrospective cohort design, and 1 was a randomized control trial. In total, 662 adults with cancer were included: 74% were female and most had breast cancer (breast 60%, prostate 7%, hematologic 7%, lung 3%, other 23%). The average age at baseline was 55 years for 5 studies and 59, 65, 66, and 74 years for the other studies. Race/ethnicity was reported in 2 studies for 82 adults and the majority of adults were white. Two studies included adults that were post-treatment, 6 included adults that were during treatment or post-treatment, and 1 did not report treatment status. Six studies used an existing CR program, 2 developed a new cancer rehabilitation program based on a CR model, and 1 did not report CR program details. In 2 studies, adults with cancer were interviewed about acceptability of CR. Adults liked the peer support of CR and believed that CR increased their motivation and confidence to be active. Barriers to attending CR were travel distance and lengthy recoveries from surgery/treatment. Seven studies measured changes in outcomes before and after CR. The most frequently measured outcomes were cardiorespiratory fitness (n=4), walking speed (n=3), body composition (n=3), depression (n=3), and quality of life (n=3); in most studies these outcomes improved after rehabilitation. Three studies monitored safety and reported no adverse events.

Conclusion: CR may safely improve physical and psychosocial health of adults with cancer. Future studies would benefit from the use of more rigorous study designs with a control group, inclusion of a diverse sample of adults with cancer, and more feedback on acceptability of CR from adults with cancer.

1245 Board #371 May 27 2:30 PM - 4:00 PM

Physical Activity In Colorectal Cancer Patients 12 Months After Resection: Results From The Colocare Study

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 (No relevant relationships reported)

While several studies have objectively measured physical activity (PA) and sedentary behavior (SB) in colorectal cancer survivors, the time between cancer diagnosis and accelerometer wear within these studies was highly variable. **PURPOSE:** To quantify PA and SB in colorectal cancer survivors at a fixed time-point (12 months) after primary tumor resection. **METHODS:** The ColoCare Study is an international, longitudinal, prospective cohort study in newly-diagnosed colorectal cancer patients that collects questionnaires and biospecimens at regular intervals from diagnosis to 5 years post-resection. For this analysis, participants with stage I-III colorectal cancer from the German Cancer Research Center (DKFZ, Heidelberg, Germany) and the Huntsman Cancer Institute (HCI, Salt Lake City, UT) were provided an Actigraph GT3X+ accelerometer 12 months after primary resection and asked to wear the monitor 24 hours per day for 4+ consecutive days. PA volume and intensity were derived from raw accelerometer data using ActiLife software (v6.16.3) and Freedson (1998) activity cut-points. Pearson correlations were used to evaluate associations between PA, SB, and clinicodemographic characteristics (e.g. BMI). **RESULTS:** Sixty-eight ColoCare participants (DKFZ n=43; HCI n=25) met valid accelerometer wear criteria (>10 h/day for 4+ days) at the 12 month time-point and were thus included in analysis. Participants spent 8.2 ± 5.8% of monitor wear time in moderate-to-vigorous physical activity (MVPA) and 73.3 ± 9.7% of monitor wear time sedentary. Additionally, participants accrued 168 ± 243 weekly exercise minutes (MVPA in bouts >10 minutes) and 38% were meeting the PA guidelines. Participants enrolled at HCI were significantly more active than those enrolled at the DKFZ (Steps/day: 10,008 ± 2,947 vs. 6,188 ± 3,815, p<0.05) and those patients who did not receive adjuvant chemotherapy were more active than those who underwent chemotherapy (Steps/day: 8,585 ± 4,160 vs. 6,350 ± 3,349; p<0.05). **CONCLUSIONS:** PA levels 12 months after primary colorectal cancer resection were greater than expected, and may be influenced by geographic location and adjuvant chemotherapy use. Supported by the ACSM Paffenbarger-Blair Fund for Physical Activity Epidemiology, the Lackas Foundation, and NIH U01 CA206110

1246 Board #372 May 27 2:30 PM - 4:00 PM

Impact Of Physical Activity Trajectories On Colon Cancer Risk

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Colon cancer is a major public health and clinical concern, as it is the third leading cause of cancer death in the United States. Numerous types and intensities of physical activity (PA) are shown to reduce risk of colon cancer, however research is inconclusive on what time point in life (early, later, or maintaining throughout life) PA is most important to reduce colon cancer risk.

PURPOSE: To evaluate whether the maintenance of and changes in PA levels over time, as measured over the life course as trajectories, are associated with colon cancer risk.

METHODS: We used PA and health data from 334,905 generally healthy men and women in the NIH-AARP Diet and Health Study to test whether various PA patterns over the life course impacted colon cancer risk. Using latent class trajectory models,

we identified seven distinct PA trajectories using four time points across the life course from teenage years through middle age. We used cox proportional hazard regression to assess the association between the PA trajectories and colon cancer incidence.

RESULTS: In adjusted analyses (age, sex, education, smoking, alcohol, and red/processed meat intake), compared to those with consistently low PA levels, we found that those who maintained PA through life significantly reduced risk of colon cancer by about 13% (HR = 0.87, 95% CI 0.80-0.94; 0.87, 95% CI 0.76-0.99), and those who increased PA levels significantly reduced colon cancer risk by about 11% (0.89, 95% CI 0.78 - 1.03). However, those who decreased PA levels had a significantly higher risk of colon cancer (1.13, 95% CI 1.03-1.23).

CONCLUSIONS: Our results suggest that consistent participation in PA and increasing PA from low levels in the life course may be most protective of colon cancer risk. Promotion of PA throughout life for all ages and abilities is critical to minimize colon cancer risk, develop effective interventions, and disseminate prevention messages.

1247 Board #373 May 27 2:30 PM - 4:00 PM
Effect Of Exercise Intervention On Insulin, Igfs And Igf1ps In Cancer Patients

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PURPOSE: Increased level of insulin and insulin like growth factor (IGF) have not only been associated with increased risk of different cancers but also with poor prognosis after cancer diagnosis. Aerobic exercise training lowers the levels of insulin and IGF in healthy people. Research looking at the effects of different exercise interventions on insulin, IGF and Insulin Growth Factor Binding Protein (IGFBP) is newly emerging. The purpose of this study is to systematically review the effects of exercise on insulin, IGF and IGFBPs in cancer patients.

METHODS: An electronic literature search was conducted using PubMed database up to July 2019, with search terms: cancer, exercise, insulin-like growth factor, IGF, and IGFBP. Eligible studies included peer-reviewed, randomized clinical trials (RCTs) that utilized either exercise or physical activity as their intervention for cancer survivors. All study design, participant characteristics, intervention, IGF related outcomes, and key findings were evaluated systematically and summarized.

RESULTS: Eight articles were deemed eligible for the systematic review. Cancer types included breast cancer, colorectal cancer, prostate cancer, non-small cell lung cancer, and endometrial cancer. Mean age of the sample population included in our study was 60.3± 6.9 years (n, intervention group= 184; n, control group= 160). Mode of exercise consisted of either aerobic, strength training, combination of aerobic and strength training, endurance exercise, or Tai chi. All but one study showed that exercise resulted in significant reduction or no change in circulating levels of IGF-1 and IGF-2. Results were inconsistent with exercise on IGFBP-3 levels. **CONCLUSIONS:** The literature is inconsistent of the impact of exercise to lower IGF levels and that could be because of the different duration and type of exercise intervention in different studies. Because of the inconsistency, meta-analysis could not be performed. Large randomized control trials with different exercise interventions are required in this area to reach a firm conclusion. A greater understanding of the impact of exercise and dosing of exercise can empower physical therapists to play a greater role in cancer survivorship programming.

B-85 Free Communication/Poster - Preclinical
Exercise Oncology

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

1248 Board #374 May 27 2:30 PM - 4:00 PM
Resistance Training Attenuates Cancer Cachexia-induced Cardiac Remodeling

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(No relevant relationships reported)

Cancer-induced cachexia is a state of ill health characterized by cardiac and skeletal muscle atrophy that has profound impacts on cardiovascular function and quality of life. Resistance training (RT) during treatment has been shown to improve cardiac function via cardiac hypertrophy. **PURPOSE:** To assess the capacity for RT to minimize cachexia-induced cardiac remodeling. **METHODS:** All procedures were done in accordance with an IACUC approved protocol. Male-Wistar rats (n=48) were

randomly assigned to a sedentary (SED), RT, SED+cancer, and RT+cancer group. Animals assigned to RT groups trained for a total of 13 wk using an elevated food model to simulate low intensity RT. SED animals were placed in standard animal housing for an equivalent amount of time. At week 10, animals were injected with Walker-256-mammarycarcinoma cells (10⁶ cells) or an equivalent amount of 0.9% saline. Left ventricular morphology was measured using echocardiography prior to injection and at the end of the 13 wk experiment. Differences in cardiac morphology (i.e. thickness and diameter) between groups were analyzed using a one-way ANOVA (p < 0.05). **RESULTS:** There was a significant (p < 0.05) difference in posterior wall thickness during systole of SED animals (0.30±0.04 cm) compared to of RT (0.34±0.05 cm). Posterior wall thickness during diastole was significantly (p < 0.05) increased in RT+cancer (0.21±0.03 cm) animals compared to SED+cancer (0.18±0.04 cm). SED+cancer animals had a significantly larger left ventricular diameter (LV) (0.72±0.04 cm) than SED controls (0.67±0.06 cm). The combination of RT+cancer significantly attenuated the increase in LV diameter (0.67±0.034 cm). **CONCLUSIONS:** The results suggest that the posterior wall is susceptible to cachexia induced remodeling. however, RT attenuated the degree of cardiac remodeling.

1249 Board #375 May 27 2:30 PM - 4:00 PM
Effects Of Exercise Training On Cachexia In Mice Bearing The Colon-26 Carcinoma

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(No relevant relationships reported)

Colorectal cancer (CRC) is the third most prevalent cancer in the U.S. and risk is increased by lifestyle factors such as poor diet and physical inactivity. Also, CRC patients are highly susceptible to developing cachexia, which is characterized by muscle wasting, fatigue, weakness, and immune function impairments, that lead to increased morbidity and mortality. Studies have shown that aerobic and resistance training, independently, can effectively attenuate the deleterious effects of cachexia, and though research on concurrent training is limited, studies are reporting that combined exercise positively affects muscle wasting. **PURPOSE:** The purpose of this study was to examine the effects of exercise training on markers of cachexia to determine if aerobic training (TM), resistance training (RT), or combined training (TM+RT) would be most effective. **METHODS:** Male Balb/c mice were randomly assigned to SED (n = 24) or EX (n = 36) groups. EX mice were further allocated to either TM (n = 12), RT (n = 12), or TM+RT (n = 12). After 5 weeks of EX, 12 SED and all EX mice were inoculated with C26 cells; EX continued for 3 additional weeks before mice were sacrificed. Cachexia was assessed via histochemical/biochemical analyses and forelimb grip strength. **RESULTS:** Cachexia was induced in Sed+Tumor, evidenced by significant changes in body mass (P < 0.05; -14%), gastrocnemius mass (P < 0.01; -16%), gastrocnemius cross sectional area (CSA) (P < 0.05; -35%), forelimb grip strength (P < 0.01; -18%), splenomegaly (P < 0.01; +83%), and plasma IL-6 (P < 0.01; +211%). Moreover, MHCIIa and IIb atrophied similarly in Sed+Tumor mice. All exercise groups had significant improvements in all examined markers of cachexia when compared to Sed+Tumor, with the exception of gastrocnemius mass (P > 0.05). Additionally, RT significantly improved relative grip strength versus all other groups (P < 0.05). Overall myofiber CSA increased significantly with all EX modes (P < 0.05). Finally, systemic inflammation was significantly decreased in all EX groups, as evident by decreases in spleen mass and plasma IL-6 (P < 0.01). **CONCLUSIONS:** These data support past literature in that exercise provides significant benefit to cachectic mice, and this may be due, in part, to decreased systemic inflammation. Specifically, RT, alone and with TM, provided the most benefit.

1250 Board #376 May 27 2:30 PM - 4:00 PM
The Effect Of Creatine And Creatinine Supplementation On Doxorubicin Treatment Of Walker 256 Mammary Carcinoma Cells In Vitro

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(No relevant relationships reported)

Doxorubicin (DOX) is a powerful chemotherapeutic agent with potent cytotoxic effects that result in increased rates of cell death and reduced viability. Recent evidence has shown that creatine (Cr) may minimize DOX-induced cytotoxicity to non-cancerous tissues; however, few studies have investigated the effect of Cr on tumor proliferation with or without DOX. **Purpose:** To determine if supplementation with Cr or creatinine (CrN) alters cell viability in a tumor model when combined with DOX over a 48 hr time period. **Methods:** Walker 256 mammary carcinoma cells were cultured in growth medium (90% DMEM 10% FBS) until they reached 90-95% confluency. Cells were seeded on to a 96-well plate at a density of 10,000 cells/ml with fresh growth media and incubated for 24 hr. Cells were then exposed to growth media containing either 10 µM of DOX, 10 mM of Cr, 10 mM CrN, 10 µM DOX + 10 mM Cr, 10 µM DOX + 10 mM CrN, or regular growth media as a control for an additional 48 hr. Cell viability

was assessed at 0, 12, and 48 hr using an EarlyTox™ Cell Integrity Kit and analyzed via a Nikon live cell confocal imaging system. **Results:** At 12 hr post-treatment, DOX and DOX+Cr had significantly lower cellular viability compared to baseline ($P < 0.05$). At 48 hr, Cr, CrN, and DOX+CrN had significantly lower cellular viability compared to baseline ($P < 0.05$). No significant differences in viability were found in the control group. **Conclusion:** The addition of Cr or CrN did not affect the cytotoxic effects of DOX.

1251 Board #377 May 27 2:30 PM - 4:00 PM
Cd8+ T-cell Depletion Abolishes The Anti-metastatic Effects Of Voluntary Running In A Mouse Model Of Breast Cancer

Helene Rundqvist, Laura Barbieri, Pedro Velica, Sara Mijwel, Arne Östman, Randall Johnson. *Karolinska Institutet, Stockholm, Sweden.*

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(No relevant relationships reported)

PURPOSE: Regular physical exercise provides a significant risk reduction for breast cancer and recent studies suggest beneficial effects also on disease specific recurrence and mortality. However, little is known about how exercise exerts its protective effects. The primary aim of this study to evaluate the effect of voluntary running on tumor progression and metastasis in the PyMT mouse model of breast cancer.

METHODS: From 4 weeks of age, female MMTV-PyMT mice on the FVB background were housed with access either to wirelessly recording running wheels or locked control wheels. Tumor growth was monitored continuously, tumor stage and pulmonary metastases were determined histologically at the 12 week endpoint. In a follow up study, pre-trained female FVB mice were injected intravenously with 2×10^5 PyMT derived tumor cells (IC3) and after an additional 10 weeks of voluntary running, pulmonary metastases and immune cell infiltration was quantified (histologically and with flow cytometry). The CD8+ T-cell population was deleted using weekly administration of CD8 specific antibodies.

RESULTS: PyMT mice average running distance was 6.4 ± 2.4 km/day. No significant effects of voluntary running on tumor- initiation, volume or stage were found.

However, a reduced number of metastases were observed in mice with access to running wheels (Ctrl 22.0 ± 6.8 and Runners 9.1 ± 1.7). Significant reductions in pulmonary metastasis frequency were also found in runners after intravenous injections of tumor cells (Ctrl 5.2 ± 1.1 and Runners 1.9 ± 0.7) and running mice had a lower number of metastases with a high proliferation score. Metastatic lesions from running mice showed higher content of Granzyme B positive cells (Ctrl 1.2 ± 0.5 and Runners 4.9 ± 1.1), indicating an increased infiltration of cytotoxic T-cells. Depletion of CD8+ cells abolished the reduction in metastatic burden found in running mice compared to non-running mice. All data is presented as Mean \pm SEM.

CONCLUSIONS: In this highly aggressive, genetic, breast cancer model, an average of 6 km/day of voluntary running showed little effect on tumor formation and growth. However, the findings suggest that physical activity reduced outgrowth of metastatic lesions through an increased infiltration of cytotoxic immune cells.

1252 Board #378 May 27 2:30 PM - 4:00 PM
Exercise Reduces Tumor Growth And Burden In A Mouse Model Of Non-small Cell Lung Cancer

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(No relevant relationships reported)

Introduction: Exercise has been shown to reduce the prevalence of certain cancers. Moderate-intensity exercise has been shown to have significant effects on tumor initiating mechanisms in mice resulting in decreased tumor incidence for a variety of cancers including pancreatic, gastrointestinal, and mammary. This is the first report of the role that exercise plays in the suppression of spontaneous murine lung cancer.

Methods: CCSPCre/LSL-KrasG12D mice were generated by crossing a mouse with the LSL-K-rasG12D mutant allele with a mouse harboring Cre recombinase inserted in the Clara cell secretory protein (CCSP) locus. Tumor-bearing progeny were assigned to either exercise (EX) or sedentary control groups. At tumor onset (4wks of age), 10wks of moderate exercise training was conducted for the EX group on a motor-driven treadmill (13.5m/min) for 45min/day, 5days/wk. Tumor burden was assessed by two variables: (1) visual count of lung surface tumor numbers; and (2) internal tumor volume established from H&E stains. Homogenized spleen samples were analyzed via ELISA for IL-6 and TNF- α protein levels. **Results:** For sedentary mice (N=14) lung tumor count was 40.57 ± 3.483 tumors (mean \pm SEM). Lung tumor count in the exercised mice (N=10) was significantly reduced to 21.80 ± 1.705 tumors ($p < 0.001$). Sedentary mice (N=6) tumor percentage of lung volume was $12.34 \pm 0.528\%$. Percent lung tumor volume in exercised mice (N = 8) was significantly reduced to $6.913 \pm 0.262\%$ resulting in a 44% reduction of tumors within lung tissue. IL-6 and TNF-alpha spleen data did not show any significant changes due to exercise in relation to lung cancer. **Conclusions:** These results demonstrate that moderate exercise can slow the

progression of tumorigenesis in a mouse model of lung cancer. However, the exercise mechanism of action remains unclear; while we did see a trend toward decreased levels of IL-6, no significant changes were seen in systemic pro-inflammatory cytokines IL-6 and TNF-alpha. Lung cancer is the leading cause of cancer mortality worldwide with current treatments resulting in an average 17% five year survival rate. Moderate exercise may be a practical method for patients to help suppress tumor progression.

1253 Board #379 May 27 2:30 PM - 4:00 PM
Impaired Protein Synthesis And Elevated Methylarginines May Contribute To Cancer-associated Cachexia

Hawley E. Kunz, Jessica M. Dorschner, Taylor E. Berent, Zachary C. Ryan, Theodore A. Craig, Rajiv Kumar, Ian R. Lanza. *Mayo Clinic, Rochester, MN.*

(No relevant relationships reported)

Cachexia, an illness-associated syndrome characterized by muscle wasting that cannot be reversed with nutritional support, is a significant contributor to cancer-associated morbidity and mortality. The mechanisms driving the loss of muscle mass are not well defined, and predictive or early diagnostic biomarkers have not been identified.

PURPOSE: To determine factors that may contribute to cancer-associated losses in muscle mass and to identify potential biomarkers indicative or predictive of the severity of muscle wasting. **METHODS:** Lewis lung carcinoma (LLC1) cells or vehicle (CON) were injected subcutaneously into the left flank of seven week-old C57BL/6 male and female mice. After 21 days, skeletal muscle mass and function were assessed. Mitochondrial energetics were assessed in permeabilized muscle fibers using high-resolution respirometry, and fractional protein synthesis rates following the administration of $^{13}C_6$ -phenylalanine were measured by mass spectrometry. To explore potential mechanisms and biomarkers of cachexia, untargeted metabolomics was performed using plasma and skeletal muscle from LLC1 and CON mice. **RESULTS:** Tumor-bearing mice showed evidence of cachexia, with 6.8% lower body mass ($p < 0.001$), 10.0% lower quadriceps mass ($p = 0.010$), 9.7% lower gastrocnemius mass ($p = 0.001$), and 9.6% lower grip strength ($p = 0.004$) at day 21. Mixed muscle protein synthesis was impaired in LLC1 mice (-18.6%, $p = 0.0279$). Synthesis of both the sarcoplasmic and myofibrillar proteins was lower in LLC1 mice (-34.4%, $p < 0.0001$ and -24.5%, $p = 0.0039$, respectively). Mitochondrial protein synthesis was not significantly affected, and no differences in mitochondrial energetics were observed between LLC1 and CON mice. Untargeted metabolomics revealed significant increases in asymmetric dimethylarginine (ADMA) and N-monomethyl L-arginine (L-NMMA) in both the skeletal muscle and plasma of LLC1 mice. **CONCLUSION:** The synthesis of contractile and sarcoplasmic proteins was inhibited in cachectic, tumor-bearing mice. Elevations in ADMA and L-NMMA, endogenous nitric oxide synthase inhibitors formed during proteolysis, may both serve as biomarkers of cachexia and play a mechanistic role in the loss of muscle mass.

Project supported by the Andersen Corporate Foundation and T32AR056950.

1254 Board #380 May 27 2:30 PM - 4:00 PM
Use Of Creatine And Creatinine To Improve Cell Viability In Doxorubicin-treated Cardiac Myoblasts, Skeletal Muscle Myoblasts, And Aortic Myoblasts

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(No relevant relationships reported)

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 Doxorubicin (DOX) is a powerful chemotherapy agent that is associated with a number of deleterious side effects, including cardiac, smooth, and skeletal muscle loss. Although the mechanisms behind the observed myotoxicity are not fully understood, the bulk of muscle loss is attributed to the generation of reactive oxygen species (ROS) and interference with DNA replication. Conversely, creatine (Cr) supplementation has been shown to have a therapeutic role in several disease states characterized by high ROS generation and metabolic dysfunction, which are common with DOX treatment.

PURPOSE: To investigate the effects of Cr and creatinine (CrN) treatment on cell viability in DOX-treated myoblasts. **METHODS:** Skeletal muscle cells (RKSMC), H9C2 cardiac myoblasts, and A10 aortic smooth muscle myoblasts were cultured in growth medium (10% FBS and 90% DMEM) until they reached 90-95% confluency. Cells were then collected and seeded on a 96-well plate at a density of 10,000 cells/ml containing fresh skeletal muscle growth media and allowed to recover for 24 hours. Cells were then exposed to fresh growth media containing either 25 μ M of DOX, 10 mM of Cr, 10 mM CrN, 25 μ M DOX + 10 mM Cr, or 25 μ M DOX + 10 mM CrN for an additional 24 hours. Rates of apoptosis were assessed using a cell viability kit (Molecular Devices) and analyzed via a Nikon live cell confocal imaging system. **RESULTS:** DOX treatment resulted in significantly lower viability regardless

of cell type ($P < 0.05$). On average, viability was $46.3 \pm 7.1\%$ for DOX treated cells. The addition Cr or CrN with DOX significantly increased viability to $78.4 \pm 8.1\%$ and $79.9 \pm 14.6\%$, respectively ($P < 0.05$). **CONCLUSION:** Initial evidence from this investigation provides direct evidence to support the use of Cr and CrN to improve cell viability with DOX treatment.

C-07 Thematic Poster - Aging, Mobility and Neurobiology

Thursday, May 28, 2020, 9:30 AM - 11:30 AM

Room: CC-2000

1293 Chair: Todd Manini, FACSM. *University of Florida, Gainesville, FL.*
(No relevant relationships reported)

1294 Board #1 May 28 9:30 AM - 11:30 AM
EARLY AND LATE RAPID NEUROMUSCULAR PARAMETERS OF THE PLANTAR FLEXORS IN MIDDLE-AGED AND OLDER MALES

Benjamin E. Dalton, Alex A. Olmos, Matthew T. Stratton, Phuong L. Ha, Trisha A. VanDusseldorp, Alyssa R. Bailly, Yuri Feito, FACSM, Gerald T. Mangine, Tyler M. Smith, Garrett M. Hester. *Kennesaw State University, Kennesaw, GA.* (Sponsor: Dr. Yuri Feito, FACSM)
(No relevant relationships reported)

Rapid torque production is important for physical function in older adults. Early and late rapid torque parameters are influenced by different physiological factors; therefore, they may be differentially affected by aging. Few comparisons exist between middle-aged and older adults for early and late rapid torque measures.

PURPOSE: To compare early and late rapid torque measures of the plantar flexors (PFs) in middle-aged (MM) and older males (OM).

METHODS: Twenty-nine MM (n=14; 45.3±2.6 yrs) and OM (n=15; 65.3±3.2 yrs) performed maximal voluntary isometric contractions of the PFs using a dynamometer. Peak torque (PT), as well as rate of torque development (RTD; Δ torque/ Δ time) and impulse (area under the curve) during the early (0-50 ms; RTD₀₋₅₀, IMP₀₋₅₀) and late (100-200 ms; RTD₁₀₀₋₂₀₀, IMP₁₀₀₋₂₀₀) contraction phases were calculated. Torque at 50 (TQ₅₀), 100 (TQ₁₀₀), and 200 ms (TQ₂₀₀) was also obtained. Additionally, RTD and TQ variables were normalized to PT. The onset was 2.5 Nm for all torque variables. Electromyography of the medial gastrocnemius was recorded in order to obtain rate of electromyography rise (RER). RER was calculated as the linear slope of the normalized electromyography signal at 30, 50, and 75 ms from the onset. Independent samples t-tests were used for group comparisons.

RESULTS: PT (p=0.105), TQ₅₀ (p=0.156), early (p=0.162), and late (p=0.074) RTD were similar between groups. TQ₁₀₀ (MM=69.71±16.85 vs. OM=55.99±18.54 Nm·s⁻¹; p=0.046), TQ₂₀₀ (MM=114.76±26.79 vs. OM=91.56±28.10 Nm·s⁻¹; p=0.031), and IMP₁₀₀₋₂₀₀ (MM=4.79±1.11 vs. OM=3.83±1.17 Nm·s; p=0.032) were lower in OM. Normalized torque variables showed no differences (p>0.05). RER (p=0.057-0.072) was similar between groups.

CONCLUSIONS: Our data indicates that late rapid torque parameters of the PFs were preferentially influenced by age, yet PT appeared to mediate this result. Although not significant, the effect sizes for RER ($d=0.69-0.74$) may suggest that rapid muscle activation was influential as well.

1295 Board #2 May 28 9:30 AM - 11:30 AM
Associations Between Physical Fatigability, Vo₂ Peak And Measures Of Muscle Strength In Older Adults

Brett Davis¹, James Sampley¹, Heather Quiariate¹, Eunhan Cho¹, Bailey Theall¹, Josh Granger¹, Matthew C. Scott¹, Steven B. Heymsfield², Frank Greenway², Neil M. Johannsen¹, Guillaume Spielmann¹, Brian A. Irving, FACSM¹. ¹*Louisiana State University, Baton Rouge, LA.* ²*Pennington Biomedical Research Center, Baton Rouge, LA.* (Sponsor: Brian A. Irving, FACSM)
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(No relevant relationships reported)

Age related declines in cardiorespiratory fitness (VO₂ peak) and muscle strength lead to impaired physical function and frailty in older adults. Higher levels of perceived fatigue, fatigability, exacerbate impairments in physical function and frailty in older adults. However, the independent and combined associations between VO₂ peak, muscle strength and fatigability remain incompletely defined. **PURPOSE:** This study examined the cross-sectional associations between VO₂ peak, muscle strength, and self-reported physical fatigability among untrained older adults. **METHODS:** The present analyses included, twenty (13F, 7M), older adults (X±SD, 71±4y) participating in an ongoing exercise intervention (REALPA). VO₂ peak was determined using a graded exercise test on treadmill. Isometric and isokinetic knee extensor strength was assessed on the non-dominant leg using a Biodex Dynamometer. Peak isometric torque was measured at an angle of 60°, while peak isokinetic torque was measured at 60°/

second. Physical fatigability were determined using the Pittsburgh Fatigability Scale. We used multiple linear regression to measure the association between the Physical Fatigability Score (0-50, no fatigue to extreme fatigue), VO₂ peak, peak isometric strength, and peak isokinetic strength after adjusting for age. **RESULTS:** The X±SD for body mass index (BMI), VO₂ peak, peak isometric torque, and peak isokinetic torque, were 28±4 kg/m², 20±4 ml/kg/min, 149±34 Nm, and 119±40 Nm, respectively. The physical fatigability scores were 12±7, ranging from 2 to 26. Before adjusting for age, peak isometric and isokinetic strength were inversely correlated with physical fatigability (r=-0.42, p=0.07 and r=-0.41 p=0.07, respectively). After adjusting for age, the partial correlations became statistically significant (r=-0.48, p=0.04 and r=-0.50 p=0.03, respectively). In contrast, VO₂ peak was not correlated to physical fatigability. **CONCLUSION:** The present results suggest that untrained older adults with lower measures of peak isometric and isokinetic strength report higher perceived physical fatigability. Further studies should examine the impact of increased skeletal muscle strength and its effect on perceived physical fatigability in older adults. This study was supported by the NIH 5R21AG058181-02.

1296 Board #3 May 28 9:30 AM - 11:30 AM
Perceived Physical Fatigability Explains The Association Between Physical Activity And Gait Speed

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(No relevant relationships reported)

Lower physical activity (PA) and greater perceived physical fatigability (fatigability) contribute independently to slower gait speed.

PURPOSE: To fully understand these complex relationships and inform potential interventions, we examined the bidirectional effects between PA and fatigability on gait speed in two generations of older adults (probands and their offspring) enrolled in the Long Life Family Study, a cohort enriched for exceptional longevity.

METHODS: At Visit 2 (2014-2017), we measured self-reported PA (typical day over past year) using the Framingham PA Index, perceived physical fatigability with the Pittsburgh Fatigability Scale (PFS, 0-50), and usual gait speed (m/s, fastest of two 4m trials). Linear mixed-effect models (accounting for family relatedness) were used to conduct regressions and mediation adjusted for age, sex, BMI, current smoker, health indicators, depression and field center.

RESULTS: At Visit 2, participants (N=2059) ranged in age from 60-107 yrs, with 54.1% female, 99.6% white, PA = 36.6 ± 7.0 MET-hrs/day, PFS = 13.9 ± 9.4, and gait speed = 1.02 ± 0.31 m/s. Compared to offspring (mean ± SD 69.9 ± 6.2 yrs, n=1762), probands were older (92.0 ± 6.9 yrs, n=297), with lower PA, greater PFS scores, and slower gait speed (all p<0.001). Each five MET-hrs/day less PA was directly associated with 0.025 m/s (probands) and 0.005 m/s (offspring) slower gait speed; for fatigability, each five points greater PFS was directly associated with 0.04 m/s (probands) and 0.03 m/s (offspring) slower gait speed (all p<0.001). Further, fatigability explained 41.2% (probands) and 44.4% (offspring) of the effect of less PA on slower gait speed, whereas PA explained 11.0% (probands) and 4.8% (offspring) of the effect of greater fatigability on slower gait speed.

CONCLUSIONS: Given that fatigability largely explained PA's effect on slower gait speed, and the consistency between generations, our findings support fatigability as a potential mediator in the pathway from PA to gait speed. Although we need longitudinal data to confirm the casual directionality, increasing PA may be a likely intervention to reduce perceived physical fatigability and slow the downward spiral leading to worse physical function among older adults.
Funded by NIA U01AG023712, U01AG023744, U01AG023746, U01AG023749, U01AG023755.

1297 Board #4 May 28 9:30 AM - 11:30 AM

Aerobic Fitness Protects Against Age-Related Cognitive Decline In A Population At Risk For Alzheimer's Disease

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PURPOSE: To determine whether mid-late life aerobic fitness prospectively predicts longitudinal cognitive trajectories in a sample of cognitively unimpaired older adults at risk for Alzheimer's disease.

METHODS: One hundred and four adults (mean age at baseline 64.47 ± 6.1) from the Wisconsin Registry for Alzheimer's Prevention underwent a graded treadmill exercise test and neurocognitive examinations at baseline assessment. Two additional biennial neurocognitive examinations were conducted 2.54 ± 0.96 , and 4.00 ± 0.41 years after baseline testing (follow-up range: 1.54 - 4.80 years). Aerobic fitness was defined as the highest oxygen consumption (VO_{2peak} , mL/kg/min) value recorded during the final stage of the maximal exercise test when standardized criteria were met. The cognitive measure of interest was the preclinical Alzheimer's cognitive composite (PACC) score which includes neurocognitive measures that have demonstrated to be sensitive to early age-related decline in preclinical Alzheimer's disease, i.e., measures from the Rey Auditory Verbal Learning Test and the Wechsler Intelligence and Memory Scales. A linear mixed effects model was used to investigate whether longitudinal trajectories of cognition varied as a function of fitness while controlling for the variance explained by age, sex, and education.

RESULTS: On average, participants displayed a VO_{2peak} of 26.57 ± 6.40 mL/kg/min. At baseline, age was negatively associated with fitness ($r = -.43$; $p < .001$) and cognitive function ($r = -.27$; $p = .007$). Longitudinal analysis revealed a significant time \times VO_{2peak} interaction ($p = .032$), indicating that greater aerobic fitness mitigated cognitive decline over a 2 - 4 year period.

CONCLUSIONS: Cognitive function declines with age and the progression of Alzheimer's disease. These data indicate that aerobic fitness may preserve cognition in older adulthood, and suggest that engagement in activities aimed at improving fitness (e.g. exercise training) may mitigate age-related cognitive decline. Future studies that assess changes in fitness will be needed to better elucidate the causality of the observed relationship.

Ryan J. Dougherty was supported by a NIH NRSA grant: F31AG062009

1298 Board #5 May 28 9:30 AM - 11:30 AM

Hippocampal Plasticity After Acute Exercise In Older Adults: A Diffusion Tensor Imaging Study

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(No relevant relationships reported)

PURPOSE: The hippocampus is a critical region for many cognitive and memory processes that experience structural and functional decline with age. Exercise is beneficial for the aging brain and shows preferential benefits for hippocampal volume, activation, and memory-related cognitive processes. However, research thus far has primarily focused on the effects of exercise on long-term volumetric changes in the hippocampus using structural MRI. Critically, microstructural alterations within the hippocampus over short time intervals have been associated with neuroplasticity and cognitive changes that do not alter its volume but are still functionally relevant. It is not yet known, however, if microstructural neuroplasticity occurs in the hippocampus in response to a single session of exercise.

METHODS: We used a within subject-design to determine if a 30-minute bout of moderate-intensity aerobic exercise altered bilateral hippocampal diffusion tensor imaging (DTI) measures in healthy older adults ($n=30$) compared to a seated rest control condition.

RESULTS: Following exercise there was significantly lower fractional anisotropy (FA) relative to seated rest within the bilateral hippocampus, and this effect was driven by higher radial diffusivity (D_r). No significant differences in mean diffusivity (MD) or axial diffusivity (D_a) were observed. Additionally, cerebral blood flow (CBF) data were obtained in a subset of participants ($n=13$). Differences in D_r within the bilateral hippocampus were significantly associated with differences in bilateral hippocampal perfusion.

CONCLUSIONS: These findings suggest that a single session of exercise can lead to microstructural changes in the hippocampus of healthy older adults, and that these differences may be associated with changes in the extracellular space and glial, synaptic, and dendritic processes within the hippocampus. Repeated microstructural

alterations from acute bouts of exercise may accumulate and precede larger volumetric and functional improvements in the hippocampus, a region that is often susceptible to age and pathological-related cognitive decline.

1299 Board #6 May 28 9:30 AM - 11:30 AM

Late-life Physical Exercise, Neuropsychiatric Symptoms And The Risk Of Incident Mild Cognitive Impairment

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(No relevant relationships reported)

PURPOSE: Mild cognitive impairment (MCI) is the intermediate stage between normal cognitive aging and dementia. We examined the association between lack of engaging in physical exercise (PE) and presence of neuropsychiatric symptoms (NPS), both separately and combined, with the outcome of incident MCI.

METHODS: This prospective cohort study in the setting of the population-based Mayo Clinic Study of Aging in Olmsted County, MN, included 3206 cognitively unimpaired persons aged ≥ 50 years (1629 males; 853 APOE $\epsilon 4$ carriers; 74 years median age). The outcome of interest in the Cox proportional hazard models was incident MCI, with age as the time scale. Predictors were lack of engaging in light, moderate and vigorous intensity PE within one year of baseline assessment; and presence of NPS (agitation, anxiety, apathy, appetite change, nighttime behavior, depression, and irritability) as measured by the Neuropsychiatric Inventory Questionnaire. We also compared the risk of incident MCI between four groups of participants: no NPS/ engaging in PE (reference group); NPS/ engaging in PE; no NPS/ not engaging in PE; and NPS/ not engaging in PE. Analyses were adjusted for sex, education, global cognition, medical comorbidities, and Apolipoprotein E (APOE) $\epsilon 4$ status.

RESULTS: After a median follow-up of 5.3 years, 599 participants developed incident MCI. Individuals who did not engage in light (HR [95% CI]; 1.25 [1.00, 1.55]), moderate (1.19 [1.00, 1.41]) or vigorous intensity PE (1.36 [1.01, 1.83]) had an increased risk of incident MCI. Having anxiety (1.60 [1.09, 2.33]), apathy (1.91 [1.39, 2.62]) or depression (1.66 [1.30, 2.12]) was also associated with an increased risk of incident MCI. Participants who did not engage in PE (be it of light, moderate or vigorous intensity) in the presence of NPS had the highest risk of incident MCI. For example, not engaging in moderate intensity PE and having anxiety (1.94 [1.20, 3.15]), apathy (2.04 [1.34, 3.13]) or depression (1.93 [1.41, 2.66]) was associated with an increased risk of incident MCI as compared to the reference group.

CONCLUSIONS: Lack of engaging in late-life PE and NPS are independent risk factors of incident MCI. A combination of both factors is associated with an even more elevated risk of developing MCI, with NPS appearing to be a stronger driving force than lack of PE.

C-08 Thematic Poster - Dietary Nitrate

Thursday, May 28, 2020, 9:30 AM - 11:30 AM

Room: CC-2009

1300 Chair: Anni Vanhatalo, FACSM. *University of Exeter, Exeter, United Kingdom.*

(No relevant relationships reported)

1301 Board #1 May 28 9:30 AM - 11:30 AM

Dietary Inorganic Nitrate Supplementation And Ventilatory Threshold In Patients With Reduced Ejection Fraction Heart Failure

Joaquin Ortiz de Zevallos¹, Christopher Neil², Luke C. McIlvenna³, Itamar Levinger³, Jason D. Allen, FACSM¹, Mary N. Woessner³. ¹*University of Virginia, Charlottesville, VA.* ²*Western Health, St Albans, Australia.* ³*Victoria University, Melbourne, Australia.* (Sponsor: Professor Jason D. Allen, FACSM)

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(No relevant relationships reported)

Patients with chronic heart failure (HF) are characterized by exercise intolerance. Maximal oxygen consumption (VO_{2peak}) is predictive of health outcomes, but is

often influenced by early onset fatigue or external factors. Oxygen consumption at the ventilatory threshold (V_{O_2AT}) is a submaximal marker of sustainable oxygen uptake and has been shown to predict 6 month mortality in HF. An intervention that increases V_{O_2AT} in HF would likely produce beneficial clinical and quality of life outcomes. Nitric oxide (NO) bioavailability is a mediator of skeletal muscle perfusion, mitochondrial function and contractile efficiency during exercise. Heart Failure with reduced ejection fraction (HFrEF) is characterized by a reduction in endothelial function and bioavailable NO. Dietary inorganic nitrate supplementation has been shown to increase NO bioavailability and exercise tolerance in patients with other cardiovascular diseases and HFrEF. **PURPOSE:** To determine the effect of dietary inorganic nitrate supplementation on V_{O_2AT} in patients with HFrEF.

METHODS: Sixteen patients with HFrEF (15 men, 63 ± 4 y, BMI: 31.8 ± 2.1 kg·m⁻²) participated in a randomized, double-blind, crossover design study. Participants consumed either beetroot juice (BRJ - 16mmol nitrate/day), or a nitrate-depleted placebo (PL) for five days prior to completing a cardiopulmonary exercise test (CPX). **RESULTS:** Following BRJ supplementation plasma nitrite increased significantly compared to placebo (511.5 ± 461.0nM vs. 195.0 ± 176.8nM; p<0.05). No differences were observed for the onset of VT (BRJ: 611.0 ± 119.7s; PL: 611.0 ± 142.3s; p=0.9) or V_{O_2AT} (BRJ: 1159.7 ± 207.8ml·min⁻¹; PL: 1132.4 ± 221.0ml·min⁻¹; p=0.53).

CONCLUSIONS: Dietary nitrate supplementation, despite significant increase in circulating nitrite, produced no changes time to anaerobic threshold or sustainable sub-maximal oxygen uptake. Supported by Australian Heart Foundation Vanguard Award 101389 to Jason D. Allen

1302 Board #2 May 28 9:30 AM - 11:30 AM

Nitrate Supplementation And Exercise Tolerance In Well-trained Middle And Older-aged Adults

Michael J. Berry, FACSM, Gary D. Miller, Daniel B. Kim-Shapiro, Macie S. Fletcher, Caleb G. Jones, Zachary D. Gauthier, Summer L. Collins, Swati Basu, Timothy Heinrich. *Wake Forest University, Winston-Salem, NC.*

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Reported Relationships: M.J. Berry: Industry contracted research; Isagenix International LLC.

PURPOSE: Nitrate (NO_3^-), through its conversion to nitrite (NO_2^-) and nitric oxide, has been shown to increase exercise tolerance in healthy younger adults and older diseased patients. Nitrate's effect in well-trained middle to older-aged adults has not been studied. Therefore, the purpose of this investigation was to examine the effects of a NO_3^- rich beverage on submaximal constant work rate exercise time in well-trained middle to older-aged adults.

METHODS: Fifteen, 41-64 year-old, well-trained middle to older-aged adults were assigned to receive one of two treatments (NO_3^- rich beverage then placebo or placebo then NO_3^- rich beverage), after which an exercise test at 75 percent of the subject's maximal work rate was completed.

RESULTS: The NO_3^- rich beverage increased plasma NO_3^- and NO_2^- levels by 270 μ M and 0.81 μ M, respectively (p<0.001). Exercise time was not significantly different (p=0.31) between the NO_3^- rich versus placebo conditions (1130±151 vs 1060±132 sec, respectively). Changes in exercise time between the two conditions ranged from a 55% improvement to a 40% decrease with the NO_3^- rich beverage. Oxygen consumption and rating of perceived exertion were not significantly different between the two conditions.

CONCLUSIONS: In middle to older-aged well-trained adults, NO_3^- supplementation has non-significant, albeit highly variable, effects on exercise tolerance.

1303 Board #3 May 28 9:30 AM - 11:30 AM

Nitrate-rich Beetroot Juice Offsets Salivary Acidity Following Carbohydrate Ingestion Before And After Endurance Exercise

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(No relevant relationships reported)

Oral disease is prevalent in elite athletes and is associated with frequent carbohydrate ingestion which lowers salivary-pH. Conversely, ingestion of nitrate (NO_3^-)-rich beetroot juice can increase salivary-pH. **Purpose** To determine the effect of NO_3^- on salivary-pH following carbohydrate ingestion before and after exercise. **Methods** Eleven male endurance runners completed a double-blind randomised placebo-controlled study comprising four experimental trials. Participants ingested the following fluids one hour before each trial: (a) 140 ml of water (negative-control), (b) 140 ml of water (positive-control), (c) 140 ml of NO_3^- -rich beetroot juice (~12.4 mmol NO_3^-) (NO_3^-) or (d) 140 ml NO_3^- -depleted beetroot juice (placebo). During the negative-control trial, participants ingested 795 ml of water in three equal aliquots: before, during, and after 90 min of submaximal running. In the other trials they received 795 ml of carbohydrate supplements in the same fashion. One venous blood

was collected before and after exercise. At the same time points, saliva was sampled before and repeatedly for 20 min following carbohydrate or water ingestion, area under the curve (AUC) was calculated for these samples. **Results** As expected, nitrite (NO_2^-) and NO_3^- were highest in the NO_3^- -trial (all P<0.001). Salivary-pH followed a similar pattern (NO_3^- -trial - Pre-exercise 7.4 ± 0.4 Post-exercise 7.4 ± 0.4, negative-control - Pre-exercise 7.1 ± 0.3 Post-exercise 7 ± 0.2, positive-control - Pre-exercise 7.1 ± 0.3 Post-exercise 6.9 ± 0.2, placebo - Pre-exercise 7 ± 0.3 Post-exercise 7 ± 0.2, all P<0.05). Compared to negative-control, salivary-pH AUC was significantly reduced following carbohydrate in positive-control and placebo (Pre-exercise - positive-control 33 ± 2.9, placebo 33.2 ± 2.7, negative-control 36.3 ± 1.8. Post-exercise - positive-control 32.1 ± 3, placebo 32.7 ± 2.4, negative-control 36.2 ± 1.9, all P<0.05). Conversely, AUC was similar in negative-control and NO_3^- despite ingestion of carbohydrate in the NO_3^- -trial (Pre-Exercise 34.8 ± 2.5, Post-exercise 34.5 ± 2.6, both P≥0.221). **Conclusion** Ingesting NO_3^- -rich beetroot juice attenuates the reduction in salivary-pH after carbohydrate supplements suggesting that NO_3^- may protect athletes' teeth from acid erosion caused by frequent carbohydrate ingestion.

1304 Board #4 May 28 9:30 AM - 11:30 AM

Dietary Inorganic Nitrate Supplementation And Exercise Tolerance In Patients With Reduced Ejection Fraction Heart Failure

Jason D. Allen, FACSM¹, Christopher Neil², Luke C. McIlvenna³, Joaquin Ortiz de Zavallos¹, Itamar Levinger³, Mary N. Woessner³. ¹University of Virginia, Charlottesville, VA. ²Western Health, St Albans, Australia. ³Victoria University, Melbourne, Australia.

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(No relevant relationships reported)

Exercise intolerance is the primary cause of morbidity and decreased quality of life in patients with chronic heart failure (HF). The strong prognostic value of exercise capacity in patients with HF warrants identification of interventions which maximize exercise capacity in this population. Although the etiology of HF is complex, reduced nitric oxide (NO) bioavailability is an underlying characteristic that has been shown to moderate physiological processes related to exercise including vascular function, tissue perfusion, mitochondrial function and contractile efficiency. Dietary inorganic nitrate supplementation has been shown to increase NO bioavailability and increase exercise tolerance in several clinical populations, including peripheral arterial disease, pulmonary disease, and HF with preserved ejection fraction. **Purpose:** To determine the effect of dietary inorganic nitrate supplementation on exercise capacity in patients with heart failure with reduced ejection fraction (HFrEF). **Methods:** Sixteen patients with HFrEF (15 men, 63 ± 4 y, BMI: 31.8 ± 2.1 kg·m⁻²) participated in a randomized, double-blind, crossover design study. Participants consumed either a nitrate rich beetroot juice (16mmol nitrate/day), or a nitrate-depleted placebo for five days prior to the first testing visit, with continued dosing until completion of a cardiopulmonary exercise test (CPX). Between treatment differences were analysed via paired- t-test analysis. Statistical significance was set *a-priori* at p< 0.05. **Results:** Both plasma nitrate and nitrite increased following nitrate supplementation (933%, p<0.001 and 94%, p< 0.05, respectively). No differences were observed for VO_{2peak} (nitrate 18.5 ± 5.7ml·kg⁻¹·min⁻¹, placebo: 19.3 ± 1.4ml·kg⁻¹·min⁻¹; p=0.13) or time to exhaustion (nitrate: 1165 ± 92sec, placebo: 1207 ± 96sec, p=0.16) following supplementation. Similarly, there were no differences between the two treatments in blood pressures or deoxygenated or oxygenated haemoglobin at rest or at any stage of the exercise testing. **Conclusion:** Inorganic nitrate supplementation did not improve exercise tolerance, blood pressures or tissue perfusion in patients with HFrEF.

Supported by Australian Heart Foundation Vanguard Award 101389 to Jason D. Allen

1305 Board #5 May 28 9:30 AM - 11:30 AM

Twelve Weeks Of Nitrate, Beta-alanine, Or Combined Treatment In NCAA Division III Male Soccer Players

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(No relevant relationships reported)

In a sport of long duration, such as soccer, with many high-intensity bouts interspersed within the match, enhancing performance to last the duration of the match and maintain high levels of intensity is paramount. Thus, with proper nutrition and physical preparation, supplements such as beta-alanine (due to its intracellular buffering capacity) and nitrate (due to its vasodilatory and ergogenic effects in endurance exercise) may have value in this population.

PURPOSE: The purpose of this investigation was to examine the effects of chronic supplementation with nitrate, beta-alanine, or combined treatment in NCAA Division III male soccer players.

METHODS: Twenty-two NCAA Division III male soccer players (age: 19.1 ± 1.1yrs; mass: 74.8 ± 8.0kg; body fat: 13.6 ± 4.0%) were randomly assigned into one of four

groups: nitrate plus placebo (NIT), beta-alanine plus placebo (BA), placebo (PLA), or active treatments (ACT) and participated in this 12-week double-blind, placebo-controlled study. At pre-intervention testing, participants completed body composition measures, VO_2 max, 30-second Wingate test on day one, and 40-yard dash and Yo-Yo Intermittent Recovery: Level 2 (YOYOIR2) on day two and testing sessions were repeated at 6- and 12-weeks post training and supplementation. A 4x3 repeated measures ANOVA was used to analyze the data with a-priori p value set at ≤ 0.05 .

RESULTS: There was a significant time effect for the following variables indicating that the training protocol induced performance adaptations: VO_2 max ($p = 0.0$), Wingate peak power and mean power ($p = 0.04$; $p = 0.006$), 40-yard dash ($p = 0.003$), and YOYOIR2 ($p = 0.0$). Change in performance over time (% change) for VO_2 max was NIT: 9%, BA: 7%, ACT: 12% vs PLA: 8%. Wingate mean power % change was NIT: 17%, BA: 6%, ACT: 4% vs PLA: 5%. Wingate peak power % change was NIT: 10%, BA: 11%, ACT: 10% vs PLA: 9%. YOYOIR2 % change was NIT: 48%, BA: 54%, ACT: 74% vs PLA: 10%. Despite this, there were no significant group by time effects for any variables.

DISCUSSION: After 12 weeks of daily supplementation, no statistical differences were shown between groups for the variables tested. Despite this, improvements were made by each group in comparison to the placebo group.

CONCLUSIONS: Although further research is warranted, addition of these supplements may be beneficial to soccer players.

1306 Board #6 May 28 9:30 AM - 11:30 AM
Influence Of Chlorinated Pool Water Exposure On Oral Nitrate Reduction In Healthy Adults

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(No relevant relationships reported)

Dietary nitrate (NO_3^-) supplementation can improve exercise performance with this effect mediated by reduction of NO_3^- to nitrite (NO_2^-) and then nitric oxide. The reduction of NO_3^- to NO_2^- is catalyzed by oral NO_3^- reducing bacteria. Chlorine is an antimicrobial agent that is commonly used to sterilize pool water, but it is presently unclear whether the lack of an improvement in swimming performance in trained swimmers following dietary NO_3^- supplementation can be ascribed to impaired oral NO_3^- reduction (ONR). **PURPOSE:** To test the hypotheses that ONR would be greater: 1) in non-swimmers (NS) compared to elite swimmers (ES), and 2) before compared to after a pool training session in ES.

METHODS: Thirteen ES (8 males, 21 \pm 2 yrs) and fourteen NS controls (9 males, 25 \pm 4 yrs) participated in this study. In a randomized, double blind, crossover experimental design, ONR was assessed in ES before (AM-Pre and PM-Pre) and after (AM-Post and PM-Post) a morning and afternoon pool training session. In NS, ONR was only assessed in the morning. For assessment of residual oral NO_3^- concentration ($[\text{NO}_3^-]$), participants held 10 mL of water in their mouth for 3 min and subsequently expectorated the content of their oral cavity. Following a 3 min recovery, participants repeated this process with either 10 mL of water (PL) or a 1 mM KNO_3 solution (NIT). Salivary $[\text{NO}_3^-]$ was assessed using ozone-based chemiluminescence. In ES, ONR was assessed via a 2 \times 2 repeated-measures ANOVA, while differences in ONR between ES and NS was assessed using an independent-samples t-test.

RESULTS: There was no difference in ONR between ES (0.10 \pm 0.07 $\mu\text{mol}\cdot\text{min}^{-1}$) and NS (0.12 \pm 0.13 $\mu\text{mol}\cdot\text{min}^{-1}$, $P > 0.05$). There was a condition \times time interaction effect for ONR in ES ($P < 0.05$). Compared to PL, ONR in NIT was higher AM-Pre, AM-Post, PM-Pre and PM-Post ($P < 0.05$); however, ONR in NIT was not different between the AM-Post (0.12 \pm 0.11 $\mu\text{mol}\cdot\text{min}^{-1}$) and AM-Pre (0.10 \pm 0.07 $\mu\text{mol}\cdot\text{min}^{-1}$) or PM-Post (0.17 \pm 0.15 $\mu\text{mol}\cdot\text{min}^{-1}$) and PM-Pre (0.16 \pm 0.10 $\mu\text{mol}\cdot\text{min}^{-1}$) conditions ($P > 0.05$). Oral NO_3^- reduction in NIT was higher in PM-Pre compared to AM-Pre ($P < 0.05$). **CONCLUSIONS:** Similar ONR was exhibited in ES and NS, and ONR was not acutely attenuated in ES following morning or afternoon pool training sessions. These observations suggest that exposure to chlorinated pool water does not interfere with ONR.

1307 Board #7 May 28 9:30 AM - 11:30 AM
Beetroot Supplementation Lowers Blood Pressure, But Does Not Improve Exercise Efficiency In Female Masters Swimmers

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(No relevant relationships reported)

Beetroot supplements are high in dietary nitrate, which increases nitric oxide (NO) in the blood circulation. While NO can lower blood pressure and reduce the oxygen cost of exercise, this has mainly been studied in male athletes. Less is known about the effects of BRS in female athletes, especially swimmers. **PURPOSE:** To determine if acute beetroot supplementation (BRS) lowers blood pressure (BP) and improves exercise efficiency in female masters swimmers during treadmill exercise. **METHODS:** 11 swimmers (57.8 \pm 10.5 y) underwent 2 randomized, double-blinded

trials and ingested beetroot supplement (BE) or placebo (PL). BP, heart rate (HR), and NO response, determined indirectly via changes in salivary nitrite (NO_2^-), was measured pre-ingestion (Base), pre-exercise (Pre), and 5 min post-exercise (Post). Oxygen consumption (VO_2), HR, and rating of perceived exertion (RPE) were measured during the modified Balke test until HR reached 85% of age-predicted maximum. Changes in salivary NO_2^- were determined using NO_2^- detection strips and quantified as percentage of reference standard. 2-way repeated measures ANOVA was used to determine differences in BP, HR and salivary NO_2^- . Peak VO_2 , treadmill time, and peak RPE were analyzed by 2-tailed t-tests. **RESULTS:** Salivary NO_2^- increased from Base to Post in BE compared to PL (32.5 \pm 7.0 vs 2.7 \pm 3.9%, $p = 0.001$). No treatment differences existed for peak VO_2 (BE: 29.3 \pm 2.0 vs PL: 29.7 \pm 2.7 $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, $p = 0.31$), treadmill time (BE: 15.5 \pm 1.9 vs PL: 15.4 \pm 1.8 min, $p = 0.92$), or peak RPE (BE: 6.2 \pm 0.5 vs PL: 6.5 \pm 0.5, $p = 0.26$). Diastolic BP was significantly lower in BE vs PL, respectively (Base: 74.6 \pm 1.7 vs 73.2 \pm 2.3, Pre: 73.6 \pm 1.8 vs 74.5 \pm 2.1, Post: 74.5 \pm 1.7 vs 76.1 \pm 2.2 mmHg, $p = 0.03$, treatment \times time), while systolic BP changes trended towards significance in BE vs PL (Base: 116.6 \pm 1.5 vs 115.5 \pm 1.6, Pre: 115.0 \pm 1.7 vs 116.0 \pm 1.7, Post: 116.5 \pm 1.4 vs 118.3 \pm 1.5 mmHg, $p = 0.053$). HR at Base, Pre, and Post was not different in BE vs PL (62.0 \pm 2.4, 63.2 \pm 2.5, and 72.6 \pm 3.2 vs 63.6 \pm 2.1, 65.4 \pm 2.2, and 74.6 \pm 2.4 bpm, $p = 0.86$). **CONCLUSIONS:** Acute BRS lowers diastolic BP, but does not improve exercise efficiency in this group of trained, normotensive female masters swimmers. More research is needed in other female masters athlete groups such as runners and cyclists, and in female athletes with hypertension.

1308 Board #8 May 28 9:30 AM - 11:30 AM

The Effects Of Beetroot And Tart Cherry Supplementation On Repeated Sprint Performance

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(No relevant relationships reported)

PURPOSE: In recent years, sports supplements have been of interest to athletes as a possible way to increase performance. Two supplements of high interest are beetroot (BR) and tart cherry (TC) juice. BR is known to have an ergogenic effect due to its high nitrate contents, helping to vasodilate blood vessels in times of low oxygen availability. TC is known for its anti-oxidative and anti-inflammatory properties, which is shown to benefit athletes as well. Therefore, this study aimed to investigate whether beetroot and tart cherry supplementation would improve repeated sprint performance in healthy individuals.

METHODS: Using a randomized cross-over, double-blind, placebo-controlled design, 12 healthy individuals (4 females and 8 males, 24.4 \pm 2.7 years) were consumed BR, TC, and placebo capsules separately to determine the effects of these supplements on repeated sprint cycling performance. Participants completed a baseline sprint test, including a 5-minute warm-up, followed by six 10 second sprints (6x10) interspersed by a minute passive recovery. Participants received capsule contained 500mg of powder. In total, 2000mg of BR, TC, and placebo were separately consumed for four days prior to testing day. Peak power (W) and average power (W) were measured using Monark bike instrument data. Blood pressure was taken before and following the test. Lactate testing was done prior to the test, immediately after, as well as 10 minutes following the cycling sprint protocol.

RESULTS: Results showed that the average power was significantly higher in BR (491.5 \pm 78 W) and TC (497 \pm 82 W) against PL (477 \pm 90 W), while no difference was found between BR and TC conditions. Furthermore, the lactate level at 10 minutes following the test was significantly lower in BR (10.3 \pm 0.67 mmol/l) versus TC (11.08 \pm 1.23 mmol/l) and PL (11.6 \pm 1.12 mmol/l) conditions. There was no significant difference among TC, BR, and PL on peak power. **CONCLUSIONS:** Our results indicate that while BR and TC supplementation both improved performance at the 10-s repeated cycling sprint, this improvement was only accompanied by differences in lactate levels after the protocol in response to BR supplementation.

C-09 Thematic Poster - Energy Balance and Weight Control

Thursday, May 28, 2020, 9:30 AM - 11:30 AM
Room: CC-2011

1309 **Chair:** Barry Braun, FACSM. *Colorado State University, Fort Collins, CO.*
(No relevant relationships reported)

1310 **Board #1** **May 28 9:30 AM - 11:30 AM**
Yoga Participation And Weight Loss Within A Behavioral Intervention
Sally Sherman, Ph.D., Renee J. Rogers, Ph.D., FACSM, Kelliann K. Davis, Ph.D., FACSM, Nalingna Yuan, M.S., John M. Jakicic, Ph.D., FACSM. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: John M. Jakicic, Ph.D., FACSM)
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(No relevant relationships reported)

Yoga may elicit numerous benefits including weight loss. However, it is unclear if adults with obesity will lose more weight as frequency and amount of yoga increases within a behavioral weight loss intervention. **PURPOSE:** To compare the association between yoga participation and weight loss across two styles of yoga. **METHODS:** Fifty adults with obesity (BMI: 31.3±3.8 kg/m²; 45.8±9.5 years) participated in a 6-month group-based behavioral weight loss intervention. All participants were prescribed a calorie and fat-reduced diet (1200-1800 kcal/day, 20-30% fat intake). Randomization was to either a Restorative (RES) or Vinyasa (VIN) style of yoga, with one supervised session per week and 4 home-based sessions using videos developed and provided by the investigators on an electronic tablet. Yoga sessions increased from 20 to 40 to 60 minutes per session across the intervention. Weight was assessed at baseline and 6 months. Analysis of variance with repeated measures was used to assess weight loss. Linear regression analyzed the association between yoga participation with weight loss. **RESULTS:** Weight significantly decreased from 87.3±2.6 kg to 81.8±2.6 kg in RES and from 88.4±2.6 kg to 82.5±2.6 kg in VIN (p<0.0001), with no difference between yoga conditions (p=0.882). Total participation days in yoga was significantly and linearly related to weight loss in both RES and VIN styles (β=0.088, p=0.018; β=0.089, p<0.001, respectively). Total participation minutes in yoga was significantly and linearly related to weight loss in both RES and VIN styles (β=0.002, p=0.034; β=0.003, p<0.001, respectively). **CONCLUSIONS:** Findings indicate that the amount and frequency of participation in yoga is associated with weight loss within the context of a comprehensive behavioral intervention. Future studies need to examine strategies to enhance yoga participation in adults with overweight or obesity, and to understand the pathways by which yoga may influence body weight regulation.

1311 **Board #2** **May 28 9:30 AM - 11:30 AM**
Energy Expenditure Measured Overnight In A Whole-room Indirect Calorimeter In Four Collegiate American-style Football Linemen
Timothy D. Allerton¹, Eric Ravussin¹, Jennifer Rood¹, Brian Irving, FACSM², Nathan Lemoine², Shelly Mullenix², Jack Marucci², Neil Johannsen². ¹*Pennington Biomedical Research Center, Baton Rouge, LA.* ²*Louisiana State University, Baton Rouge, LA.* (Sponsor: Brian Irving, FACSM)
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(No relevant relationships reported)

Purpose: Increased adiposity during football playing career increases the prevalence of post-career obesity and poor cardiometabolic health. Linemen are often required to alter body weight to meet performance goals, but validated energy expenditure equations (EE) for athletes with high body weights and high physical activity level are lacking. Furthermore, data regarding resting energy expenditure using the gold standard methodology of whole-room indirect calorimeter (metabolic chambers) is not available. The purpose of this study was to measure EE in collegiate American-style football linemen overnight. **Methods:** Participant's oxygen consumption and carbon dioxide production were measured in 1-minute intervals over a 12-hour period in a metabolic chamber. Sleeping energy expenditure (sleep EE) was defined as the average EE during the periods between 0000 and 0500 hours. Resting metabolic rate (RMR) was defined as period after waking between 0600 and 0700 hours with the participant remaining still. Measured sleep EE and RMR were compared to values obtained from prediction equations established by Ravussin et al (1986) to estimate RMR and sleep EE using anthropometric data. **Results:** Participants (n=4) were young (19.5 ± 1.0 years old) males with a mean weight of 161.1 ± 10.2 kg with 32 ± 4% body fat. Anthropometric predicted RMR (3260 ± 132 kcal/day) over-estimated RMR by 419 ±

161 kcal/day (14%) when compared to measured RMR (2841 ± 154 kcal/day, P=0.01). However, estimated sleep EE, predicted by Ravussin et al. (1986) (2312 ± 41 kcal/day) was under-estimated by 13% when compared to measured sleep EE (2760 ± 348 kcal/day, P=0.01). **Conclusions:** Prediction equations to estimate RMR and sleep EE can over-predict or under-predict, respectively, actual EE in American-football linemen. Studies with a larger number of participants are required to develop better prediction equations for young athletes with high fat mass and high levels of physical activity.

1312 **Board #3** **May 28 9:30 AM - 11:30 AM**
Non-exercise Activity During Dietary Restriction Or Aerobic Exercise Interventions In Individuals With Overweight Or Obesity
Sarah A. Purcell¹, Kristina T. Legget¹, Tanya M. Halliday², Seth A. Creasy¹, Jennifer M. Blankenship¹, Allison Hild¹, Jason R. Tregellas¹, Edward L. Melanson, FACSM¹, Marc-Andre Cornier¹. ¹*University of Colorado - Anschutz Medical Campus, Aurora, CO.* ²*University of Utah, Salt Lake City, UT.* (Sponsor: Dr. Edward Melanson, FACSM)
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(No relevant relationships reported)

PURPOSE: Reduced non-exercise physical activity (PA) may contribute to attenuated weight loss during behavioral interventions. Our objective was to compare PA and sedentary behavior (SB) before and after dietary restriction (DIET) versus aerobic exercise intervention (EX).

METHODS: Adults with overweight or obesity were randomized to undergo 12 weeks of DIET or EX, both aimed at 2000 kcal/week reduction in energy balance. Average steps and time spent sitting, standing, stepping, light activity, and moderate-to-vigorous activity (MVPA) were measured using ActivPAL accelerometers at baseline and for approximately 7 days within the last 2 weeks of the intervention. PA and SB variables were assessed with and without removal of exercise sessions. Data were analyzed using mixed methods analysis of variance with time (baseline vs. follow-up) as the within-subjects factor and group (diet vs. exercise) as the between-subjects factor. In post-hoc analyses, dependent samples t-tests assessed changes within groups.

RESULTS: 26 individuals (n=15 DIET, n=11 EX) had valid accelerometry data at both time points (age: 36±8 years, body mass index: 30.3±3.0 kg/m², n=19 [73%] women). The DIET group trended towards greater weight loss (DIET -7.2±6.4 kg; EX: -3.5±6.3 kg, p=0.071). Without removing exercise sessions, MVPA increased within the EX group (baseline: 60±11, follow-up: 73±15 min, p=0.011), but not in the DIET group (baseline: 63±15, follow-up: 62±16 min, p=0.847). However, after removing exercise session data, no significant interactions, within-subject effects, or between-subject effects were observed for steps or time spent sitting, standing, stepping, light activity, or MVPA. **Table 1.**

CONCLUSION: PA and SB were not differentially affected by DIET and EX interventions, suggesting that these strategies may not result in compensatory reduction in PA.

Supported by the American Diabetes Association and NIH Grants: UL1 TR000154, T32 DK007658-29, K01 DK100445.

Table 1. Changes in non-exercise physical activity and sedentary behavior between dietary restriction (DIET) and aerobic exercise (EX) groups

Measurement	Baseline	Follow-up	Change	P, analysis of variance for repeated measures		
				Within-group	Between-group	Inter-action
Steps, average number						
DIET	4134±1004	4051±1068	-83±1129	0.56	0.82	0.84
EX	4106±761	3936±854	-171±971			
Sit time, minutes						
DIET	568±102	600±114	32±84	0.76	0.18	0.14
EX	547±104	526±38	-21±91			
Stand time, minutes						
DIET	280±96	253±92	-27±64	0.07	0.98	0.70
EX	275±67	257±53	-18±52			
Step time, minutes						
DIET	106±28	102±26	-5±27	0.44	0.84	0.91
EX	104±21	100±23	-3±24			
Light activity, minutes						
DIET	44±16	40±14	-4±12	0.24	0.98	0.86
EX	43±17	41±13	-3±15			
MVPA, minutes						
DIET	63±15	62±16	-1±17	0.80	0.68	0.99
EX	60±11	60±14	-1±14			

1313 Board #4 May 28 9:30 AM - 11:30 AM

Obesity Does Not Modulate Men's Eating Behavior After A High Intensity Interval Exercise Session

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(No relevant relationships reported)

PURPOSE: To investigate the impact of obesity on acute and subacute responses to High Intensity Interval Exercise (HIIE) on hunger feelings and energy intake (EI) in young men.

METHODS: Ten men with obesity (OB) (body mass index [BMI]: 34.6 ± 4.4 kg / m²) and 10 normal weight (CG) (BMI: 23.1 ± 3.9 Kg/m²) participated in a HIIE session, comprised of a series of three, 6-minute intervals consisting of 6 sprints for a duration of 30 seconds at 100% of maximum aerobic velocity (MAV), followed by 30 seconds of active recovery at 50% MAV, and concluding with 4 minutes of passive recovery. Participants' food intakes were measured using 24h dietary recalls at baseline and 24h-post HIIE. Hunger feelings were measured using a visual analog scale at Baseline, 2h and 24h after HIIE.

RESULTS: CG individuals achieved higher MVA (P<0.01) and VO_{2peak} (P=0.04) than OB ones. No differences in energy expenditure during the HIIE session were observed between groups (OB: 234 ± 90 kcal and CG: 254 ± 72 kcal, P=0.8). No effect of HIIE on EI (kcal), fat and protein consumption in either group was observed. Carbohydrate intake increased in both groups after the HIIE (P<0.01). Relative energy intake post HIIE session was lower in the OB group (1749±976kcal) compared with CG (2274±536kcal) (P=0.05). Hunger feelings increased 2h and 24h-post HIIE compared with baseline, CG from 12 (1-79) mm at baseline to 72 (10-98) mm post-2h and to 60 (4-86) mm post-24h and in OB from 19.5 (0-50) mm at baseline to 50 (9-73) mm in Post-2h and 60 (8-92) mm in Post-24h (Group: P=0.71, Time: P<0.01, GXT: P=0.06). The desire to eat increased in both groups when compared with baseline, CG from 17 (0-81) mm at baseline to 70 (12-87) mm in Post-2h and to 47 (7-85) mm in Post-24h and in OB from 34 (1-89) ± 36.0 mm at baseline to 63 (11-86) mm in Post-2h and 51 (7-84) mm in Post-24h (Group: P=0.65, Time: P<0.01, GX: P=0.29).

CONCLUSIONS: Obesity did not appear to influence eating behavior or hunger feelings post-HIIE in young men.

1314 Board #5 May 28 9:30 AM - 11:30 AM

The Impact Of Exercise Energy Expenditure On Total Daily Energy Expenditure.

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(No relevant relationships reported)

PURPOSE: The present study examined, among weight-stable overweight or obese adults, the effect of increasing doses of exercise energy expenditure (EEex) on changes in total daily energy expenditure (TDEE), total body energy stores (Es) and body composition.

METHODS: Participants included healthy, sedentary females and males aged 21 to 45 with a body mass index between 25 and 35 kg/m² who were randomized to one of three groups for a period of 26 weeks: moderate exercise group (ModEX; EEex goal of 17.5 kcal/kg/week), high exercise group (HighEX; EEex goal of 35 kcal/kg/week), or observation group (OBS). Participants maintained body weight within 3% of baseline weight. Pre/post measurements included body composition, EEex, calculated energy intake, total daily energy expenditure (TDEE), total body energy stores (Es), and resting metabolic rate (RMR). Outcomes were compared among groups, and among group by sex.

RESULTS: Sixty weight-stable participants (31 males and 29 females) completed the protocols. There were no differences among groups in any baseline variable. EEex increased in a stepwise manner as compared to OBS (p<.001). As compared to OBS, there was no group effect on changes in TDEE, energy intake, fat free mass or RMR. Fat mass and total energy stores decreased among the HighEF female participants (p = 0.007).

CONCLUSIONS: The increase in EEex did not result in an equivalent increase in TDEE. There was a sex difference in the relationship among energy balance components. These results suggest that, without substantial weight change, the doses of exercise produced a compensatory reduction in non-exercise energy expenditure, and potentially a sex-specific change in body composition. This project was funded by an unrestricted grant from the Coca Cola Company.

1315 Board #6 May 28 9:30 AM - 11:30 AM

Decreased Ghrelin And Increased PYY And GLP-1 Following Acute Aerobic Vs Resistance Exercise

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PURPOSE: To determine if aerobic exercise (AEX) and resistance exercise (REX) differentially influence acute energy intake and appetite regulation. **METHODS:** Physically inactive adults with overweight/obesity (n=24, 35±1.7 yrs, BMI: 28.5±1.0 kg/m²; 50% female) completed 2 conditions: 1) AEX (treadmill walking at 65-70% of age-predicted maximum heart rate for 45 minutes) and 2) REX (1-set to failure of 12 resistance exercises). Each condition was initiated in the postprandial state (35 minutes post breakfast). Appetite (visual analog scale for hunger, satiety and prospective food consumption [PFC]) and hormones (ghrelin, PYY, and GLP-1) were measured before and every 30 minutes for 3 hours following consumption of the standardized breakfast meal. Post exercise food cravings (following 90 min VAS and blood draw via Food Cravings Inventory [FCI] questionnaire) and *ad libitum* energy intake at the lunch meal were also measured. **RESULTS:** There was no difference in post-exercise *ad libitum* energy intake between conditions (AEX: 937±65 kcal vs. REX: 991±68 kcal). There were also no differences in post exercise food cravings, nor area under the curve (AUC) for hunger, satiety, or PFC. However, there was a trend for higher satiety scores 150 min post breakfast in the REX condition (AEX: 35±4 mm vs. REX: 42±4 mm, p=0.08). AUC for ghrelin (AEX: 143,592±7,464 pg/mL vs. REX: 130,737±4,928 pg/mL, p=0.002), PYY (AEX: 23,812±1,592 pg/mL vs. REX: 20,540±1,177 pg/mL, p<0.001), and GLP-1 (AEX: 1,615±110 pg/mL vs. REX: 1,314±93 pmol/L, p<0.001) were all higher in the AEX condition compared to REX. For ghrelin and PYY, the higher AUC for AEX was due to greater values for all of the post-exercise time points evaluated (all p<0.05). For GLP-1, the higher AUC for AEX was due to significantly higher levels at the 90 minute postprandial time point (p<0.001), and a trend for greater levels at the 120 minute time point (p=0.07). **CONCLUSIONS:** The data suggest that an acute bout of aerobic exercise appears to increase both ghrelin, an orexigenic gut peptide, as well as PYY and GLP-1, anorectic gut peptides, compared to an acute bout of resistance exercise. However, acute *ad libitum* energy intake was not different between conditions. Future work is needed to determine if exercise modality influences chronic energy intake and appetite regulation.

1316 Board #7 May 28 9:30 AM - 11:30 AM

The Effects Of High Intensity Interval Training Versus Moderate Intensity Continuous Training On Energy Compensation

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(No relevant relationships reported)

To determine the effects of high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) on energy compensation in response to 12-weeks of supervised aerobic exercise.

After a 4 wk lead in period of 3x/wk of MICT, subjects (N = 24) were randomly assigned into: HIIT or MICT, for an additional 8 wks. HIIT included a 10x1 min protocol 3x/wk and MICT included 30 min of exercise 5x/wk. Subjects completed both stationary cycling and inclined treadmill exercise. 13 participants (1 M, 12 F) were randomized into the HIIT group (28.0 ± 9.7 yr; BMI = 23.9 ± 3.9 kg/m²; VO_{2max} = 29.0 ± 6.0 ml/kg/min). 11 participants (2 M, 9 F) were randomized into the MICT group (26.0 ± 6.9 yr; BMI = 27.4 ± 8.7 kg/m²; VO_{2max} = 26.2 ± 7.3 ml/kg/min). Resting metabolic rate (RMR), body composition, and maximal oxygen uptake (VO_{2max}) were measured at baseline and after 4 and 12 wks. Physical activity and dietary intake were measured for 7-day periods pre-intervention and during wks 5 and 12. Compensation was calculated through caloric equivalents of fat and lean mass compared to cumulative total exercise energy expenditure.

5 of 11 in MICT and 6 of 13 in HIIT were categorized as compensators. Change in fat mass (kg) (MICT: -0.59 ± 1.89, HIIT: -0.03 ± 1.72, p=0.45), change in weight (kg) (MICT: +0.66 ± 2.11, HIIT: -0.54 ± 1.45, p=0.12), and overall compensation (kcal) (MICT: 3111 ± 17220, HIIT: 3870 ± 15911, p=0.91) were similar between exercise groups. The difference between actual and predicted weight loss was greater for MICT (-1.61 ± 2.15 kg) than HIIT (-0.07 ± 1.45 kg, p=0.049). Potential compensatory variables including changes in RMR, VO_{2max}, daily steps, and sedentary time were not different between the compensator and non-compensator groups (P > 0.05). Mean energy and macronutrient intake did not differ among all participants, by exercise intervention group, or by compensation status (P > 0.05).

Both HIIT and MICT led to a similar percentage (~45%) of participants compensating for the exercise intervention. Despite the large difference in cumulative exercise training time (480 vs 1200 min, HIIT vs MICT), body fat and weight changes were similar between groups. Finally, our data suggests that HIIT may elicit weight loss that is closer to that predicted by exercise energy expenditure when compared to MICT.

1317 Board #8 May 28 9:30 AM - 11:30 AM

Effects Of Different Forms Of Exercise On Metabolism Following Short-term Overfeeding And Reduced Physical Activity

Jean-Philippe Walhin¹, Yung-Chih Chen², Aaron Hengist¹, James L. J. Bilzon¹, James A. Betts, FACSM¹, Dylan Thompson¹.

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(No relevant relationships reported)

PURPOSE: Short-term overfeeding combined with reduced physical activity impairs metabolic function and alters the expression of key genes within adipose tissue. We have shown that daily vigorous-intensity running can prevent these changes even with a matched energy surplus. However, the influence of exercise type, intensity and/or duration on these responses remains to be ascertained. **METHODS:** Forty-eight healthy young men (mean ± SD; age 22 ± 3 yr; body mass 73.8 ± 7.2 kg; height 1.77 ± 0.06 m) were randomly allocated for 1 week to either: (1) over-consume their habitual diet by 50% whilst restricting their physical activity below 4000 steps.day⁻¹ (*energy surplus*; n=13); (2) the *energy surplus* regimen plus 45 min of daily vigorous-intensity arm-crank ergometry at 70% VO_{2peak} (*arm-crank*; n=11); (3) the *energy surplus* regimen plus 45 min of daily moderate-intensity walking at 50% of VO_{2peak} (*moderate exercise*; n=12) or; (4) the *energy surplus* regimen plus intermittent short bouts of walking every hour during waking hours to meet a prescribed step count each day (*activity breaks*; n=12). All prescribed physical activity (groups 2-4) was isoenergetic and matched by additional food intake to standardize energy surplus across groups. At baseline and follow-up, fasted blood samples, abdominal subcutaneous adipose biopsies and skeletal muscle biopsies were obtained and oral glucose tolerance tests conducted. **RESULTS:** The matched energy surplus across all groups resulted in an increased insulinemic response from baseline to follow-up (time effect: p<0.001), with little evidence that prescribed physical activities offset this response (group*time: p=0.09). Similarly, the energy surplus *per se* increased expression of FAS, GLUT4 and SREBP-1c and decreased the expression of HSL, AMPK and PDK4 within adipose tissue, with no difference between groups. Key genes within skeletal muscle were unaffected baseline to follow-up in any condition. **CONCLUSIONS:** A short-

term energy surplus induced by overfeeding and reduced physical activity impaired metabolic function at the systemic and adipose level. The forms of physical activities investigated were not sufficient to clearly offset those changes.

C-10 Thematic Poster - Skeletal Muscle Health and Aging

Thursday, May 28, 2020, 9:30 AM - 11:30 AM
Room: CC-2007

1318 **Chair:** Edward Merritt. *Southwestern University, Georgetown, TX.**(No relevant relationships reported)*

1319 Board #1 May 28 9:30 AM - 11:30 AM

The Impact Of Age On The Transcriptional And Morphological Profile Of Skeletal Muscle

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(No relevant relationships reported)

Aging is associated with many physiological changes that impact physical function. Most notably, older adults experience a progressive loss of skeletal muscle mass and function, termed sarcopenia. A better understanding of the molecular and phenotypical changes associated with advancing age may provide therapeutic targets for interventions to slow the progression of sarcopenia. **PURPOSE:** To characterize the transcriptional and morphological profile of aging skeletal muscle. **METHODS:** Resting *vastus lateralis* muscle biopsies were collected from 9 young (Y; 27±3yr, 179±7cm, 82±10kg, 26±3BMI) and 9 older adults (O; 68±5yr, 172±8cm, 77±19kg, 26±5BMI) following an overnight fast. Whole transcriptome next-generation RNA sequencing was performed on cDNA synthesized from skeletal muscle RNA. Differentially expressed genes (FDR-adjusted P-value ≤ 0.05) were identified through DESeq2 and subjected to bioinformatic analyses using DAVID (v6.8). Skeletal muscle morphology including fiber type, satellite cell (SC) content, and capillarization was assessed through immunofluorescent microscopy. **RESULTS:** In total, 900 differentially expressed genes were identified in the skeletal muscle of O versus Y (+1.5 fold change = 213; -1.5 fold change = 127). DAVID functional analyses indicated that aging was associated with functions related to glycogen metabolism, amino acid metabolism, ubiquitination, and transition between fast and slow fibers. Consistent with the latter, a significant difference (P=0.048) in myosin heavy chain (MyHC) fiber type profile was identified (Y = MyHCI: 29±4%, MyHCII: 71±4%; O = MyHCI: 46±7%, MyHCII: 54±7%). Moreover, aging was associated with a numerical reduction in SC specific to MyHCI (Y = 0.13±0.02, O = 0.07±0.02 SC/MyHCI fiber, P=0.07) but not MyHCII fibers (Y=0.12±0.03, O=0.08±0.02 P=0.373). Independent of fiber type, capillaries per fiber was significantly lower (P=0.015) in O (1.53±0.34) vs. Y (4.59±0.85). **CONCLUSION:** Advancing age is associated with changes in the transcriptional and morphological profile of skeletal muscle. These findings highlight potential therapeutic targets for the preservation of skeletal muscle mass and function with advancing age.

Supported by a JumpStart Grant, CHS, ASU.

1320 Board #2 May 28 9:30 AM - 11:30 AM

Effects Of Old Age And Contraction Mode On Knee Extensor Muscle Metabolic Economy In Vivo

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(No relevant relationships reported)

The energetic cost of generating force is greater than maintaining it. Additionally, dynamic contractions are more energetically costly than isometric contractions. Metabolic economy (ME; mass-normalized torque or power produced per unit ATP consumed) is similar between young and older adults during isometric contractions,

but less is known about age-related differences in ME during dynamic contractions. **PURPOSE:** To examine age-related differences in ME during maximal effort isometric, isokinetic, and isotonic contractions of the knee extensor muscles. We hypothesized that age-related differences in ME would be present only during dynamic contractions. **METHODS:** 10 young (Y; 27.5±1.2 yr, 6 men) and 10 older (O; 71.2±1.6, 5 men) healthy adults performed three 24-s bouts of maximal knee extensor contractions: 1) sustained isometric contraction (MVIC), 2) isokinetic contractions (120°·s⁻¹ (MVDC₁₂₀; 0.5 Hz), and 3) isotonic contractions with a load of 20% MVIC (MVDC_{20%}; 0.5Hz). Phosphorus magnetic resonance spectroscopy of the vastus lateralis was used to calculate ATP flux through the creatine kinase reaction, non-oxidative glycolysis, and oxidative phosphorylation. Quadriceps muscle contractile volume was measured using serial fat-water magnetic resonance images. All spectroscopy and imaging data were acquired using a whole-body 3T magnetic resonance system. The torque-time integral (TTI) during the MVIC, and power-time integral (PTI) during MVDC₁₂₀ and MVDC_{20%} were calculated. Total ATP flux was used to determine the ATP cost of each 24-s bout, and ME was calculated as specific TTI or PTI, divided by ATP cost. Differences between groups were evaluated using independent samples t-tests. **RESULTS:** ME was not different between young (0.12±0.01 Nm·s·cm⁻³·mM ATP⁻¹) and older (0.11±0.01 Nm·s·cm⁻³·mM ATP⁻¹; p=0.765) muscle during the MVIC. However, during both MVDC₁₂₀ and MVDC_{20%}, ME was greater in young than older muscle (MVDC₁₂₀: 0.011±0.001 vs. 0.007±0.001 W·s·cm⁻³·mM ATP⁻¹; p=0.002, respectively; and MVDC_{20%}: 0.011±0.001 vs. 0.009±0.001 W·s·cm⁻³·mM ATP⁻¹; p=0.031, respectively). **CONCLUSION:** These results show an age-related deficit in ME that is evident only during dynamic contractions, potentially due to the higher energy demand of these contractions.

1321 Board #3 May 28 9:30 AM - 11:30 AM
Age-specific Resistance-type Exercise Training Improves Performance Without Altering Strain-injury Susceptibility
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Purpose: Two tenets of exercise programming/training are injury prevention and performance enhancement. The purpose of this study was to determine whether a validated model of resistance-type exercise training (RTET) utilizing stretch-shortening contractions (SSCs) could alter susceptibility to the mechanical induction of skeletal muscle strain injury with aging. **Methods:** F344xBN rats' dorsiflexor muscles were SSC RTET *in vivo* for 1 month on a custom-built isokinetic rodent dynamometer utilizing age-specific RTET protocols. Performance for dorsiflexor muscles were analyzed temporally, and immediately following skeletal muscle strain injury. ANOVA was used for statistical analysis; α was set at $p < 0.05$. **Results:** Rodents receiving no SSC RTET prior to injury had significant static (-48.6% and -54.5%, respectively) and dynamic (-40.9% and -49.8%, respectively) peak force deficits. Age-specific, SSC RTET improved muscle performance in young and old rodents by 15% and 18%, respectively ($p < 0.05$). Interestingly, young and old rodents undergoing SSC RTET still incurred significant static (-48.8% and -55.7%, respectively) and dynamic (-47.5% and -48.7%, respectively) peak force deficits, which were similar deficits compared to untrained rodents. **Conclusions:** Although age-specific SSC RTET increases skeletal muscle adaptation, these results suggest that skeletal muscle strain induction susceptibility is unaltered following SSC RTET, irrespective of age.

1322 Board #4 May 28 9:30 AM - 11:30 AM
Impaired Recovery From Muscle Disuse In Early Life Compared To Young And Mature Adulthood
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 (No relevant relationships reported)

Physical inactivity negatively influences health and wellness, which has been a particular concern with aging. Less is understood regarding the impact of muscle disuse during early stages of postnatal skeletal muscle development. **PURPOSE:** We propose that exposure to muscle disuse early in life will adversely impact muscle recovery compared to adulthood. **METHODS:** Postnatal day 30 (Young), mature 5 month (Adult) and aged ~25 month (Old) mice were studied as freely moving (Control) or experienced muscle disuse in the form of hindlimb unloading (HU) for two weeks followed by a 7 day recovery period where they were allowed to freely ambulate or "reload" (RL7). We assessed tissue composition, hindlimb and forelimb muscle size and myofiber diameter and cross-sectional area (CSA).

RESULTS: Muscle weight was not recovered in the Young and Old for soleus (absolute, normalized) or plantaris (absolute) ($P < 0.05$). In the soleus, the difference between Control and RL7 was 1.19±0.38, 0.21±0.32, 0.81±0.32 mg for Young, Adult and Old, respectively. There was a trend for the Young to have impaired recovery vs adult ($p=0.056$). In the plantaris, the difference between Control and RL7 was 1.84±0.77, 0.37±0.65, 1.45±0.64 mg for Young, Adult and Old, respectively. The soleus myofiber CSAs were not recovered in any group and the MHC I myofiber were particularly affected in the Young. The plantaris myofiber CSAs were not recovered in the Young due to an impaired recovery in the MHC IIx+b myofibers. **CONCLUSIONS:** Postnatal mice are particularly susceptible to muscle disuse as shown by impaired muscle recovery compared to young adult and old adult mice. Supported by NIA R01AG AG050781

1323 Board #5 May 28 9:30 AM - 11:30 AM
Muscle Density, Not Size, Is Inversely Associated With All-cause Mortality: The Multi-Ethnic Study Of Atherosclerosis
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Purpose: Little is known about associations between lean muscle and mortality in healthy adults. The purpose of this study was to evaluate associations between abdominal muscle quantity (area) and quality (density) with risk of all-cause mortality in a diverse cohort. **Methods:** Abdominal muscle area and density were measured in men (n=946) and women (n=955) from the Multi-Ethnic Study of Atherosclerosis using computed tomography scans at the L2-L4 spinal column, with muscle density scored as attenuation in Hounsfield units. Sex-stratified cox proportional hazard models were used to assess risk of all-cause mortality across sex-specific quartiles of muscle area and density adjusting for confounders, with area and density entered simultaneously. **Results:** Mean age for men and women at baseline was 64.2 and 65.1 and median follow-up time was 10.6 and 10.9 years, respectively. The mortality rate for men was higher than for women (19.9% vs. 12.5%). Hazard ratios of all-cause mortality by quartiles of muscle area and density are shown in Table 1. For muscle density there was an inverse dose response with mortality, such that men and women in the highest quartiles of muscle density had 73% and 57% lower risk of mortality, respectively, in fully adjusted models compared to those in the lowest quartiles. There was no association between muscle area and mortality. **Conclusions:** In a large, diverse cohort of men and women, greater abdominal muscle density, but not muscle size, was associated with a markedly lower risk of all-cause mortality with over a decade of follow up. These results highlight muscle quality as a powerful predictor of mortality in relatively healthy community dwelling adults. Future studies are needed to investigate biological mechanisms linking skeletal muscle fat infiltration with mortality.

Multivariable Associations of Abdominal Muscle Density and Muscle Area with Total Mortality

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	p-trend
Males (n=946)					
Density	1 (ref)	0.57 (0.39-0.83)	0.33 (0.20-0.55)	0.27 (0.14-0.51)	<0.001
Area	1 (ref)	0.93 (0.63-1.39)	0.91 (0.57-1.48)	1.31 (0.77-2.22)	0.515
Females (n=955)					
Density	1 (ref)	0.67 (0.40-1.10)	0.63 (0.35-1.14)	0.43 (0.18-1.01)	0.042
Area	1 (ref)	0.97 (0.59-1.60)	0.94 (0.51-1.73)	1.11 (0.54-2.29)	0.925

Data are hazard ratio (95% confidence interval); Model adjusts for age, race/ethnicity, height, diabetes, systolic blood pressure, antihypertensive medication, total cholesterol, HDL cholesterol, statin use, cigarette smoking, cancer history, kidney function, physical activity, sedentary time, visceral fat and BMI.

1324 Board #6 May 28 9:30 AM - 11:30 AM
Associations Of Skeletal Muscle Lipid Infiltration With Hypertrophy And Physical Performance Outcomes In Older Adults
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 (No relevant relationships reported)

Preserving muscle mass and quality is critical for long term health and longevity. Unfortunately, the hypertrophic potential of aged individuals is diminished, with some experiencing less than favorable outcomes from supervised resistance training programs. This has led investigators to explore the "poor" responder muscle

phenotype. **PURPOSE:** The purpose of this study was to determine whether muscle lipid infiltration plays a role in anabolic adaptation responses, such as muscle growth and physical performance.

METHODS: The effects of a 14-week progressive resistance training (PRT) program on muscle size and quality, strength, and physical function in 48 individuals aged 65 and older (mean age \pm SD, 70.8 \pm 4.5 yrs) was determined. Computed tomography (CT) imaging of cross-sectional mid-thigh regions was used to measure intermuscular adipose tissue (IMAT) and thigh muscle density (TMD) as measures of thigh muscle lipid content. Associations between these lipid depots and baseline function, as well as muscle adaptations to PRT, were made for muscle size (DXA muscle mass and CT muscle area) and physical function and performance (strength, power, SF-36, PROMIS) using multiple linear regression models adjusted for potential confounders such as sex, BMI, CT muscle area, and baseline muscle strength. The association of muscle lipid and physical activity were conducted as a secondary analysis.

RESULTS: At baseline, TMD (mean Hounsfield unit \pm SD, 42.1 \pm 4.0 HU), but not IMAT (mean area \pm SD, 12.5 \pm 4.3 cm²), was significantly associated with all physical function and performance variables (R^2 range 0.45-0.75, $p < 0.05$) except leg extension strength and power. Neither IMAT nor TMD was related to physical activity. Following PRT, IMAT was not associated with any exercise adaptation, whereas TMD was negatively associated with percent change in isometric strength (R^2 0.17) and muscle power (R^2 0.28, $p < 0.05$).

CONCLUSIONS: Muscle fatty infiltration can impact strength and power gains following PRT in older persons. More work is needed to understand the dynamics of ectopic muscle fat accumulation and its influence on physical function and muscle metabolism/anabolism.

1325 Board #7 May 28 9:30 AM - 11:30 AM

Effects Of Age And End-stage Osteoarthritis On Markers Of Skeletal Muscle Long Interspersed Element-1 Activity

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(No relevant relationships reported)

PURPOSE: Long Interspersed Element-1 (L1) is the only active, autonomous transposable element (termed retrotransposon) in the mammalian genome. L1 retrotransposons can insert themselves into the genome and, consequently, have been associated with a number of diseases and aging. L1 transcripts that are not reverse transcribed into the genome can accumulate in the cytoplasm and activate an inflammatory response via the cGAS-STING pathway. The purpose of this study was to examine skeletal muscle L1 markers and STING protein levels in younger/healthy participants as well as older participants with end-stage osteoarthritis (OA) undergoing total hip or knee arthroplasty.

METHODS: Skeletal muscle was obtained perioperatively from OA patients (62 \pm 11 years old) undergoing total hip or total knee arthroplasty (THA n=4; TKA n=6; total n=10) who were enrolled in the TWEAK Trial (R01HD084124, NCT02628795) at UAB. Muscle samples were collected from both surgical (Sx) and contralateral (CTL) thighs. A third cohort of young, healthy individuals (Y; 22 \pm 2 years old) (Auburn, AL, USA) served as a comparator group (n=10). RNA, DNA, and protein were isolated for analysis. L1 mRNA expression and DNA content were quantified using primer sets for L1.3, the most active element, as well as ORF1. DNA methylation status and chromatin state of the L1 promoter were also interrogated. Protein targets included ORF1p and STING. Dependent variables were analyzed using a one-way ANOVA with Fisher's LSD post hoc where appropriate.

RESULTS: Both L1.3 and ORF1 mRNA were higher in Sx vs Y ($p=0.003$ and $p<0.001$, respectively) as well as CTL vs Y ($p<0.001$). Protein expression was higher in Sx vs Y for both ORF1p ($p=0.003$) and STING ($p=0.013$). There were no between-group differences in DNA content for L1.3 or ORF1, or the methylation status and chromatin state of the L1 promoter.

CONCLUSIONS: These data show higher L1-related mRNA expression in old vs. young adult muscle irrespective of OA status. Alternatively, indices of protein signaling were elevated in Sx muscle only, suggesting upregulation of the cGAS pathway may play a role in the inflammatory burden often unique to muscle surrounding an OA joint. Future work will enable us to better determine if increased muscle L1 activity contributes to localized muscle inflammation susceptibility with aging or OA.

1326 Board #8 May 28 9:30 AM - 11:30 AM

Aging Induces A Differential Muscle Transcriptome Profile Following Resistance Exercise Training

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(No relevant relationships reported)

PURPOSE: Resistance exercise training (RET) in older adults produces a lesser muscle hypertrophy response as compared to young adults. We hypothesized that this anabolic resistance to exercise may be associated with a differential muscle transcriptome profile. We enrolled 10 young and 10 older men into a 12-week progressive RET program. Skeletal muscle biopsies were obtained from the *vastus lateralis* before and after RET.

METHODS: The transcriptome profiles of skeletal muscle from both young and older adults were obtained by utilizing next-generation RNA sequencing. **RESULTS:** We analyzed a total of 26,486 genes (i.e., RNA transcripts) in skeletal muscle and found that 11,262 genes in young subjects and 11,830 genes in the older adults were up-regulated after 12 weeks of RET. On the other hand, we observed a down-regulation of 11,079 and 11,214 genes in the young and old groups, respectively. In particular, we found that autophagy linked gene expression (e.g., ATG 12, PIK3R4, ULK 2, ULK3) and transcripts related to muscle hypertrophy (e.g., AKT, EIF2S2, GSK3b) were differentially expressed between young and older adults. Interestingly, we identified 21 genes (e.g., COL5A2, COL3A1, COL1A1) encoding extracellular matrix (ECM) and ECM-associated proteins that were significantly upregulated only in the elderly ($P<0.05$). **CONCLUSIONS:** Skeletal muscle gene expression is differentially regulated in older adults in response to RET which may contribute to anabolic resistance and reduced muscle hypertrophy with aging. Future studies will include mechanistic experiments to identify how aging alters gene expression and whether anabolic resistance can be reversed. Funding: NIH/NIA R56 AG051267

C-11 Thematic Poster - Walking with Knee Arthritis and Arthroplasty

Thursday, May 28, 2020, 9:30 AM - 11:30 AM
Room: CC-2010

1327 Chair: Julia Freedman Silvernail. *University of Nevada, Las Vegas, Las Vegas, NV.*

(No relevant relationships reported)

1328 Board #1 May 28 9:30 AM - 11:30 AM

Associations Between Ultrasonographic Measures Of Femoral Cartilage, Self-reported Function, And Walking Speed In Individuals With Medial Compartment Knee Osteoarthritis

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Ultrasound has been used to evaluate femoral cartilage cross-sectional area (CSA) and echo intensity (EI) in young individuals without knee pathology. Yet it remains unknown if ultrasound derived measures of CSA and EI are associated with patient reported outcomes (PRO) and physical performance (habitual walking speed) in individuals with knee osteoarthritis (KOA).

PURPOSE: To determine associations between ultrasonographic femoral cartilage CSA and EI, and PRO and habitual walking speed in individuals with medial compartment KOA.

METHODS: Twenty-one individuals with medial compartment KOA (76% female, age = 61 \pm 8 yr, BMI = 29.3 \pm 4.0 kg/m²) participated in this study. Habitual walking speed was assessed over a 6-meter walkway using infrared timing gates. PRO were measured using the Western Ontario and McMaster Universities Osteoarthritis Index function subscale (WOMAC-Function). Participants were seated with their knees extended on an examination table for 45 minutes in order to unload the femoral cartilage and acquire a resting ultrasound image. Three images were acquired on the involved limb and the derived measures (CSA and SI) from the medial femoral cartilage were averaged. Separate, stepwise linear regression models were used to

determine the associations between WOMAC-Function and walking speed (predictor variables) and the medial femoral cartilage CSA and EI (criterion variables) after accounting for BMI and Kellgren-Lawrence scores of the involved limb.

RESULTS: Smaller CSA was associated with slower habitual walking speed ($\Delta R^2=0.249$, $P=0.014$) and greater EI was associated with worse WOMAC-Function ($\Delta R^2=0.261$, $P=0.014$).

CONCLUSIONS: PRO and habitual walking speed are easily obtainable measures for clinicians and significantly associate with medial femoral cartilage CSA and EI measured using ultrasound. CSA and EI may provide valuable information about potential structural and compositional alterations in femoral cartilage in individuals with KOA. A comparison of ultrasound outcomes to previously established imaging modalities, such as MRI, is needed to determine the clinical significance of CSA and EI.

1329 Board #2 May 28 9:30 AM - 11:30 AM
Impact Of Pain Suppression On Three-dimensional Gait Kinematics In Knee Osteoarthritis Patients

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PURPOSE: Knee osteoarthritis (KOA) is characterized by pain and adaptations in knee kinematics during gait. The study aimed at assessing the impact of pain suppression on three-dimensional (3D) knee kinematics during gait in KOA patients. **METHODS:** Participants had 1) tibiofemoral KOA with or without patellofemoral KOA, 2) a pain intensity ≥ 3 on a 0-10 pain intensity scale, and 3) a radiographic grade ≥ 2 . Each patient performed two gait trials: a pain trial and a pain-free trial. An intra-articular knee injection of 5ml of lidocaine (1%) was administered between trials. To ensure that the local anesthetic effect was properly activated, the second trial started at least 15 minutes after the injection. 3D knee kinematics were captured at comfortable speed and statistical analyses were conducted on 10 mechanical markers linked to KOA progression (paired T-test or Wilcoxon signed-rank test for non-normal distribution of delta values).

RESULTS: 7 women and 4 men participated. Their mean age was 60 years (95%CI: 55;65) and the mean BMI was 29.3 kg/m² (25.8;32.8). The mean pain decreased from 4.6 (3.2;6.0) to 0.5 (0.0;0.9) with the injection. The suppression of knee pain led to changes on 2 markers during the loading phase of the gait cycle (Table). Participants significantly improved their flexion amplitude (+9.7°) and reduced their internal tibia rotation in regards to the femur (+2.3°; both $p<0.001$) between trials. The change was clinically significant (more than 2.0°) for all of the patients on their flexion amplitude and for 55% of them on their internal tibia rotation.

CONCLUSION: Results suggest an association between pain and knee kinematics during the loading phase of the gait cycle. A limited flexion amplitude and an internal tibia rotation in regards to the femur could be corrected with pain suppression. Further studies are needed to have a better understanding of the impact that pain may have on gait adaptations in KOA patients.

Differences on 3D mechanical markers between pain and pain-free trials			
*: $p<0.05$; **: $p<0.001$; Confidence interval: CI	Pain trial Mean in degrees (95%CI)	Pain-free trial Mean in degrees (95%CI)	Paired samples tests (T-test or Wilcoxon test)
Sagittal plane: Flexion(+)/ Extension(-)			
Flexion at heel strike	9.9° (7.0;12.7)	9.7° (5.8;13.7)	p=0.84
Flexion amplitude during loading **	10.8° (7.7;13.9)	20.5° (16.6;24.4)	p<0.001 **
Flexion amplitude during stance	15.2° (10.9;19.6)	16.7° (12.5;20.9)	p=0.13
Maximum flexion during swing	62.6° (57.7;67.5)	63.0° (56.8;63.9)	p=0.59
Range of motion during gait cycle	58.4° (53.5;63.2)	60.3° (56.8;63.9)	p=0.25
Frontal plane: Varus(+)/ Valgus(-)			
Varus at heel strike	6.9° (4.1;9.7)	8.3° (3.0;13.6)	p=0.59
Varus thrust during loading	2.5° (1.3;3.7)	2.4° (0.1;4.8)	p=0.48
Varus during stance	6.5° (3.2;9.7)	5.2° (2.4;8.1)	p=0.19
Transversal plane: External rotation(+)/ Internal(-)			
External tibia rotation at heel strike	4.0° (1.4;6.6)	5.0° (2.5;7.6)	p=0.59
Internal tibia rotation during loading **	-0.3° (-2.2;1.6)	2.0° (-0.1;4.2)	p<0.001 **

This was funded by the FPQIS (Quebec Government).

1330 Board #3 May 28 9:30 AM - 11:30 AM
The Therapeutic Efficacy Of Platelet-Rich Plasma On Gait And Balance In Patients With Knee Osteoarthritis

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 (No relevant relationships reported)

The beneficial effects of leukocyte-rich platelet-rich plasma (LR-PRP) on subjective functional outcomes in knee osteoarthritis (KOA) is limiting, to this end there is a paucity of data about its efficacy on objective functional outcomes.

PURPOSE: To examine the therapeutic efficacy of LR-PRP on gait and balance in patients with KOA.

METHODS: Eight patients with unilateral and bilateral KOA (4 men; 55.3 ± 10.9 years; 31.22 ± 8.35 kg/m²) participated after signing a written informed consent. Participants visited the outpatient clinic in Baylor College of Medicine H. Ben Taub Department of Physical Medicine and Rehabilitation two times (baseline and follow-up; six to eight weeks apart). At baseline, the study physiatrist (PJ) provided a single ultrasound guided intra-articular LR-PRP injection. Our primary endpoint was balance using previously validated wearable sensors (BioSensics, Newton, MA) at 6-8 weeks post LR-PRP injection. Secondary endpoints included: pain symptoms, activity of daily life and quality of life using the 12-item Knee Injury and Osteoarthritis Score (KOOS-12), and gait speed.

RESULTS: Results for outcome parameters are shown in Table 1. Pain symptoms, activity of daily life and quality of life improved 31%, 33% and 46%, respectively, but the improvements did not reach statistical significance level (all $p > 0.05$). Gait speed was very similar between baseline and follow-up ($p > 0.05$). Some balance parameters tended to improve. Medio-lateral center-of-mass sway and center-of-mass sway area decreased 34% and 41%, respectively. Medio-lateral hip sway and hip sway area decreased 40% and 46%, respectively. However, the improvements in balance parameters did not reach statistical significance level (all $p > 0.05$).

CONCLUSIONS: Results suggest potential of LR-PRP on gait and balance. Based on the results, further study with a larger sample size is warranted.

Primary and secondary endpoints				
	Baseline	Follow-up	P-value	Effect size (Cohen's d)
KOOS-12: Pain symptoms	50.0 ± 17.6	65.3 ± 18.3	0.178	0.85, Large effect
KOOS-12: Activity of daily life	55.0 ± 28.6	73.3 ± 20.5	0.223	0.74, Medium effect
KOOS-12: Quality of life	34.2 ± 10.4	50.1 ± 20.8	0.148	0.97, Large effect
Gait speed, m/s	0.97 ± 0.16	0.94 ± 0.18	0.696	0.18, No effect
Balance: Medio-lateral center-of-mass sway (degree)	0.46 ± 0.31	0.30 ± 0.09	0.178	0.70, Medium effect
Balance: Anterior-posterior center-of-mass sway (degree)	0.75 ± 0.40	0.64 ± 0.22	0.512	0.34, Small effect
Balance: Center-of-mass sway area (degree)	0.27 ± 0.27	0.16 ± 0.08	0.253	0.55, Medium effect
Balance: Medio-lateral ankle sway (Degree)	1.11 ± 0.75	0.87 ± 0.33	0.416	0.41, Small effect
Balance: Anterior-posterior ankle sway (Degree)	1.26 ± 0.82	1.05 ± 0.21	0.507	0.35, Small effect
Balance: Ankle sway area (Degree)	1.03 ± 1.00	0.72 ± 0.33	0.415	0.42, Small effect
Balance: Medio-lateral hip sway (Degree)	0.96 ± 0.58	0.58 ± 0.18	0.098	0.88, Large effect
Balance: Anterior-posterior hip sway (Degree)	1.64 ± 0.73	1.48 ± 0.78	0.684	0.21, Small effect
Balance: Hip sway area (Degree)	1.29 ± 1.28	0.70 ± 0.42	0.232	0.62, Medium effect

1331 Board #4 May 28 9:30 AM - 11:30 AM

Associations Between Flexion Deformity And Sagittal Gait Impairments In Knee Osteoarthritis Patients

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(No relevant relationships reported)

PURPOSE: Knee flexion deformity and gait impairments (GIs) are common clinical findings in knee osteoarthritis (KOA) patients. This study aimed at assessing the associations between the presence of flexion deformity and sagittal GIs in KOA patients.

METHODS: Patients were included if 1) KOA was the main cause of knee pain, 2) their worst pain in the past 7 days was ≥ 4 on a 0-10 pain intensity scale, 3) they had Kellgren-Lawrence grade ≥ 2 . Therapists involved in the study (N=10) assessed flexion deformity by goniometry. They assessed the presence of four known sagittal GIs in KOA patients (flexum at heel strike, fixed flexion during loading and during stance, limited dynamic range of motion (DROM) during a cycle) with a knee kinesigraphy. Fischer's tests were used to assess between-group (presence or absence of flexion deformity) differences on the proportion of patients with each GI.

RESULTS: 214 patients from 54 clinics participated. 61.2% were women, the mean age was 63 years (95%CI: 62;64), and the mean BMI was 29.4 kg/m² (28.7;30.1). Almost one out of two patients (40.2%) had a flexion deformity. More than two thirds of the participants showed a limited DROM (69.2%). The proportion of patients with a limited DROM was significantly higher in the group who had a flexion deformity (+22.4%; $p < 0.001$). However, more than half of the patients with a limited DROM did not have a flexion deformity (77/148: 52.0%). Similar results were observed on the three other sagittal GIs (Table; all $p \leq 0.01$).

CONCLUSION: Results support that patients with knee flexion deformity are more likely to have sagittal GIs. However, the majority of patients who had sagittal GIs did not have a flexion deformity. It supports that it remains essential to assess deformity and also the value of completing clinical evaluation with a dynamic kinematic measurement to ensure that assessors do not miss the presence of gait alterations, even in the absence of flexion deformity.

Between-group differences on the presence of sagittal gait impairments				
*: $p < 0.05$; **: $p < 0.005$	All patients N=214	Presence of flexion deformity N=86	Absence of flexion deformity N=128	Fischer's test
Presence of sagittal gait impairment:	N (%)	N (%)	N (%)	p-value
Flexum at heel strike	146 (68.2%)	68 (79.1%)	78 (60.9%)	$p < 0.005$ **
Fixed flexion during loading	156 (72.9%)	73 (84.9%)	83 (64.8%)	$p < 0.005$ **
Fixed flexion during stance	173 (80.8%)	77 (89.5%)	96 (75.0%)	$p = 0.01$ *
Limited dynamic range of motion	148 (69.2%)	71 (82.6%)	77 (60.2%)	$p < 0.001$ **

This was funded by the FPQIS (Quebec Government).

1332 Board #5 May 28 9:30 AM - 11:30 AM

Effect Of Power Output And Knee Osteoarthritis On Frontal Plane Knee Joint Moments During Cycling

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(No relevant relationships reported)

Cycling is often prescribed for rehabilitation of older adults with knee osteoarthritis (OA), during which the power output or external workload is manipulated to facilitate training for muscular and aerobic fitness. The effect of cycling power output on external knee adduction moment (a surrogate measure of severity and progression of knee OA) in older adults with and without knee OA is unknown. **PURPOSE:** To determine the effect of cycling power output on external knee adduction moment in older adults with and without knee OA. **METHODS:** Thirteen older adults with knee OA (66.0±8.6 years) and 13 controls (64.0±7.2 years) completed 3-minute cycling trials at power outputs of 75 Watts (W) and 100 W at a cadence of 60 revolutions per minute on a stationary cycle ergometer. Reflective markers (n=33) were attached bilaterally on participants' pelvis, lower extremity, shoes, and force pedals. Three-dimensional marker positions and pedal reaction forces were sampled synchronously at 240 Hz. Using an inverse dynamics approach, external knee adduction moments were computed for both power output conditions. Peak external adduction moments were identified and averaged across 60 crank cycles for the more affected leg in the knee OA group and the dominant leg in the control group. A two-way mixed model ANOVA was used to examine the effects of power output (75 vs. 100 W) and group (knee OA vs. control) on peak external knee adduction moment. **RESULTS:** A group x power output interaction was observed ($p = 0.029$; partial $\eta^2 = 0.183$). Peak external knee adduction moment increased with power output in both groups, but the magnitude of increase was much greater for the knee OA (5.8±3.5 vs. 7.7±3.9 Nm, $p < 0.001$) compared to the control group (6.1±3.5 vs. 6.8±3.9 Nm, $p = 0.047$). **CONCLUSION:** Increases in detrimental knee joint moment with power output are greater for older adults with knee OA compared to healthy controls. Older adults with knee OA should exercise caution when pedaling at higher power outputs during rehabilitation.

1333 Board #6 May 28 9:30 AM - 11:30 AM

Age-related Difference In Perceived Pain, Health Status, And Fall Risk Following Total Knee Replacement

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(No relevant relationships reported)

Introduction: Significant improvements in pain and function have been reported following successful total knee replacement (TKR); however, patients continue to demonstrate persistent balance impairments, increasing the risk of falls and injuries. National joint replacement registries have reported a substantial growth in younger knee osteoarthritic patients (<60 yrs) undergoing TKR, but this younger TKR population is generally understudied. Age-related differences have been previously reported for gait, balance recovery responses, and perceived knee function, distinguishing younger TKR patient from the typical, older TKR patients. **Purpose:** To investigate if age-related difference in perceived pain and health status exist following total knee replacement. **Methods:** Thirty-six unilateral TKR patients (18 younger TKR patients: 57.1±4.6 yrs; 32.5±4.1 kg/m² and 18 older TKR patients: 74.5±6.6 yrs; 31.8±3.5 kg/m²), following TKR surgery took part in the study. Each patient completed the following questionnaires: The Activities-Specific Balance Confidence (ABC), the Oxford Knee Score (OKS), and the Short Form-36 (SF-36). The Timed Up and Go (TUG) test and self-reported number of falls in the previous 12-months were also collected. **Results:** The younger TKR patients reported higher balance confidence (88.4±11.2 v. 73.7±11.7) and functional mobility (9.2±2.1 v. 13.5±3.8 sec), as well as less falls (1.4±0.2 v. 4.2±1.7), compared to the older TKR patients ($p < 0.05$). The

younger TKR patients also reported less perceived knee pain when completing tasks of daily living ($18.2.4\pm 3.2$ v. 12.7 ± 3.7 : OKS subset for pain) and higher overall health-related quality of life ($76.7.4\pm 1.2$ v. 68.7 ± 1.7) than reported by the older TKR patients ($p < 0.05$). **Discussion:** The younger TKR patients are at reduced risk (higher balance confidence and functional mobility) of falling and reported less falls than the older TKR patients. The age-related differences in perceived knee pain and health-related quality of life following TKR suggest a patient's age should be a factor when deciding the intervention protocol strategies used for rehabilitation following TKR. Future research should investigate potential age-specific intervention protocol strategies, including pain management and psychomotor training.

1334 Board #7 May 28 9:30 AM - 11:30 AM
A Comparison Of Gait Biomechanics And Clinical Outcomes Between Traditional And Robot-Assisted Total Knee Arthroplasty

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(No relevant relationships reported)

More than 600,000 knee replacements are performed each year in the U.S. for patients with knee osteoarthritis (OA), a rate expected to rise as high as 3 million by 2030. However, mechanical axis malalignment during total knee arthroplasty (TKA) has been found in almost one-third of surgeries. Recent advances in surgical technology include the use of robots to improve implant precision, including the Mako Robotic-Arm Assisted System, with the goal of improving clinical outcomes and gait biomechanics. **PURPOSE:** To compare gait biomechanics and clinical outcomes between patients who underwent TKA with the Mako System (MAKO) and patients who underwent traditional TKA (TRAD), as well as to healthy participants. **METHODS:** Gait biomechanics were collected on female participants (6 MAKO, 7 TRAD, 16 HEALTHY limbs; age: 50-80 years) using an 8-camera Vicon motion capture system and two force plates. The Forgotten Joint Score (FJS) and Knee Injury and Osteoarthritis Outcome Score (KOOS) surveys were collected on all TKA participants. One-way ANOVAs compared biomechanics between participants, while unpaired t-tests compared survey data between surgical groups. Effect sizes (ES) were calculated using Cohen's d. **RESULTS:** Both surgical groups exhibited lower hip extension excursion (MAKO: $23.9 \pm 3.8^\circ$, TRAD: $24.0 \pm 5.4^\circ$, HEALTHY: $32.7 \pm 8.0^\circ$, $p = 0.008$, ES = 1.41). The external knee varus moment was trending lower for the MAKO group compared to the HEALTHY and TRAD groups with a large effect size (MAKO: $.33 \pm .17$ Nm/kg, TRAD: $.44 \pm .09$ Nm/kg, HEALTHY: $.49 \pm .14$ Nm/kg, $p = .051$, ES = 1.15). No differences were seen in survey scores between groups, but a large effect size was observed for the FJS (MAKO: 68.8 ± 21.9 , TRAD: 50.5 ± 23.6 , $p = 0.17$, ES = 0.80). **CONCLUSIONS:** TKA participants exhibited limited hip extension excursion, which may indicate compromised gait stability compared to healthy participants. The external knee varus moment was trending lower in Mako participants compared to traditional TKA and healthy participants. Because elevated knee varus moments have been correlated with pain and disease progression in knee OA, this finding indicates the Mako procedure may lower a major correlate of disease. Mako participants had higher FJS scores, which indicates they are less aware of their artificial joint. No grant support was provided.

1335 Board #8 May 28 9:30 AM - 11:30 AM
Knee Kinetics Of Patients With Different Types Of Total Knee Arthroplasty Implants During Downhill Walking

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(No relevant relationships reported)

Ramping walking is a common daily activity that is often incorporated in rehabilitation for total knee arthroplasty (TKA) patients. However, no studies have investigated knee biomechanics of patients with total knee arthroplasty (TKA), and comparisons between posterior stabilized (PS), cruciate retaining (CR) and bi-cruciate stabilized (BCS) TKA implants during ramp walking.

Purpose: To examine the differences in knee biomechanics between patients with the three different types of TKA implants and healthy controls during downhill walking on a 10° ramp.

Methods: Five BCS, 10 CR, 10 PS TKA patients and 10 healthy controls performed five downhill walking trials at their self-selected pace, on a 10° instrumented ramp mounted through rigid contact surface structures mounted onto two force platforms (AMTI). Three-dimensional kinematic data (240 Hz, Vicon) were collected in conjunction with ground reaction force data (1200 Hz). A 2×4 (limb \times group) mixed design ANOVA was used to examine selected knee joint kinematic and kinetic variables.

Results: In downhill walking, a significant limb effect was found in peak loading-response ($p=0.005$) and push-off knee extension moment (KEM, $p=0.015$). Peak

loading-response KEMs were smaller ($p=0.006$) in replaced limbs (0.94 Nm/kg) than non-replaced limbs (0.97 Nm/kg). Similar findings were seen in peak push-off ($p=0.015$) KEMs. Peak loading-response knee abduction moment (KAbM) were mostly similar between the replaced limbs of three TKA groups and healthy controls in downhill walking. Peak loading-response KAbMs were smaller in non-replaced limbs of BCS (-0.34 Nm/kg, $p=0.018$) and PS (-0.37 Nm/kg, $p=0.001$) patients compared to that in their non-replaced limbs (BCS: -0.53 Nm/kg & PS: -0.49 Nm/kg).

Conclusion: The results from this study showed that during downhill walking, peak KEMs were lower in replaced limbs than non-replaced limbs for all TKR patients, suggesting a deficit in knee extensor strength regardless of TKA designs. Post-surgery rehabilitation should focus on eccentric strength training of quadriceps for their replaced knees to reduce the asymmetry in knee movement and loading. BCS and PS patients may need additional attention in strengthening of quadriceps and hamstrings of the replaced limbs.

C-12 Free Communication/Slide - Strength, Size, and Power

Thursday, May 28, 2020, 9:30 AM - 11:30 AM

Room: CC-3020

1336 Chair: Christopher D. Black, FACSM. University of Oklahoma, Norman, OK.

(No relevant relationships reported)

1337 May 28 9:30 AM - 9:45 AM

Using Critical Power To Predict Ramp Incremental Cycling Performance: Three Parameters Are Better Than Two

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The two-parameter critical power (CP_{2p}) model states that the tolerable duration (T_{lim}) of severe-intensity cycling is determined by critical power (CP) itself, and the finite energy store that may be expended at work rates above CP (W'). Notwithstanding its ability to provide useful predictions of T_{lim} across a variety of exercise modes, the two-parameter model (CP_{2p}) consistently overestimates T_{lim} for ramp incremental exercise. **PURPOSE:** To determine whether a three-parameter model of CP (CP_{3p}) provides more accurate predictions of T_{lim} compared with those made by the CP_{2p} model. **METHODS:** Seventeen healthy, recreationally-active adults (1 female; age: 29 ± 4 yrs, BMI: 25 ± 3 , peak O_2 uptake: 50 ± 8 ml \cdot kg $^{-1}\cdot$ min) completed a ramp cycling protocol, and a series of exhaustive, constant work rate (CWR) trials across 5 separate visits (~ 70 -100% peak work rate). The CWR trials were used to establish each participant's power- T_{lim} relationship, from which the CP_{2p} and CP_{3p} models were fitted to data. Cross-validation (CV) was used to assess external model validity. Finally, the observed T_{lim} during the ramp incremental protocol was compared to that predicted by the CP_{2p} and CP_{3p} models. **RESULTS:** CP_{2p} was higher than CP_{3p} (239 ± 14 W v 233 ± 13 W, $P < 0.05$), whereas W' was smaller for the two- v three-parameter model (20.3 ± 1.3 kJ v 27.2 ± 2.9 kJ, $P < 0.05$). The CP_{3p} model yielded a better fit to power- T_{lim} data than the CP_{2p} model, as judged by the lower root-mean-square error (RMSE) computed from the CV procedure (128 s v 141 s). The predicted ramp T_{lim} obtained via the CP_{2p} model was longer than the actual T_{lim} for ramp incremental cycling ($\Delta 21.9$ s, $P < 0.05$); however, the ramp T_{lim} predicted by the CP_{3p} model was not different from the actual ramp T_{lim} ($\Delta 1.7$ s, $P < 0.05$). Furthermore, there was higher absolute agreement between actual and predicted ramp T_{lim} for the CP_{3p} compared with the CP_{2p} model, as evidenced by a higher concordance correlation coefficient (0.98 v 0.94) and lower RMSE (16.4 s v 27.7 s). **CONCLUSIONS:** Our findings indicate that the CP_{3p} model provides better predictions of ramp exercise performance than the CP_{2p} model. These findings provide further support for the idea that T_{lim} for supra-CP cycling is determined not only by the magnitude of W' , but also by a maximal rate at which W' can be accessed, particularly at high work rates.

1338 May 28 9:45 AM - 10:00 AM

Muscle Strength And Size Correlations At Baseline And Following Unilateral Resistance Training

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(No relevant relationships reported)

Traditional theory has linked muscular size and muscular strength at baseline and following resistance training, though recent studies have challenged the independence of these traits, especially within the context of chronic resistance training. We previously completed a large study of strength and size changes with 12 weeks of progressive resistance training in previously untrained adults. **PURPOSE:** We examined the effects of progressive resistance training on the relationship between muscle volume (VOL) and muscle strength, measured as both dynamic (one repetition maximum; 1-RM) and isometric (maximal voluntary contraction; MVC) strength. We further tested for sex differences in these relationships. **METHODS:** 665 healthy young (18>age>40) and untrained individuals (254 men and 411 women) were tested. Muscle volume (by magnetic resonance imaging) and strength (1-RM and MVC) measures were taken before and after 12-weeks of resistance training of the non-dominant biceps/triceps. Subjects trained with progressively increasing weights twice per week using biceps preacher curl, biceps concentration curl, standing biceps curl, overhead triceps extension, and triceps kickback. We used Pearson correlations to test strength-size relationships in the entire cohort and within sex both at baseline and percent change following training. **RESULTS:** Weak to moderate correlations were seen at baseline: VOL-1-RM ($r=0.43$ in all, 0.32 in women and 0.14 in men, all $p<0.01$) and VOL-MVC ($r=0.34$ in all, 0.19 in women and 0.28 in men, all $p<0.01$). Following training, specific relationships between percent changes in strength and size were: VOL-1-RM ($r=0.04$ in all, $p=0.3$; 0.13 in women, $p=0.006$; and 0.14 in men, $p=0.03$) and VOL-MVC ($r=0.13$ in all, $p<0.01$; 0.19 in women, $p<0.01$; and 0.12 in men, $p=0.054$). **CONCLUSION:** At baseline, significant but weak correlations exist between strength and size, regardless of sex. Following training, correlations became weaker, and even insignificant for change in volume to change in 1-RM in the whole cohort and change in volume to change in MVC in men. Together, these data provide evidence that isometric and dynamic strength are complex traits, especially following resistance training, that are affected by factors beyond size.

1339 May 28 10:00 AM - 10:15 AM

Hormonal, Psychological, And Muscle Damaging Effects Of An Acute Bout Of Farmers' Walk Resistance Exercise

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The Farmers' Walk (FW) exercise may help to enhance resistance training programs by incorporating movements which supplement functional tasks such as lifting and carrying weight over various distances. Minimal information exists concerning the intramuscular responses associated with FW performance, which may negatively promote perception and application of this exercise in prescribed protocols. **PURPOSE:** To investigate the hormonal, psychological, and muscle damaging effects of an acute bout of the Farmers' Walk Carry (FWC) when compared to an individual's unloaded walking pattern (NWC). **METHODS:** Fifteen participants (mean \pm SEM; age: 21.6 ± 0.5 yrs; height: 172.5 ± 2.4 cm; weight: 81.8 ± 4.0 kg) completed a series of testing sessions. In the initial session, participant's demographic information, anthropometrics, body composition, lower body power, and strength were measured. Subsequently, participants completed two counter-balanced conditions during which they performed 10 repetitions of a 20 m walk while either carrying 70% of their 1-repetition maximum deadlift or non-weighted walk. Participants were

allowed a 30 s rest period after odd-numbered repetitions, and 2 min of rest after even-numbered repetitions. Participants provided self-reported evaluations of muscle soreness (VPMS), blood sampling for myoglobin (Mb) and creatine kinase (CK-MB), and saliva samples for testosterone (T) which were collected prior to the exercise protocol, immediately after the exercise protocol, and 30- and 60-min after completion of the exercise. Post-exercise assessment consisted of blood sampling, saliva, countermovement jump (CMJ) height, and VPMS scores collected at 24 h, 48 h, and 72 h in both conditions. **RESULTS:** Increases were observed for overall ($p<0.001$) and upper body VPMS measurements ($p<0.01$) along with decreases in CK-MB ($p=0.04$) during the FWC. No significant differences were revealed for Mb, T, or CMJ height. **CONCLUSIONS:** The discrepancy found between upper- and lower-body muscle soreness (VPMS) during the FWC may be related to differences in primary muscle recruitment and their joint concentric, eccentric, and isometric muscle actions. These variances may have indirectly minimized post-exercise muscle damage, hormonal responses, and neuromuscular inhibitions of lower body performance.

1340 May 28 10:15 AM - 10:30 AM

High-velocity Resistance Training Improves Power Output Across The Entire 1RM Percentage Spectrum In Elderly Individuals

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The aging process is related to impairments in several biological systems, such as the neuromuscular system. Of concern, considerable reductions in strength and power output are observed after the sixth decade of life, which are strongly related to declines in functional capacity. High-velocity resistance training (HVRT) is an alternative to counteract these impairments in the elderly population.

PURPOSE: To compare the mean and peak power output adaptations to twelve weeks of HVRT. **METHODS:** Thirteen older adults (69.4 ± 6.2 years; 71.5 ± 16.0 kg; 161.8 ± 8.9 cm) were recruited and, after giving their informed consent, completed two familiarization sessions and, on a separate day (baseline), were assessed for their legpress one repetition maximum (1RM) and mean and peak power output at loads corresponding to 30-90% 1RM using a linear encoder. Four weeks after baseline and prior to the intervention (pre-intervention) both 1RM and power tests were repeated and all participants underwent twelve weeks of HVRT twice per week. The exercise training protocol was comprised of five exercises (legpress, knee extension, seated bench press, seated row and calf raise) and progressed from 1-3 sets of 10 repetitions per exercise at 40-60% 1RM. Tests were repeated post-intervention and mean and peak power comparisons were made using one-way ANOVAs with repeated measures and Bonferroni's post hoc. **RESULTS:** Mean and peak power output results are shown in Figure 1. Peak power improved significantly at all loads when compared to both baseline and pre-intervention (all $p < 0.05$), while mean power output improved from 30-70% 1RM (all $p < 0.05$) but not at 80 and 90% 1RM. No differences were observed between baseline and pre-intervention measures (all $p > 0.05$). **CONCLUSION:** HVRT is an effective alternative to counteract power output declines across a wide range of loads in older adults. This is relevant as different functional tasks seem more associated to muscle power at different percentages of 1RM.

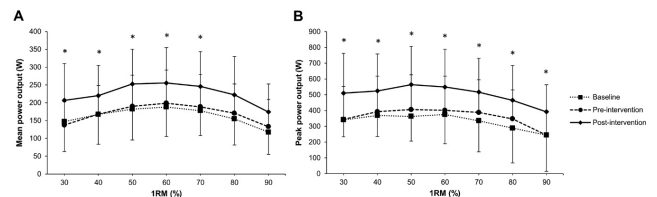


Figure 1. Mean (A) and peak (B) power output adaptations to twelve weeks of high-velocity resistance training in elderly individuals ($n = 13$). * = post-intervention significantly different from baseline and pre-intervention moments ($p < 0.05$). Mean and peak power output improvements ranged, on average, from 23-43% and 34-52% when compared to baseline and 20-40 and 20-34% when compared to pre-intervention values, respectively.

1341 May 28 10:30 AM - 10:45 AM

The Effects Of Practice On Maximal Force And Low-Frequency Fatigue In Collegiate Basketball Players

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(No relevant relationships reported)

Low-Frequency Fatigue (LFF) refers to the disproportionate loss of force at low as compared to high firing frequencies. LFF is thought to manifest during high intensity, moderate-to-high-force, repetitive eccentric, or stretch-shortening cycle activities,

similar to the demands of basketball. **PURPOSE:** Therefore, the purpose of the present study was to examine the effects of basketball practice on maximal isometric force and LFF.

METHODS: Eleven NCAA Division 1 basketball players (Males = 6 and Females = 5) performed a Maximal Voluntary Isometric Contraction (MVIC) and neuromuscular electrical stimulation of the knee extensors at a high and low frequency before (Pre), immediately after (Post) and 24-hours (24Post) following a basketball practice during the preseason. Athletes wore Inertial Measurement Units to capture the external training load (eTL) of the practice. The ratio of force produced during the low to high frequency muscle stimulation was used as an index of LFF. A one-way repeated measures analysis of variance was performed to determine differences in MVIC and LFF across time, with significance set at $p \leq 0.05$. Effects sizes (Cohen's d) were calculated for pairwise comparisons and interpreted as trivial (0-0.19), small (0.20-0.49), medium (0.50-0.79), and large (0.80 and greater). **RESULTS:** The average of the eTL parameters during practice were PlayerLoad = 636.5 ± 66.1 arbitrary units (au); PlayerLoad per Minute = 4.76 ± 0.69 au; Total Jumps = 143.8 ± 53.0 count (ct); Inertial Movement Analysis (IMA)_High = 39 ± 20 ct; IMA_Medium = 135 ± 53 ct; IMA_Low = 582.8 ± 156 ct. There was a significant time effect for MVIC ($p = 0.031$), but post-hoc pairwise comparisons revealed no significant difference across time ($p > 0.05$). There was a significant time main effect for LFF (Pre = 0.515 ± 0.025 ; Post = 0.483 ± 0.038 ; 24Post = 0.513 ± 0.033 , $p = 0.019$), with post-hoc pairwise comparisons revealing no significant difference from Pre- to Post-practice ($p = 0.104$), but did exhibit a large negative effect ($d = 1.0$). There was a significant increase from Post- to 24Post-practice ($p = 0.039$, $d = 0.84$). **CONCLUSIONS:** Based on these preliminary findings it appears basketball practice induces LFF in collegiate basketball athletes that recovers back to baseline within 24 hours of the bout. Although LFF was present, MVIC appeared unaffected.

1342 May 28 10:45 AM - 11:00 AM
Relative Contributions Of Muscular Strength, Muscle Size, And Tissue Oxygenation To Isometric Performance Fatigability

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PURPOSE: Performance fatigability (PF) has been defined as fatigue-induced decline in force. It has been hypothesized that muscle mass and strength may affect the magnitude of PF by limiting oxygenated blood to the muscle during sustained isometric muscle actions. Therefore, the purpose of the present study was to determine the relative contributions of muscular strength, muscle cross-sectional area (mCSA), and the rate of decline in tissue saturation index (TSI%) to PF.

METHODS: Fifteen men (\pm SD: 20.9 ± 1.7 yr) performed a sustained bilateral isometric leg extension muscle action at 45% of maximum voluntary isometric contraction (MVIC) until failure. PF was quantified as the percent decline in force from pretest to posttest MVIC. mCSA was defined as the sum of the right and left vastus lateralis (VL). Muscular strength was defined as pretest MVIC. Near-infrared spectroscopy was used to assess TSI% from the right VL and was log transformed to determine the linear slope coefficient (b) of TSI% vs. Time (every 5%). A paired t -test was used to examine differences between pretest and posttest MVIC. Regression analyses were used to determine the full-model and stepwise linear regression model.

RESULTS: The mean (\pm SD) sum of the VL mCSA was 51.3 ± 8.6 cm². The pretest MVIC (119.4 ± 17.6 kg) was significantly ($p=0.003$; $d=1.3$) greater than the posttest MVIC (96.7 ± 16.9 kg). The mean PF was $17.5 \pm 16.5\%$, and there was a significant ($p=0.031$), negative b (-0.005 ± 0.003 au) for TSI% vs. Time. The muscular strength standardized β was 3.25 times and 6.5 times greater than mCSA and TSI% standardized β s, respectively (Table 1). The stepwise linear regression analysis indicated that only muscular strength was a significant predictor of PF.

CONCLUSION: Muscular strength independent of muscle mass and rate of decline in TSI% contributed to PF. There was, however, 59% unexplained variance, so future investigations should examine the contribution of neuromuscular and metabolic responses to PF.

Table 1. Regression models for predicting performance fatigability.

Predictor	Full-model regression			Stepwise regression model		
	R	p-value	Standardized Beta	R	p-value	Standardized Beta
Strength	0.64	0.01	0.52	0.64	0.01	0.52
mCSA	0.66	0.52	0.16			
TSI%	0.66	0.77	0.08			

1343 May 28 11:00 AM - 11:15 AM
Effect Of Loading On Unintentional Lifting Velocity In The Overhead Press And Deadlift

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Previous work has shown greater declines in average concentric velocity (ACV) values during sets to fatigue for the bench press compared to the squat. The decline in ACV during sets of the overhead press (OHP) and deadlift (DL) has not yet been investigated. This information would be useful for those using ACV to prescribe training loads.

PURPOSE: To determine the effect of different loads on ACV during single sets of repetitions to failure with the OHP and DL.
METHODS: 30 individuals (23 ± 3 yrs) with current training experience with both the OHP and DL completed a 1RM protocol for the OHP and DL. Participants then returned to the lab on two separate occasions and completed one set of the OHP and DL to volitional fatigue at either 70% or 90% of their 1RM in a randomized order. The open barbell system measured ACV of all repetitions. The absolute and relative (%) decline in ACV was calculated for each condition and compared between loads (70% vs. 90%1RM) and between lifts (OHP vs. DL). Paired samples t -tests were used to compare ACV values between individual repetitions within each condition.

RESULTS: There were significant differences ($p < 0.05$) in both absolute and relative ACV decline between lifts and between loads. The absolute and relative decline in ACV was greatest for the 70%OHP condition (0.36 ± 0.12 m/s; $58 \pm 11\%$) followed by 90%OHP (0.19 ± 0.10 m/s; $43 \pm 16\%$), 70%DL (0.16 ± 0.08 m/s; $31 \pm 14\%$), and 90%DL (0.09 ± 0.06 m/s; $26 \pm 17\%$). For the 70%OHP condition, ACV was significantly ($p \leq 0.014$) greater for the third repetition (0.59 ± 0.15 m/s) compared to all subsequent repetitions; for 90%OHP, ACV was significantly ($p \leq 0.004$) greater for the first repetition (0.39 ± 0.13 m/s) compared to the third and all subsequent repetitions. For the 70% DL condition, ACV was significantly ($p \leq 0.014$) greater for the third repetition (0.49 ± 0.08 m/s) compared to the first, fourth, sixth, and all subsequent repetitions; for 90%DL, ACV was significantly greater ($p \leq 0.043$) for the second repetition (0.32 ± 0.04 m/s) compared to all other repetitions.

CONCLUSIONS: These data suggest the velocity decline during sets to fatigue is influenced by both the load and the lift performed. Greater declines in velocity are apparent during the OHP compared to the DL and when lifting lower (70%1RM) compared to higher loads (90%1RM).

1344 May 28 11:15 AM - 11:30 AM
Neuromuscular Fatigue Following Concentric Versus Eccentric Maximal Single Joint Exercise Of Similar Mechanical Work

Pierre Clos¹, Yoann M. Garnier², Alain Martin¹, Romuald Lepers¹. ¹University of Bourgogne Franche Comté, Dijon, France. ²Clermont-Auvergne University, Dijon, France.
 Email: Pierre.Clos@u-bourgogne.fr
 (No relevant relationships reported)

PURPOSE: This work aimed to examine the effect of contraction type (eccentric-ECC- or concentric- CON) on neuromuscular fatigue magnitude and etiology following exercise performed at maximal intensity and similar total mechanical work.

METHODS: Ten males participated in 4 experimental sessions (separate days) during which they performed 2 sets of maximal knee extensors contractions. The first and the second sets of the two first sessions (one in ECC and one in CON) ended when the dynamic peak torque loss reached 20% and 40%, respectively. The work achieved per set in each contraction type was then completed in the other contraction type. Two sessions (four sets) were thus performed both in ECC and CON. Knee extensors neuromuscular function (maximal voluntary isometric contraction- MVIC; voluntary activation level- VAL; high-frequency potentiated doublet- Dt) was examined before, immediately after the first and the second set of contractions. Dynamic fatigue was assessed through the decline in dynamic peak torque at the end of each set. Two-way repeated measures ANOVA served to test the effect of time and condition on MVIC, VAL and Dt, and was followed-up by Tukey's HSD test. Non-parametric Friedman's ANOVA was applied to dynamic peak torque, and followed-up by Wilcoxon's matched pairs test. **RESULTS:** MVIC declined similarly for ECC and CON at the end of the first (-14.4 ± 8.5 ; $P < 0.001$) and the second set (-20.6 ± 11.1 ; $P < 0.001$). Dynamic peak torque decreased more in CON (from -22.5 ± 4.0 to -37.8 ± 10.7 ; all $P < 0.01$) than ECC (from -9.1 ± 5.7 to 21.9 ± 5.1 ; $P < 0.01$), except in the set in which the greatest work was reached (-35.3 ± 14.3 vs -38.0 ± 6.8 ; $P = 0.51$). Only the ECC session in which participants achieved the highest work led to a significant reduction in VAL ($-9.5 \pm 11.2\%$; all $P < 0.03$). Dt declined after three of the four CON sets (from -4.8 ± 25.8 N.m to -23.4 ± 22.4 N.m; all $P < 0.02$), those featuring the largest works.

CONCLUSIONS: After the completion of a given work at maximal exercise intensity, reduction in MVIC did not mirror the greater magnitude of knee extensors torque loss in CON than ECC. ECC and CON contractions elicited central fatigue and peripheral fatigue, respectively. Fatigue magnitude and etiology both depended on the amount of work performed.

C-13 Clinical Case Slide - Hand

Thursday, May 28, 2020, 9:30 AM - 11:10 AM
Room: CC-2005

1345 Chair: Aaron Lee. *MacNeal Hospital, Berwyn, IL.*
(No relevant relationships reported)

1346 Discussant: Christopher McMullen. *University of Washington, Seattle, WA.*
(No relevant relationships reported)

1347 Discussant: Sherrie L. Ballantine-Talmadge, FACS. *CU Sports Medicine and Performance Center, Boulder, CO.*
(No relevant relationships reported)

1348 May 28 9:30 AM - 9:50 AM
Right Hand Dominant Musician With Right Hand Weakness
Sarah Merrill¹, Marcia Faustini². ¹*UC San Diego, San Diego, CA.*
²*UC Davis, San Diego, CA.*
(No relevant relationships reported)

HPI: EM is a RHD 19yF musician presenting with insidious onset, progressive RH weakness worsening over the last 1-2 years. No trauma. She has difficulty with pincer grasping. Weakness is constant but exacerbated when playing guitar or flute for long periods of time. No numbness, pain, tingling or swelling of the RUE. Denies any fevers, chills, recent URI, polyarthralgia. No family history of neurologic or autoimmune disease.

PE: No notable muscle atrophy or TTP in the RUE. Full ROM in neck, shoulder, elbow and wrist. 4/5 strength in pincer grip on right, 5/5 strength in right rotator cuff muscles, tricep, bicep, wrist flexion/extension. +Median nerve weakness, radial and ulnar nerve intact. Normal sensation and RUE reflexes. Positive Adson's. Negative Spurling, Roos tests., Hoffman, Negative Tinel's and Phalen's at the wrist. **DDX:** Radial neuropathy, Carpal tunnel syndrome, Paget Schroetter Syndrome, Thoracic outlet syndrome, Parsonage-Turner syndrome

TEST AND RESULTS: Labs: Within normal limits EMG: Results consistent with a significant True Neurogenic Thoracic Outlet Syndrome on the right. There is also electrodiagnostic evidence of a mild right ulnar mononeuropathy at the ulnar groove. Xray cervical spine: Enlarged transverse processes bilaterally at C7, larger on the right. Partial fusion at C3-4 with 2 mm retrolisthesis of C4 on C5 in extension that reduces with flexion. MRI Brachial plexus: Right cervical rib (at C7), with a hyperintense C8 spinal nerve coursing through this area, as are the medial cord, and visualized proximal ulnar nerve and possibly of the median nerve, likely attributable to mass effect from the cervical rib and/or an accompanying fibrous band. RUE vascular study: negative

FINAL WORKING DIAGNOSIS: Neurogenic Thoracic Outlet Syndrome
TREATMENT AND OUTCOMES: Initial EMG pointed to neurogenic TOS. Subsequently, patient completed cervical spine xrays and MRI of the brachial plexus, revealing cervical ribs with likely brachial plexus compression. Patient attended physical therapy to focus on posture while playing instruments, stretching of scalene muscles and strengthening scapular stabilizers. Unfortunately, she did not improve with conservative management. She has been seen by orthopedics and vascular surgery and is currently awaiting cervical rib resection surgery.

1349 May 28 9:50 AM - 10:10 AM
Not Your Ordinary Cause Of Hand Pain
Shannon C. Clemons, Haven Donavan. *UHS Wilson Memorial Hospital, Vestal, NY.* (Sponsor: Andy Getzin, MD, FACS) Email: sportsdocshannon@gmail.com
(No relevant relationships reported)

HISTORY: An 18-year-old senior high school football player sustained an avulsion fracture to the left 5th digit proximal phalanx on October 2018 during practice which was treated with an ulnar gutter cast for 6 weeks. He played through the remaining

football season and baseball season, after which, he presented to the clinic with what he felt was instability in his left hand. He reported no new trauma. Upon examination, there was mild tenderness in the 5th digit and tenderness localized to the head of the 4th metacarpal. The patient denied numbness, weakness, swelling, or bruising to the site of pain, but endorsed clicking of the 4th digit when making a fist and opening his hand again.

PHYSICAL EXAMINATION: Mild Boutonniere's deformity of 5th. Full ROM with all finger motions. Snapping sensation when going from fully flexed position in 4th digit to fully flexed position. Tenderness to palpation at 5th digit PIP and at 4th digit just proximal to MCP. Slightly more movement with anterior - posterior translation of the 4th metacarpal dorsally compared to the proximal phalanx. Sensation intact to light touch.

DIFFERENTIAL DIAGNOSIS: 1. Stress fracture 2. Trigger Finger 3. Dieterich's Disease 4. Bone Contusion 5. Improper rehab from initial splint immobilization from original injury

TEST AND RESULTS: X-rays: Interval healing of nondisplaced fracture of the fifth digit proximal phalanx. Cystic lesion of the head of the fourth metacarpal not evident on the comparison study. MRI: Abnormality of the 4th metacarpal head including articular surface flattening with adjacent subcortical marrow edema bordered by linear somewhat serpiginous hypointense signal, perhaps sclerosis, and with some tiny subchondral cystic foci as well. Small amount of T2 hyperintense marrow signal in the visualized distal shaft of the 4th metacarpal as well. Small 4th MCP joint effusion.

FINAL/WORKING DIAGNOSIS: Dieterich's Disease (avascular necrosis of the metacarpal head)

TREATMENT AND OUTCOMES: 1. Curettage of avascular necrosis and autogenous bone graft from distal radius, internal Fixation of metacarpal with K-wire and Ulnar gutter splint 4. Removal of K-wire at 6 weeks, application of ulnar gutter OT brace. 5. Home OT with ROM and muscle strengthening exercises. 6. Formal OT. Patient regained full function of the hand and returned to sports.

1350 May 28 10:10 AM - 10:30 AM
Hand Injury - Basketball

Jared W. Willard, Ashlee Lafontaine, Andrew Gregory, David Liddle. *Vanderbilt University Medical Center, Nashville, TN.*
Email: jared.willard@vumc.org
(No relevant relationships reported)

HISTORY - 16-year-old male presenting with left thumb injury. Patient presented due to thumb injury during basketball 5 weeks prior to presentation. He reported a basketball was thrown extremely hard and hit him on the lateral side of the thumb, pushing his thumb towards his 5th digit. Despite pain, he was able to finish the game. He had noticeable swelling when the game ended. Despite icing, he continued to have swelling in addition to pain with pinching items or texting. This led him to the urgent care 1 week prior to presentation. X-rays were obtained at the urgent care and he was sent to sports medicine clinic.

PHYSICAL EXAMINATION - Examination of left hand showed noticeable deformity at MCPJ, with proximal phalanx appearing subluxed on MC. Flexible deformity on radial aspect of the thumb MCP joint. Tenderness to palpation over the radial side of the MCP joint where there is a prominence. No swelling or bruising. Full range of motion of the thumb without limitation. Strength 4/5 with thumb flexion, extension, abduction, adduction. Pain with thumb manual muscle strength testing. Stable to UCL stress at 0 and 30 degrees. RCL laxity at 0 and 30 degrees without clear endpoint. Normal thumbs up and okay sign. Normal thumb to pinky opposition. Normal grip. Neurovascularly intact.

DIFFERENTIAL DIAGNOSIS:

1. Radial collateral ligament tear
2. Flexor pollicis brevis tear
3. 1st proximal phalanx fracture
4. Sesamoid fracture

TESTS AND RESULTS:

XR Left Hand

Impression: No fractures identified. Subluxation of thumb at MCP joint.

MRI Left Hand

Impression: Complete disruption of radial collateral ligament of the MCP joint of the thumb with ulnar subluxation of the phalanx compared to the metacarpal. Significant joint fluid. Ulnar deviation of the flexor pollicis longus and sesamoids. Some marrow edema of the distal metacarpal as well as subchondral bone of first phalanx.

FINAL/WORKING DIAGNOSIS

Chronic radial collateral ligament rupture at metacarpal level

TREATMENT AND OUTCOMES:

1. Surgical radial collateral ligament repair
2. Initially immobilized with thumb spica splint
3. Casted from 1-5 weeks post operatively
4. Out of cast at 5 weeks post op out; into OT formed hand-splint and range of motion exercises started
5. Follow up planned 9 weeks post-op. Work with OT to achieve full, painless ROM and normal strength prior to returning to basketball

1351 May 28 10:30 AM - 10:50 AM

Hand Injury- Football: Thumbs Up

Joshua H. Wood, Arturo Islas, Mark Stovak, FACSM, Robert Bogart. *University of Nevada, Reno, NV.*
(No relevant relationships reported)

HISTORY: 22 yo Collegiate quarterback present to clinic with thumb pain in his throwing hand which began that morning in practice. During practice he was throwing a ball, and it hit his thumb on a defensive player’s helmet which caused immediate pain and weakness. The athlete’s past medical history includes a Bennett fracture repair 17 months prior on the same hand.

PHYSICAL EXAMINATION: Examination in the clinic revealed tenderness on palpation over the thenar eminence and the anatomical snuff box. Sensation was intact. He had weakness with adduction of the thumb, and decreased ROM in all planes. Grip strength in the right hand was decreased.

DIFFERENTIAL DIAGNOSIS: 1. Recurrent Bennett’s Fracture

2. Ulnar collateral ligament injury
3. Rolando’s fracture
4. Scaphoid fracture
5. Bone bruise

TEST AND RESULTS: X-ray: Impression: Right minimally displaced Bennett fracture with near anatomic reduction. There is old sign of some ulnar collateral ligament injury noted at the MCP.

CT: Showed an acute fracture at the base of his thumb with a large fracture fragment noted attached to the ulnar collateral ligament.

FINAL WORKING DIAGNOSIS: Re-current Bennett’s fracture

TREATMENT AND OUTCOMES: 1. The patient was immediately placed in a thumb Spica brace. Due to the continued pain and previous history of a Bennett’s fracture and concern for a new fracture a CT was ordered. The CT showed a new Bennett’s Fracture.

2. Surgical repair with 3 screws
3. Started rehab 3 weeks after surgery and was cleared for competitive play 7 weeks out from surgery.

Author Comments: Images available

1352 May 28 10:50 AM - 11:10 AM

Hand Injury - Football

Marshall N. Leonard, MD¹, George P. Ackerman, MD², John Grossi². ¹North Shore, Manhasset, NY. ²NY Orthopedics, Westbury, NY.
Email: leonardsportsmed@gmail.com
(No relevant relationships reported)

HISTORY: An 18-year-old high school football player suffered a hand injury after tackling the quarterback and celebrating by punching the artificial turf. He continued playing, however during the second half, he noticed his hand was swollen. He reported no pain, full range of motion, and no numbness or tingling in his hand or fingers. He denied wrist or elbow pain.

PHYSICAL EXAMINATION: Sideline examination was performed remarkable for a mildly swollen right hand, no obvious deformity of the wrist, hand or fingers. There was mild tenderness to palpation along the ulnar aspect, with full active range of motion at the wrist and fingers. He had normal strength with flexion and extension at the wrist, MCP, PIP, and DIP, however wrist flexion and MCP flexion was painful. He was able to make a full fist and rotational alignment was not significant. Supportive tape was applied, and he continued to play without increase of swelling or pain.

DIFFERENTIAL DIAGNOSIS:

1. Fracture of metacarpal bones
2. Soft tissue contusion
3. Sprain of hand ligaments

IMAGING: AP, lateral, and oblique views of the right hand revealed a mildly displaced transverse right fifth metacarpal shaft fracture. Volar angulation of approximately 30°

FINAL DIAGNOSIS:

Boxer’s Fracture (Fracture of the 5th metacarpal bone)

TREATMENT AND OUTCOMES:

1. Operative management with plate and screw fixation considered, however nonoperative care was ultimately decided on. Patient placed in an ulnar gutter pre-fabricated splint and immobilized for at least 8 weeks.
2. Pain control with NSAIDs if needed
3. He was allowed to continue football competition; splint wrapped in a partial club cast. He was not allowed to play offensive receiver; other positions he had no limitations
4. Repeat radiographs at 4 weeks showed no interval change in the fifth metacarpal shaft fracture and early callus formation noted on orthogonal views. Patient had full ROM and strength on exam. Continued ulnar gutter splint immobilization and partial club cast for competitions, with light physical therapy initiated

5. Repeat radiographs at 6 weeks showed continued fracture healing, well aligned, normal strength on exam
6. Nonoperative management with ulnar gutter splint immobilization allowed patient to complete the football season with successful preliminary stages of fracture healing

C-14 Clinical Case Slide - Hip II

Thursday, May 28, 2020, 9:30 AM - 11:10 AM
Room: CC-2016

1353 **Chair:** Yi-Meng Yen. *Childrens Hospital, Boston, MA.*
(No relevant relationships reported)

1354 **Discussant:** Bryan Wiley. *Kaiser Permanente Medical Group, Ontario, CA.*
(No relevant relationships reported)

1355 **Discussant:** Jacob Jones. *Boston Children’s Hospital, Brookline, MA.*
(No relevant relationships reported)

1356 May 28 9:30 AM - 9:50 AM
Hip Pain In A Female Military Trainee: A Cautionary Tale Of Catastrophic Complications

Jaime Gonzalez, Alexis Ortiz, FACSM. *University of the Incarnate Word, San Antonio, TX.* (Sponsor: Alexis Ortiz, FACSM)
(No relevant relationships reported)

Hx: A 31 y/o F client presented to a PT by self-referral, with a primary c/o R hip and groin pain. The client was a previously competitive runner and triathlete and was currently undergoing US Army Initial Entry Training.

PE: The client presented with a moderately antalgic gait, exhibiting a “compensated gluteus medius” gait pattern. Grossly limited ROM in the R hip complex due to pain. No apparent edema, erythema, ecchymosis, atrophy, or deformity on observation. Positive heel tap, fulcrum, patellar-pubic percussion test.

DDx:

1. Femoral Neck Stress Fx
2. Pelvic stress fx
3. Adductor strain/avulsion
4. Hip flexor strain/avulsion
5. Femoral shaft stress fx
6. Lumbar spinal referral
7. Non-organic etiology

Tests & Results:

Plain radiography, bone scan, and MRI: consistent with the primary clinical hypothesis following the clinical examination, a FNSF.

Final Diagnoses:

FNSF, mid-femur fx, osteomyelitis

Treatment & Outcomes: Pre-op the client was given crutches and instructed in a NWB gait. She underwent an uncomplicated ORIF. The immediate post-op course, including PT, was uneventful and included reinforcement of the importance of compliance with the post-op instructions, including NWB progressing to TTWB gait with crutches.

The client experienced a fall shortly after being d/c’d from her inpatient stay, which resulted in a fx of the ipsilateral femur. She underwent a 2nd uncomplicated ORIF of her R femur fx. Again, the immediate post-op course, including PT, was uneventful. However, approximately 2 weeks following her d/c from the inpatient stay, the client began to report vague constitutional symptoms including fatigue, fever, and nausea. The PT ordered lab studies including CBC/diff, CMP, and ESR. Results were broadly abnormal and the ortho surgical service was contacted directly and a same-day referral made. Subsequent imaging and serial lab studies confirmed an infection and the patient was taken back for a 3rd surgery, ultimately resulting in an osteotomy and revision of the FNSF ORIF. After a brief stay in the ICU, the patient was transferred to the ortho floor and remained there for several weeks, while receiving IV antibiotics and serial imaging and lab studies. The client was d/c’d and transferred to the medical hold unit to begin the process to be removed from military service.

1357 May 28 9:50 AM - 10:10 AM

Radicular Pain And Numbness To The Lower Extremity Not Always A Radiculopathy.Richard A. Fontanez, Eduardo Ramos. *University of Puerto Rico Medical Science Campus, San Juan, PR.*

Email: fontanez.richard@gmail.com

(No relevant relationships reported)

HISTORY: A 47 year-old male scuba diver instructor complained of a few months history of progressive low back and right gluteal pain with associated bilateral lower extremity numbness, numbness, tingling and right leg limp. Past medical history remarkable for obesity and hypothyroidism. Denies recent illness, trauma, falls or use of any drug or steroid. **Physical Exam:** Antalgic gait with right lower extremity limp and no muscle atrophy. Tenderness over lumbar paraspinal muscles, anterior groin and greater trochanteric area. Full passive range of motion (ROM) and limited active ROM on right hip flexion, extension and abduction due to pain. Negative straight leg raise, positive log roll, internal rotation over pressure and Stinchfield's tests. Strength 5/5 in bilateral lower extremities, except for 4/5 on right hip flexion and extension due to pain. **DIFFERENTIAL DIAGNOSIS:** 1. Right hip OA 2. Lumbar facet joint arthropathy 3. Lumbar radiculopathy 4. Gluteus Medius tendinosis 5. Femur fracture 6. Dysbaric osteonecrosis of the right femoral head **TEST AND RESULTS:** 1. Lumbar spine AP and lateral views X-rays-multilevel degenerative changes of the lumbar spine with osteopenia and spondylosis 2. Pelvis AP xray- osteoarthritic changes of the hip bilaterally with sclerotic pattern involving the right femoral head 3. Right hip AP and lateral view xray- Dysplastic changes of the femoral head with evidence of the osteonecrosis and articular collapse 4. Right hip MRI w/o contrast-Advance degeneration of the right hip joint secondary to prior AVN of the femoral head and subchondral collapse 5. Quantitative bone scan: Increase uptake in the right hip acetabulum and femoral neck area. 6. Electrodiagnostic study: Acute L4-L5 radiculopathy with no electrodiagnostic evidence of the right lumbosacral radiculopathy **FINAL/WORKING DIAGNOSIS:** Dysbaric osteonecrosis of the right femoral head. **TREATMENT AND OUTCOMES:** 1. Right total hip replacement 2. Admission to acute inpatient rehabilitation hospital 3. Standard protocol for total hip replacement 4. Neuromuscular and proprioceptive training 5. Return to scuba diving after 3 months as recommended by his orthopedic surgeon and PM&R specialist. Patient was able to walk without assistive device and have the strength to carry a diving equipment.

1358 May 28 10:10 AM - 10:30 AM

Right Groin Pain In A Collegiate Offensive LinemanMichael Pitzer¹, Heather Bauby², Kaylyn Hill². ¹Virginia Commonwealth University, Richmond, VA. ²Randolph-Macon College, Ashland, VA.*(No relevant relationships reported)*

HISTORY: The patient was a 21-year-old football player who had been having atraumatic right groin pain for one month. He reported feeling a lump in the area of the pain. The pain was worse with activity and relieved by rest. He had also been experiencing subjective fevers, night sweats, nausea, and fatigue. He endorsed an intermittent rash during the course of the first month of symptoms that became very pronounced during a short episode of viral gastroenteritis. Trials of antibiotics did not improve symptoms.

PHYSICAL EXAMINATION: He was a well appearing male that was afebrile. His abdominal and genitourinary exam revealed a soft and nontender abdomen with normal bowel sounds. There was no evidence of a right inguinal hernia. There was no testicular mass or epididymal tenderness. No discrete nodules were palpable in the right groin but there was fullness in the area compared to the opposite side. On examination of the right hip he was nontender to palpation over the anterior hip and moderately tender over the proximal hip adductors. There was no tenderness to palpation over the greater trochanter. He had full range of motion with hip flexion, extension, abduction, and adduction without pain. He reported some pain with resisted adduction. FADIR test was negative.

DIFFERENTIAL DIAGNOSIS: Adductor tendonitis, Inguinal hernia, Lymphadenopathy, Lymphoma, Lymphogranuloma venereum, Kawasaki disease, and Kikuchi-Fujimoto disease. **TEST AND RESULTS:** CMP, CBC, and UA were without significant findings. HIV, hepatitis B, hepatitis C, and Epstein Barr virus were negative. ESR, CRP, rheumatoid factor, and ANA were within normal limits. Lyme Disease test was negative. A diagnostic ultrasound showed a lobulated hypochoic nodule with a fatty hilum in the right inguinal region with a volume of 6.9 mL consistent with a reactive lymph node. Pathology of the lymph node showed histiocytic necrotizing lymphadenitis consistent with Kikuchi-Fujimoto without evidence of malignant lymphoma or metastatic carcinoma.

FINAL WORKING DIAGNOSIS: Kikuchi-Fujimoto Disease **TREATMENT AND OUTCOMES:** He was started on a prednisone taper to which he had dramatic symptom improvement but with a rebound in symptoms after completing the course. He was then started on hydroxychloroquine and reported adequate symptom improvement for football participation.

1359 May 28 10:30 AM - 10:50 AM

Hip And Groin Pain - SkatingSarah A. Pierotti. *Advocate Lutheran General, Park Ridge, IL.**(No relevant relationships reported)*

Hip and Groin Pain - Skating

Sarah Pierotti, Kaleigh Suhs, Advocate Lutheran General Hospital, Park Ridge, IL **HISTORY:** A 14-year-old female softball catcher was seen in Sports Medicine clinic for follow up for left hip injury. She sustained a fall with hyperextension her left leg while rollerblading. She was evaluated at an urgent care for left hip and groin pain. An X-ray pelvis was normal and she was discharged with a diagnosis of a hip flexor strain. She was re-evaluated the next day in the ER as the pain had progressed. After CT demonstrated a pelvic hematoma she was admitted to the PICU where she developed numbness and tingling in the affected leg with decreased strength of hip flexion and knee extension.

PHYSICAL EXAM:

The patient was wheel chair dependent but stood with support. Her lumbar spine was normal other than tenderness overlying the paraspinals and iliac crest of the left side. Her left lower extremity range of motion was pain-free with hip flexion past 120, external rotation to 55 degrees and internal rotation to 25 degrees. She was unable to fully extend the hip - maintaining approximately 5 to 10 degrees of hip flexion. She had decreased sensation to light touch of anterior, medial, and lateral thigh, medial shin and medial foot. Strength of hip flexion was 3+.

DIFFERENTIAL DIAGNOSIS:

- Hip flexor strain
- Femoral neck fracture
- Labral tear
- Anterior inferior iliac spine avulsion

TEST AND RESULTS:

CT Pelvis without contrast:

- 5.0 x 7.0 x 8.6 cm high density mass along the left iliac bone deep and within the iliacus musculature along the iliac bone anteriorly and into the iliacus with mass effect on the psoas.

- Hemorrhage extending along the posterior left psoas muscle superiorly into the abdomen and descending colon

CTA Abdomen/Pelvis with contrast

- Small 4 mm blush of contrast in the inferior and posterior aspect of the left pelvic hematoma possibly a small area of active extravasation. No discrete connecting vessel identified.

FINAL DIAGNOSIS:

- Iliopsoas hematoma
- Femoral nerve neuropraxia

TREATMENT AND OUTCOMES:

- 1 Refer to Neurology with follow up for monitoring of neuropraxia
- 2 MRI to re-evaluate hematoma size, evaluate muscle and nerve involvement
3. Collaboration with pediatric surgery, vascular surgery and orthopedics for monitoring. Drainage of hematoma not recommended.
4. Referral to PT for mobilization

1360 May 28 10:50 AM - 11:10 AM

HIP INJURY -- WRESTLINGTerri A. Zachos, Jay F. Deimel. *Allegheny Health Network Saint Vincent Hospital, Erie, PA.**(No relevant relationships reported)*

Hip Injury - Wrestling

Terri A. Zachos, Jay F. Deimel, Allegheny Health Network Saint Vincent Hospital, Erie, PA.

HISTORY: A 21-year-old college wrestler presented with progressive, persistent pain in his right hip after undergoing arthroscopy at an outside institution. Despite multiple attempts at non-operative management, including activity modification, rest, physical therapy, and use of nonsteroidal anti-inflammatory drugs, pain and stiffness limited his sport-specific function.

PHYSICAL EXAMINATION: Markedly limited active range of motion, particularly with hip flexion beyond 90 degrees; pain with range of motion

DIFFERENTIAL DIAGNOSIS:

1. Chondral injury to femoral head
2. Injury (recurrence of tear) to acetabular labrum
3. Persistent cam type impingement of right hip
4. Chondromalacia of right acetabulum

TEST AND RESULTS:

Plain radiographs of pelvis and both hips

MRI of right hip

MR-arthrogram of right hip

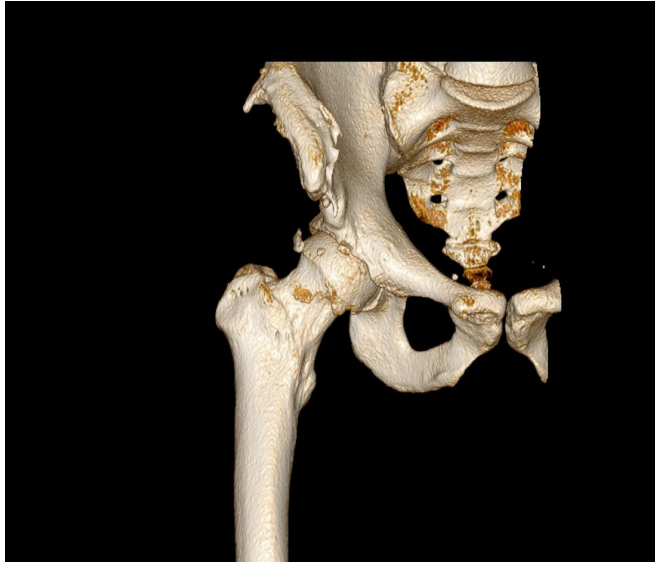
Results of all imaging studies were consistent with early progression of osteoarthritis, with changes considered advanced for a patient of his age.

FINAL/WORKING DIAGNOSIS:

Chondral injury and heterotopic ossification (HO) secondary to chronic cam type femoroacetabular impingement

TREATMENT AND OUTCOMES:

1. Right hip revision arthroscopy with labral resection and labral reconstruction with allograft tissue
2. Right hip revision arthroscopic cheilectomy/femoroplasty
3. Right hip arthroscopic excision of HO fragment measuring 3 cm x 2 cm in anterior lateral joint capsule
4. Right hip arthroscopic chondroplasty of acetabulum with microfracture/bone marrow stimulation procedure
5. Immediate post-operative physical therapy (day of surgery)
6. Single dose of external beam radiation on post-operative day 1 to minimize risk of recurrence of HO
7. 20 pounds flat foot weightbearing restriction for six weeks
8. Naproxen 375 mg bid x 6 weeks to minimize risk or recurrence of HO
9. Continuous passive motion in immediate post-operative period



3 days earlier. She noted immediate local pain of 8/10 on VAS and noticed a popping sound in the shoulder at injury. She was unable to lift her arm.

PHYSICAL EXAMINATION:

Edema was noted at the anterolateral shoulder, no gross deformity present. Palpation of soft tissues, tendon and bony structures revealed significant point tenderness at the greater tuberosity. Limited active ROM of 20 deg. in flexion, abduction and external rotation due to pain. Passive ROM was 80 degrees in flexion and abduction, 30 deg in ext. rotation. Resistive testing was weak and painful in flexion, abduction and ext. rotation. Due to significant pain complaints, further physical examination was suspended and clinician progressed to point-of-care ultrasound imaging of the shoulder complex.

DIFFERENTIAL DIAGNOSIS:

1. Rotator Cuff Tear
2. Labral Tear/ Bankart Lesion
3. Proximal Humerus Fracture
4. Shoulder Sprain
5. Reduced Shoulder Dislocation

TEST AND RESULTS:

MSK Ultrasound Imaging of the shoulder complex revealed 10mm displacement of supraspinatus footprint of humerus in LAX. Patient was referred to orthopedic surgeon for further diagnostic imaging. XRI revealed displaced and comminuted greater tuberosity fracture. 3D CT also revealed acute greater tuberosity avulsion fracture with 9mm displacement.

FINAL WORKING DIAGNOSIS:

L shoulder displaced greater tuberosity fracture

TREATMENT AND OUTCOMES:

Patient underwent open ORIF of greater tuberosity fracture with two 6.5 PEEK anchors and parachute suturing. During procedure anterior/lateral rotator cuff tear was noted and repaired using high five sutures. Post surgical rehabilitation consisted of a modified RCR protocol:

- Week 0-2: Brace immobilizer and PROM only in flexion to 90 deg.
 - Week 2-4: Brace continued. Progressed to PROM in all directions and pendulums in 4 weeks
 - Week 4-8: Progressive AAROM to AROM and gentle isometrics
 - Week 8-12: Progressed to RC strengthening and functional activities
- Patient outcomes were excellent with SPADI 4/100, full ROM in all directions, and only minor weakness in abduction/external rotation. Patient returned to full recreational athletic activities.

C-15 Clinical Case Slide - Shoulder I

Thursday, May 28, 2020, 9:30 AM - 10:50 AM
Room: CC-2022

1361 Chair: Thomas Moran. *University of Chicago-NorthShore, Chicago, IL.*
(No relevant relationships reported)

1362 Discussant: Eric E. Coris. *University of South Florida College of Medicine, Tampa, FL.*
(No relevant relationships reported)

1363 Discussant: Melissa W. Christino. *Boston Children's Hospital, Boston, MA.*
(No relevant relationships reported)

1364 May 28 9:30 AM - 9:50 AM
Shoulder Injury - Recreational Alpine Skiing
 Arie J. van Duijn¹, Jacqueline van Duijn¹, Shawn D. Felton¹, John Mehalik², Mitchell L. Cordova, FACS¹. ¹*Florida Gulf Coast University, Fort Myers, FL.* ²*Orthopedic center of Florida, Fort Myers, FL.* (Sponsor: Mitchell L. Cordova, FACS¹)
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(No relevant relationships reported)

HISTORY:
 54-year old female recreational alpine skier with history of left shoulder pain following a fall on hyperabducted outstretched arm after being hit from behind by another skier

1365 May 28 9:50 AM - 10:10 AM
An Unusual Case Of Shoulder Pain In A High School Football Player
 Eric Wayne Pettyjohn, Jason L. Zaremski, FACS¹. *University of Florida, Gainesville, FL.*
 Email: epettyjohn@ufl.edu
(No relevant relationships reported)

HISTORY: A 15 year-old right hand dominant male presented to sports medicine clinic due to left shoulder pain. The mechanism of injury was while playing football the day prior where he jumped to catch a pass, and landed directly on grass onto his left shoulder with arm by his side. Heard a "pop" when he landed, and was experiencing intermittent, generalized shoulder pain since the event. Denied prior injury of affected extremity as well as denied numbness or tingling. There was no swelling, discoloration, or bruising per the patient or the mother of the patient. There was no obvious reported deformity of the shoulder as well. The patient denied any neck or elbow pain. Symptoms were improved at rest and with arm at his side.
PHYSICAL EXAM: Left Shoulder: Pain with passive abduction, flexion on range of motion (ROM) testing. Active ROM is full in all directions. Tender to palpation (TTP) at the AC joint and scapular angle; no TTP at scapular body. Strength: 2/5 supraspinatus, 3/5 external rotation, 4/5 internal rotation, abduction, and biceps. Positive empty can and drop arm. No erythema, normal sensation throughout left upper extremity, and radial and ulnar pulses 2+ and regular.

DIFFERENTIAL DIAGNOSIS:

1. Acromioclavicular sprain
2. Rotator Cuff injury
3. Glenoid labrum injury
4. Distal clavicle contusion
5. Glenohumeral dislocation

TEST AND RESULTS:

1. XR Left Shoulder: no acute fracture, dislocation, or soft tissue abnormality. XR Left Scapula: No acute displaced fracture.
2. MRI (no IV contrast) Left Shoulder: Feathery edema in the rotator cuff musculature centered about the scapula. Low grade muscular strain vs underlying non-displaced scapular body fracture.
3. CT Shoulder Trauma w/ Joint (no IV contrast): Non-displaced hairline fracture in the mid scapular body perpendicular to the long axis. AC and GH joints are intact.

FINAL WORKING DIAGNOSIS:

Non-displaced extra-articular fracture in the mid scapular body

TREATMENT AND OUTCOMES:

1. Immobilization with sling for initial 4 weeks with pendulum swings twice daily
2. At week 4, no pain at rest with asymptomatic full strength. Physical Therapy initiated.
3. Cleared for non-contact and non-collision activities at week 8.
4. Returned to all activities without restriction at week 12.

1366 May 28 10:10 AM - 10:30 AM

Shoulder Pain-Wheelchair Basketball

Ryan P. Nussbaum, DO, Prakash Jayabalan MD, PhD. *Shirley Ryan AbilityLab/ Northwestern University, Chicago, IL.*

(Sponsor: Dr. Joseph Ihm, MD, FACSM)

Email: rnussbaum@sralab.org

(No relevant relationships reported)

HISTORY

39 year old male wheelchair basketball player was referred for shoulder pain and need for potential glenohumeral joint injection. He had experienced one year of left-sided shoulder pain that began after colliding with an opponent at high velocity during a game. At the time of the trauma, he had sudden onset burning left sided neck pain that radiated down his arm to his left thumb. He noticed that raising his left arm above his shoulder worsened the shoulder pain. Additionally, he noticed left-sided weakness with elbow flexion and shoulder abduction that made wheelchair transfers difficult.

PHYSICAL EXAMINATION

4/5 strength with left shoulder abduction and elbow flexion. Active left shoulder abduction and flexion was limited to 90 degrees, due to pain. Empty can, Hawkins's, and Neer's tests caused left anterior shoulder pain. Decreased sensation over the left lateral upper arm to pinprick and light touch. Hoffman's elicited on the left. Reflexes: 3+ left biceps. Cervical forward and left lateral flexion limited due to pain. Left Spurling's exacerbated shoulder pain.

DIFFERENTIAL DIAGNOSIS

1. Cervical radiculopathy/myelopathy
2. Left supraspinatus tear
3. Left subacromial impingement
4. Left adhesive capsulitis
4. Left brachial plexopathy

TESTS AND RESULTS**Left Shoulder MRI**

- No supraspinatus tear
- Subtle superior/posterior labral tear
- Trace biceps tenosynovitis

Cervical Spine MRI

- Left paracentral disc herniation causing moderate spinal canal stenosis with compression of spinal cord and myelomacia at C5-6 level.
- Moderate to severe foraminal stenosis, worse on the left at C5/6.

Left Brachial Plexus MRI

- No abnormality

Upper Extremities EMG/NCs

- Left primarily demyelinating median nerve mononeuropathy across the wrist.
- Denervation and re-innervation at the level of the left triceps brachii muscle without abnormalities in other C6 or C7 innervated muscles or radial innervated muscles to assist with innervation suggestive of cervical radiculopathy

FINAL WORKING DIAGNOSIS

- Left cervical radiculopathy with myelopathic features

TREATMENT AND OUTCOMES

- Referral to Neurosurgery for potential surgical decompression in setting of cervical myelopathic findings.
- Initiated physical therapy focusing on McKenzie based program with spine stabilization.

1367 May 28 10:30 AM - 10:50 AM

Shoulder Injury - Wrestling

Alex K. Ngan, Benjamin Ma, Cindy J. Chang, FACSM.
University of California San Francisco, San Francisco, CA.

(Sponsor: Cindy J. Chang, FACSM)

Email: alexngan93@gmail.com

(No relevant relationships reported)

History:

A 14 year-old wrestler was injured during a match when he was thrown over his opponent's shoulder, landing directly on his left shoulder. He reported immediate swelling of his shoulder and tingling of fingertips; at the emergency department (ED) shoulder radiographs were negative. He was given a ketorolac injection; bruising appeared a few days later. He returned to the ED one week later with left sided chest and abdominal pain; chest radiographs were negative. Two months later, he presented to our sports medicine clinic with 7/10 "achy all over" shoulder pain that worsened with movement. He denied instability, weakness or radicular symptoms.

Physical Examination:

No atrophy or deformity. Full range of motion (FROM) of cervical spine, (-) Spurlings. FROM shoulders, 5/5 strength. (-) Speeds, O'Briens, impingement, instability. (+) tenderness of the anterior to lateral humerus head, and the left 1-3 ribs starting from supraclavicular region to sternoclavicular (SC) joints. (-) pain acromioclavicular (AC) joint. Neurovascular status normal.

Differential Diagnosis:

1. Proximal humerus fracture
2. SC joint sprain
3. Rib dysfunction
4. Rib fracture(s)
5. Clavicle fracture
6. Intercostal muscle strain
7. Biceps tendon strain
8. Pectoralis muscle strain

Tests and Results:

Left shoulder imaging:

Radiographs: left AC and coracoclavicular joints each 11 mm; axillary view showed possible periosteal calcification proximal humerus

Magnetic resonance imaging (MRI): High-grade partial tearing of accessory head of biceps tendon

MRI review by sports medicine team: Calcific deposit along greater tuberosity and humeral shaft; abnormal signal at insertion of pectoralis major tendon

Final/Working Diagnosis:

Chronic distal pectoralis major tendon avulsion

Treatment and Outcomes:

1. Seen by orthopaedic surgery 6 months post injury; declined surgery in order to wrestle high school season
2. One year post injury, open repair of pectoralis major tendon, excision of heteropic ossification, and biceps tenodesis
3. Sling x 6 weeks; at week 2 passive ROM per physical therapy (PT)
4. At week 6 active ROM with 3# lifting restriction; jogging allowed
5. At 3 months post-op, 5/5 strength, no pain, and good progression; no wrestling until reevaluation at 5 months post-op
6. Last PT visit at 4 months post-op; lost to follow up after

C-16 Rapid Fire Platform - Athletes and Behavior

Thursday, May 28, 2020, 9:30 AM - 10:50 AM

Room: CC-Exhibit Hall

1368 **Chair:** Thomas Andre. *University of Mississippi, University, MS.*

(No relevant relationships reported)

1369 May 28 9:30 AM - 9:40 AM

Relationship Between A Burnout Syndrome Evaluation And Hopelessness In Mexican College Athletes.

Victo Hugo Montejo-Lambaren, Sara Ramirez-Hernandez, Alejandro Gaytan-Gonzalez, Juan Ricardo Lopez-Taylor.
Universidad de Guadalajara, Guadalajara, Mexico.

(No relevant relationships reported)

PURPOSE: To find the relationship between Burnout Syndrome and Hopelessness.

METHODS: 307 Mexican college athletes were evaluated by trained psychologists with a battery which included a Sport Burnout Syndrome Inventory (conformed by 18 items; divided in 3 factors: Emotional Exhaustion (EE), Depersonalization (D) and Reduced Personal Realization (RPR); qualified in 4 grades: "Low Risk", "Moderated Risk", "High Risk" and "With Burnout") and Beck's Hopelessness Scale (conformed by 20 items; qualified in 4 grades: "Normal", "Slight", "Moderated" and "Severe"). Multinomial logistic regression was performed to associate the components scores of burnout syndrome and the hopelessness results.

RESULTS: The association between "Moderated Risk" of Burnout Syndrome risk and "Slight Hopelessness" were statistically significant in EE Factor ($p=0.02$). Likewise, "High Risk" scores in RPR ($p=0.002$) and "With Burnout" punctuations in D ($p=0.03$) seem to be predictors of "Slight Hopelessness". On the other hand, "High Risk" scores in EE was associated with "Moderated Hopelessness" ($p=0.04$). We did not obtain "Severe" evaluated athletes in our sample.

CONCLUSIONS: Beck's Hopelessness Scale is an instrument that allows us to identify some indicators associable with the risk of committing suicide. Our results suggest that our college athletes do not show signs of suicide risk. Nonetheless, we see how higher Burnout Risk has an association with higher hopelessness scores. Both Burnout and suicide are public health issues, so we are convinced that more similar studies are necessary.

Table 1. Association between Burnout syndrome risk and Hopelessness levels.

		BHS	
		Slight hopelessness	Moderate hopelessness
EE	With BO	-†	-†
	High risk	1.87 (0.56 - 6.20)	15.96* (1.22 - 209.07)
	Moderate risk	2.17* (1.15 - 4.11)	3.77 (0.35 - 40.32)
D	With BO	3.42* (1.13 - 10.36)	3.06 (0.26 - 36.70)
	High risk	1.02 (0.37 - 2.79)	2.35 (0.33 - 16.72)
	Moderate risk	1.05 (0.48 - 2.30)	-†
RPR	With BO	1.47 (0.44 - 4.94)	4.66 (0.33 - 66.15)
	High risk	3.32* (1.58 - 7.01)	-†
	Moderate risk	1.86 (0.85 - 4.05)	3.86 (0.58 - 25.53)

Data expressed as OR (95% CI). BHS: Beck Hopelessness Scale. BO: Burnout. D: Depersonalization. EE: Emotional Exhaustion. RPR: Reduced Personal Realization. †Sample size was too low to perform the analysis. * p<0.05

1370 May 28 9:40 AM - 9:50 AM

A Pilot Study To Examine Collegiate Athletes' Attentional Focus And Goal Orientations With And Without Injury Experience

Susumu Iwasaki¹, Issei Ogasawara². ¹Fort Lewis College, Durango, CO. ²Osaka University, Toyonaka, Japan.

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(No relevant relationships reported)

PURPOSE: To explore the relationship among athletes' self-evaluations of internal & external attentional focus, goal orientations, and injury experiences.

METHODS: 102 college students (Mage = 19.65) completed a survey that measured attentional focus and goal orientations and collected demographic information and injury experience. Reliability coefficients for attentional focus (internal = .67 & external = .75) and goal orientations (task = .81 & ego = .74) were acceptable. The sample was split into two groups according to their competitive level: Group 1 participated in recreational activity or local competition, and Group 2 participated in state level or more advanced competition. ANOVA was used to examine whether injury experience is a significant predictor for attentional focus and goal orientations in each group.

RESULTS: Group 2 athletes reported significantly higher scores in task (Group 1: M = 3.68, ± .77; Group 2: M = 4.19, ± .52) and ego orientations (Group 1: M = 3.22, ± .91; Group 2: M = 3.71, ± .52) than Group 1. The subsequent ANOVA revealed that there was a significant difference for task orientation in the Group 2 (p = .019): Athletes' who reported major injury experience demonstrated lesser task orientation (M = 3.89, SD = .56) compared to those who did not (M = 4.27, SD = .49). There was no other statistically significant difference in both groups between with and without injury experience.

CONCLUSIONS: Overall results revealed that participating in higher levels of competition was related to athletes' heightened task and ego orientations. In addition, athletes who experienced major injury demonstrated lesser task orientation. Reduced task orientation can be problematic because previous research has found that task orientation is linked to positive psychological characteristics such as adherence, lesser performance anxiety, and mindfulness. This study found that fostering athletes' task orientation may be a key for injury prevention. Future research should observe longitudinally and recruit more participants to examine variables potentially relate to athletic injury.

1371 May 28 9:50 AM - 10:00 AM

Flow, Optimism And Hope: Psychological Correlates In Triathletes

MATTHEW STENSON. *College of Saint Benedict/Saint John's University, Saint Joseph, MN.*

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(No relevant relationships reported)

Flow, Optimism and Hope are psychological constructs that have been studied separately in applied sport psychology and positive psychology, but never together at the same time. **PURPOSE:** The purpose of the present study was to explore the relationships among Flow, Optimism and Hope, and determine whether Optimism and/or Hope was/were a predictor of Flow. **METHODS:** For the study, 640 triathletes (37.80 ± 10.35 yrs; 24.18 ± 34.30 total triathlons) completed an online survey consisting of a demographic questionnaire, and validated psychometric scales for Flow, Optimism and Hope. Correlations, step-wise regressions, Confirmatory Factor Analyses and Structural Equation modeling (SEM) were used to explore the data. SEM was employed to generate a number of different models consistent with hypotheses and theory. **RESULTS:** Ultimately, SEM showed that the best model was one in which Hope was a moderately strong predictor of Flow, while the small predictive value that Optimism had on Flow was indirect and moderated through Hope. For this mediation model, the SEM fit statistics demonstrated that the data fit the baseline structural model modestly well. The scaled χ^2 (x^2) (1162, N = 640) = 2466.24, p < .00; TLI = .93, CFI = .93, GFI = .86, RMSEA (90%CI) = .042 (.040 - .044) denoted that the data fit the structural model objectively well. In the mediation model, Hope, and Optimism through Hope, predicted Flow (42% explained variance). **CONCLUSION:** Hopeful triathletes are optimistic triathletes, and hopeful triathletes experience higher levels of Flow than less hopeful triathletes. Lastly, Hope moderates the influence of triathlete Optimism on Flow.

1372 May 28 10:00 AM - 10:10 AM

Differences In Wellness Levels Between Division II Athletes' Completion/non-completion History Of A College Wellness Course

Mindy Mayol¹, Urska Dobersek², Matthew D. Beekley, FACSM³. ¹University of Indianapolis, Indianapolis, IN.

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(No relevant relationships reported)

Previous research on NCAA Division II student-athletes (SAs) as it relates to multi-dimensional wellness is scarce. **PURPOSE:** To examine differences in wellness levels between SAs who completed a college wellness course and those who did not. **METHODS:** Overall, 530 SAs ($n_{males} = 355, n_{females} = 175$) between 18 and 23 years of age (M = 19.40, SD = 1.33) from 21 teams voluntarily completed the paper-based Multi-Dimensional Wellness Inventory (Mayol, Schreiber & Scott, 2017) and a demographic questionnaire. The 45-item MDWI measures one's perceived behavior with respect to personal wellness orientation within nine dimensions: physical wellness exercise (PWE), physical wellness nutrition (PWN), mental (MW), social (SW), spiritual (SPW), intellectual (IW), environmental (EW), occupational (OW) and financial (FW). A factorial MANOVA was performed to analyze the differences in wellness levels. An alpha level of p ≤ .05 was set for statistical significance. **RESULTS:** There was a statistically significant multivariate effect in SAs, F(9, 451) = 4.72, p < .001, Wilk's $\Lambda = .91$, partial $\eta^2 = .09$ with seven significant univariate main effects seen for PWE, F(1, 459) = 8.60, p = .004; PWN, F(1, 459) = 21.35, p < .001; MW, F(1, 459) = 13.01, p < .001; SW, F(1, 459) = 12.32, p < .001; IW, F(1, 459) = 14.13, p < .001; OW, F(1, 459) = 14.66, p < .001; and FW, F(1, 459) = 10.58, p = .001. No statistically significant univariate effects were seen for SPW and EW (p > .05). SA wellness course completers demonstrated higher PWE, PWN and MW levels (M = 14.43, SD = 3.29; M = 13.36, SD = 3.40; M = 17.08, SD = 2.14) than SA non-completers (M = 13.36, SD = 3.40; M = 13.36, SD = 3.40; M = 16.18, SD = 3.32). Additionally, SA wellness course completers showed higher SPW, EW and OW levels (M = 15.44, SD = 1.83; M = 15.08, SD = 2.65; M = 16.34, SD = 2.30) than SA non-completers (M = 14.87, SD = 2.03; M = 14.24, SD = 2.70; M = 15.81, SD = 2.36). **CONCLUSIONS:** Results demonstrated higher scores in PWE, PWN, MW, SW, IW, OW and FW for SAs who completed the wellness course versus SAs who did not. Findings indicate a need for future research pertaining to holistic wellness programming for SAs as well as targeted programming and support for this population. A multi-dimensional wellness intervention may assist in identifying and improving wellness deficits to further facilitate overall well-being in SAs.

THURSDAY, MAY 28, 2020

1373 May 28 10:10 AM - 10:20 AM

Characteristics Of Resting State Networks Of Elite Skating Athletes: An ICA AnalysisKeying Zhang¹, Chunmei Cao¹, Yih-Kuen Jan². ¹Tsinghua University, Beijing, China, China. ²University of Illinois at Urbana-Champaign, Champaign, IL.
Email: bsuzky0812@163.com*(No relevant relationships reported)**(No relevant relationships reported)*

Long-term motor skill learning can lead neuro plasticity changes. Until now, this conclusion is mainly proved by task fMRI and spontaneous brain activity evidence. However, these methods heavily rely on prior knowledge and hypotheses, and exist algorithm limitations.

PURPOSE:

To investigate the differences of resting state networks (RSNs) between elite skating athletes and non-athlete controls by means of data-driven approach.

METHODS:

Resting state fMRI data were acquired by Philips Achieva 3.0T scanner with a standard 32 channel head coil from 15 Chinese national level skating athletes (all men, 20.87±1.78 years old, with an average training year of 9.67±3.50) and 15 demographically matched healthy controls (all men, 20.85±1.83 years old). Gift was used to perform ICA (independent component analysis) arithmetic calculations and identify RSNs, including default mode network, somatomotor network, dorsal attention network, left fronto-parietal network and visual network. A two-sample t-test was then conducted using SPM12 to investigate whether there were significant differences between two groups. Results were reported when voxel significant at a level of $p < 0.01$. Cluster-level whole-brain family wise error (FWE) was applied for multiple comparison correction (cluster $p < 0.01$). Coordinates are given in Montreal Neurological Institute(MNI) space.

RESULTS:

1. Athletes showed higher spontaneous activity in postcentral gyrus (cluster size =230, peak coordinate =69, -12,18, peak $t=11.88$) and cingulate gyrus (cluster size =167, peak coordinate=6, -3,39, peak $t=6.65$) in somatomotor network.
2. Athletes showed higher spontaneous activity in precuneus (cluster size =337, peak coordinate =30, -66,39, peak $t=10.38$) in dorsal attention network.

CONCLUSIONS:

Elite skating athletes showed better functional connectivity in somatomotor network and dorsal attention network, which may further indicate that long-term specialized motor training may promote functional network activation patterns.

1374 May 28 10:20 AM - 10:30 AM

Sexual Harassment, Abuse, And Assault Experienced And Reported By Female Athletes In India And PakistanMd. Dilsad Ahmed¹, Bradley J. Cardinal, FACSM¹, Salahuddin Khan², Shaheen Begum³. ¹Oregon State University, Corvallis, OR. ²Gomal University, Paktoonkhwa, Pakistan. ³S.P. Pune University, Pune, India. (Sponsor: Bradley J. Cardinal, FACSM)
Email: ahmedm@oregonstate.edu*(No relevant relationships reported)*

PURPOSE: The “#MeToo Movement” has brought sexual harassment, abuse, and assault experienced by females to the forefront of society, particularly in the workplace. Within the athletic realm, females have also reported such experiences, often referred to as the maltreatment of athletes. While maltreatment has been reported for decades, in recent years victim’s voices have been amplified - particularly in the USA. Yet, for various political and social reasons, the maltreatment of female athletes in countries around the world remains poorly understood. In this study female athletes from India and Pakistan were asked to report their experiences of sexual maltreatment by their coaches.

METHODS: Female student-athletes with male coaches participated in this study ($N = 395$; India = 180, Pakistan = 215). The athletes represented a large variety of sports (>26). Participants (M age = 20.57±2.59; M years of athletic experience = 2.73±1.49) completed the Auweele et al. (2008) *Sport-Specific Touch and Behaviour Versus Unwanted Intimacy from Coaches* measure. Each item was rated by the athletes on a 6-point Likert scale. Three composite dependent variables were assessed: “Unwanted Sexual Behavior” (14 items, Cronbach $\alpha = .91$), “Physical and Verbal Behavior with a Sexual Undertone” (5 items, Cronbach $\alpha = .72$), and “Sexist and Discriminatory Behavior” (3 items, Cronbach $\alpha = .77$). Data were analyzed using a 2 (Country) by 2 (Type of Sport: Individual vs. Team) MANCOVA, with age as a covariate.

RESULTS: Main effect differences for all three variables were observed for Country ($p < .001$, $\eta^2 = .30$), with no differences observed for Type of Sport or the interaction effect ($p > .05$). Each between country variable differed significantly ($p < .001$) with η^2 values ranging from .05-.30. The athletes from Pakistan reported experiencing maltreatment from their coaches more so than the athletes from India.

CONCLUSION: Female athletes from both countries reported experiencing a wide range of sexual maltreatment issues at the hands of their coaches. The issues ranged from being told sexist jokes, to having the front side of their body massaged, to sexual encounters. The females athletes in Pakistan experienced such incidences more so than did those in India.

Keywords: Cross-cultural, inappropriate coaching behaviors, sexual maltreatment of athletes

1375 May 28 10:30 AM - 10:40 AM

Can Athletes Be Tough And Kind To Themselves? Improving Mental Health Best Practices In NcaaGrant B. Morgan¹, Andreas Stamatis², Paul Deal², Zacharias Papadakis³, Jeffrey Forsses¹, Sarah McKinley-Barnard⁴, Eric Scudamore⁵. ¹Baylor University, Waco, TX. ²State University of New York at Plattsburgh, Plattsburgh, NY. ³Barry University, Miami Shores, FL. ⁴University of South Alabama, Mobile, AL. ⁵Arkansas State University, Jonesboro, AR.
Email: grant_morgan@baylor.edu*(No relevant relationships reported)*

Recent events and official NCAA reports indicate that student-athletes’ well-being is compromised by sub-clinical issues of mental health (MH) disorders. Self-compassion (SC) and mental toughness (MT) are two psychological constructs that have been demonstrated effective against sports stressors. However, their conceptualizations seem contradictory (“machismo” mentality vs. self-kindness). Wilson, Bennett, Mosewich, Faulkner, and Crocker (2019) were the first to explore the compatibility of the two constructs towards athletic performance. **PURPOSE:** To investigate the three constructs in a NCAA environment and provide evidence towards updating current MH best practices.

METHODS: In total, 542 NCAA student-athletes from all three NCAA Divisions participated (Mage=19.84, SD=1.7). Three inventories were administered: the Mental Toughness Index (MTI), Self-Compassion Scale (SCS), and Mental Health Continuum - Short Form (MHC-SF). After IRB approval, all three questionnaires were administered via student email using Qualtrics. A multiple regression model was estimated using MTI and SCS scores as predictors of MHC-SF along with a moderation effect between MTI and SCS.

RESULTS: The model explained about 34% of variability in MHC-SF and indicated that MTI and SCS were positively related with MHC-SF ($r=.407$, $p < 0.01$; $r=.541$, $p < 0.01$, respectively). There was also a negative moderation effect [$B=-0.245$, $SE=0.097$, $p < 0.05$], meaning that MT and SC mitigate each other to an extent as they both increase.

CONCLUSIONS: Our findings generally agree with Wilson et al., 2019. Nevertheless, they indicate that -although MT and SC are compatible processes in the same athlete- their interaction may not be beneficial to MH. A possible explanation could be timing: SC and MT may enhance MH when they are employed at separate times, but not simultaneously. Including MT and SC training and teaching all athletes how to hold these competing qualities in a way that complement rather than conflict may strengthen current NCAA MH best practices.

1376 May 28 10:40 AM - 10:50 AM

Does Mindfulness Underpin The Mental Toughness - Self-compassion Relationship In Collegiate Athletes?Shana M. Walsh¹, Grant B. Morgan², Zacharias Papadakis³, Andreas Stamatis⁴. ¹Peru State College, Peru, NE. ²Baylor University, Waco, TX. ³Barry University, Miami Shores, FL. ⁴SUNY Plattsburgh, Plattsburgh, NY.
Email: swalsh@peru.edu*(No relevant relationships reported)*

Self-compassion (SC) and *mental toughness* (MT) are two psychological constructs that protect athletes against the stressors of sports, despite their seemingly contradictory conceptualizations. In the first exploration of their compatibility towards athletic performance at the elite level, Wilson, Bennett, Mosewich, Faulkner, and Crocker (2019) concluded that the connection between SC and MT is underpinned by *mindfulness*. This relationship however has not yet been explored at other levels. National Association of Intercollegiate Athletics (NAIA) programs can be compared with Division II (DII) and Division III (DIII) National Collegiate Athletic Association (NCAA) programs given their similar financial, competitive, and enrollment philosophies. **PURPOSE:** To investigate if mindfulness underpins the MT - SC relationship in DII, DIII, and NAIA student-athletes. Hypothesis: MT and SC are compatible via mindfulness in all three collegiate environments. **METHODS:** Two inventories were administered via Qualtrics: the Mental Toughness Index and the Self-Compassion Scale, which includes a mindfulness subscale. The total sample was 396 student athletes: 313 DII or DIII; 86 NAIA. Statistical analyses consisted of zero-order correlations and regression analysis in SPSS. **RESULTS:** The estimated zero-order correlation between MT and SC was .46, but dropped to .31 after controlling for mindfulness. To further explore this relationship, the percentage of variability

attributable to mindfulness was examined in a regression model. Mindfulness explained 32% of the variability beyond the 21% explained by MT for a total of 53%. **CONCLUSIONS:** This is the first study to explore the compatibility of MT and SC via mindfulness in the collegiate environment. Results suggest considerable overlap between MT and SC via mindfulness, supporting the hypothesis. Preliminary findings are in accordance with Wilson et al. (2019): mindfulness may be crucial to increasing and conserving both constructs in the sporting environment. Results may also support the notion that mindfulness be investigated as a possible component of MT, too. Suggestions for future research include larger-scale studies and triangulation through multi-rating. Possible limitations include convenience samples, unequal sample sizes, and self-reported data.

C-33 Free Communication/Poster - Firefighter Physiology

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

**1407 Board #1 May 28 9:30 AM - 11:00 AM
Deterioration Of Lipid Metabolism Despite Fitness Improvements In Wildland Firefighters**

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Wildland fire suppression presents a working environment that often exceeds an energy expenditure of 20 MJ/day. Despite high levels of chronic physical exertion, we have noted maladaptive alterations in adiposity and blood lipids in a small cohort of wildland firefighters (WLFF) over a short 3-month season. **PURPOSE:** To determine changes in clinical health metrics and serum lipids resulting from 5 months of seasonal wildland fire suppression. **METHODS:** We recruited 79 WLFF (72 males and 7 females from six crews (5 Hotshot crews, 1 Initial Attack crew) based in MT and CA and conducted a pre- and post-season observational study. After an overnight fast, nude body mass, blood pressure (BP), grip strength, and a step test ($\sim V_{O_2} = 20.7$ mL/kg/min) for heart rate (HR) steady state were recorded. Blood samples were collected and analyzed for serum total cholesterol (CHOL), high density lipoprotein (HDL), low density lipoprotein (LDL), very low-density lipoprotein (VLDL), and triglycerides (TRIG). A 2-tailed dependent t-test was used to compare pre- and post-season values. Statistical significance was established at $p < 0.05$. **RESULTS:** Body mass was increased (pre 77.4±9.7 vs post 78.4±9.5 kg, $p < 0.01$). Systolic and diastolic BP decreased (pre 133±13/76±10 vs post 128±14/73±9 mmHG, $p < 0.001$ and 0.05, respectively). Grip strength remained unchanged (pre 56.3±10.7 vs post 56.3±11.4 kg, $p > 0.05$). There was a decrease in the HR response during the step test (pre 102±13 vs post 96±9 BPM, $p < 0.001$). Serum CHOL and LDL did not change over the season ($p > 0.05$). In contrast, serum TRIG (pre 73±35 vs post 92±55 mg/dl, $p < 0.0001$) and VLDL (pre 14±7 vs post 18±11 mg/dl, $p < 0.0001$) were significantly increased by the end of the season, $p < 0.001$. Similarly, HDL was significantly reduced (pre 68±15 vs post 64±13 mg/dl), corresponding to an increase in the TC/HDL ratio (pre 1.2±0.8 vs post 1.6±1.3 ($p < 0.0001$)). **CONCLUSIONS:** Despite favorable changes in BP and aerobic fitness, there were maladaptive changes in serum lipids that occurred in conjunction with an increase in body mass. Further studies should explore the influence of diet, mental/emotional stress, and/or smoke exposure on the mechanisms responsible for the dysregulation of lipid metabolism in WLFF. Supported by the United States Forest Service, National Technology and Development Program

**1408 Board #2 May 28 9:30 AM - 11:00 AM
Weight Change In Firefighters And Associated Changes In Cardiovascular Disease Risk Factors Over Five Years**

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Obesity is a substantial risk factor (RF) for cardiovascular disease (CVD), and research suggests that 23-35% of firefighters (FFs) have a body mass index (BMI) categorized as obese. To date, limited research has examined weight change and associated changes in CVD RFs among FFs. **PURPOSE:** To assess changes in body weight and CVD RFs among an occupationally active cohort of US FFs over a 5-year period, and to investigate changes in CVD RFs in FFs who lost weight, maintained a stable weight, or gained weight. **METHODS:** Changes in CVD RFs (e.g., BMI,

blood pressure [BP], total cholesterol [TC], low and high density lipoproteins [LDL; HDL], and blood glucose [BG]) were measured during two occupational medical exams an average of 4.8±0.6 years apart in a cohort of 672 active FFs. Changes in CVD RFs within subgroups of FFs who lost >3% body weight, maintained stable weight (±3% body weight), or gained >3% body weight were tested for statistical significance using paired t-tests. **RESULTS:** FFs on average had a significant increase ($p < 0.001$) in BMI (0.8kg/m²), TC (5.5mg·dl⁻¹), LDL (5.2mg·dl⁻¹), and BG (2.1mg·dl⁻¹). FFs who gained weight had a significant increase ($p < 0.001$) in TC (12.9mg·dl⁻¹), LDL (11.1mg·dl⁻¹), and BG (2.9mg·dl⁻¹) with a significant decrease ($p < 0.05$) in HDL (-1.3mg·dl⁻¹). In contrast, FFs who lost weight showed a significant decrease ($p < 0.05$) in TC (-8.5mg·dl⁻¹), LDL (-8.5mg·dl⁻¹), and BP (systolic: -5.3mmHg; diastolic -4.2mmHg) with a significant increase ($p < 0.05$) in HDL (2.3mg·dl⁻¹). There were significant changes ($p < 0.001$) among weight stable FFs in BP (systolic: -3.5mmHg; diastolic: -3.8mmHg), and BG (2.7mg·dl⁻¹). **CONCLUSION:** On average, FFs gained weight and CVD RFs worsened over 5 years. However, a large proportion of FFs (12%) lost weight or maintained weight (38%), and weight loss was associated with improvements in CVD risk profiles. In contrast, FFs who gained weight (50%) had significant detrimental changes in several CVD RFs. These results support the importance of weight maintenance and weight loss for the prevention of CVD in the fire service.

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**1409 Board #3 May 28 9:30 AM - 11:00 AM
Influence Of Aerobic Fitness On Heart Rate Recovery Among Active-Duty Firefighters**

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Sudden cardiac death (SCD) is the leading cause of line of duty fatalities among U.S. firefighters. 32% of these SCDs occurred after the fire call in 2018, suggesting an inability of the autonomic nervous system (ANS) to recover after strenuous events. Heart rate recovery (HRR) has been previously utilized to characterize ANS recovery and has demonstrated an ability to predict future mortality and/or cardiovascular events. The National Fire Protection Association recommends that firefighters have a maximal aerobic capacity (VO_{2max}) of 42 ml/kg/min. However, the impact of meeting this aerobic fitness standard on the ANS recovery of firefighters has yet to be examined. **PURPOSE:** To examine the influence of aerobic fitness on the HRR profiles of firefighters. **METHODS:** 37 male career active-duty firefighters (mean ± SD, 39.1 ± 8.9 yrs; 178.8 ± 5.4 cm; 87.9 ± 11.2 kg) participated in this study. All participants completed both a submaximal step test and a maximal graded exercise test on a treadmill. A mono-exponential curve ($HR = HR_{ss} + HR_{amp} e^{-t/HRR}$) was fitted to the submaximal and maximal HRR data of each participant. Participants were placed into Low Fit ($n = 13$) and High Fit ($n = 24$) groups based on the VO_{2max} criterion of < 42 ml/kg/min and > 42 ml/kg/min, respectively. Independent t-tests were utilized to identify group differences in the decay rate (HRR), asymptote (HR_{ss}), and amplitude (HR_{amp}) HRR profile parameters. **RESULTS:** High Fit firefighters demonstrated significantly faster HRR ($P = 0.003$) and lower HR_{ss} ($P = 0.003$) HRR parameters than Low Fit firefighters, but no difference in HR_{amp} ($P = 0.812$) HRR parameters, during recovery after the submaximal test. In contrast, although High Fit firefighters demonstrated significantly greater HR_{amp} ($P = 0.001$) HRR parameters than Low Fit firefighters, no differences in HRR ($P = 0.096$) or HR_{ss} ($P = 0.205$) HRR parameters were observed during recovery after the maximal test. **CONCLUSION:** Although High Fit firefighters demonstrated enhanced HRR profiles after submaximal exertion, a similar influence was not observed after maximal exertion. These results suggest that aerobic fitness may positively influence ANS recovery after submaximal tasks, but slowed ANS recovery after maximal tasks may be a factor to consider when determining SCD risk among both High Fit and Low Fit firefighters.

**1410 Board #4 May 28 9:30 AM - 11:00 AM
Association Between Handgrip Strength And Blood Pressure In Firefighters**

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Elevated blood pressure (BP) is a major risk for cardiovascular morbidity. Handgrip strength (HS) is associated to all-cause and cardiovascular mortality; also, low HS increases risk of developing cardiovascular disease in the general population.

In firefighters, hypertension is an important risk factor for cardiovascular mortality while little is known regarding HS in this population. It is not known if lower or higher strength levels could be associated to different BP levels. **Purpose:** To evaluate the association between HS and BP in Firefighters. **Methods:** We evaluated 176 male firefighters with mean age of 28.1±5.7 yrs, BMI of 24.6±2.8 kg/m², systolic blood pressure (SBP) of 123.1±13.2 mmHg, diastolic blood pressure (DBP) 72.5±8.6 mmHg, and HS of 102.2±17.1 kg. Isometric HS was measured using a hand-held Saehan dynamometer (Model SH 5001) in standing position with the arm extended straight down. Two maximal contractions were performed separated by one minute. HS was calculated as the sum of the largest value recorded from each hand and expressed in kilograms. HS was evaluated according to age as: poor, fair, good, very good and excellent. Afterward, firefighters were classified as having higher HS (good, very good and excellent categories) or lower HS (poor and fair categories). BP was measured in sitting position by an automatic digital arm pressure device. We compared the SBP and DBP of volunteers according to the HS classification (higher vs lower). The independent t-test ($p < 0.05$) was used for the analysis. Data are presented as mean ± SD. **Results:** SBP was not different between those with higher and lower HS ($p > 0.05$); however, DBP was significantly different between both groups ($p < 0.01$). **Conclusion:** This study demonstrated that there is an association between muscle strength and DBP in this sample.

Table 1. Blood pressure comparison between higher and lower grip strength

	SBP	DBP
Absolute grip strength		
Higher (n= 119)	123.5 ± 12.9	73.8 ± 8.5
Low (n= 57)	122.3 ± 13.9	69.6 ± 8.3
p - value	0.56	<0.01*

*: independent t-test; SBP: systolic blood pressure; DBP: diastolic blood pressure.

1411 Board #5 May 28 9:30 AM - 11:00 AM
Effect Of Occupational Hyperthermia On Upper Body Motion While Wearing Firefighters' Protective Clothing In Hot Environment

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Firefighters perform strenuous activities for unpredictable duration periods under high environmental heat conditions. In addition to the thermal load, the tasks associated with firefighting place high physical demands on the upper extremities of the human body and dynamic balance stability. **Purpose:** To investigate the effect of occupational hyperthermia [Core temperature (T_c) ≥ 38 °C], induced by exercise in a hot environment while wearing firefighters' protective clothing (FPC), on upper body motion. **Methods:** Twelve healthy males (Age: 24 ± 3.20 years; VO_{2max} : 56.33 ± 7.42 mL/kg/min) were recruited to complete a Timed Up and Go (TUG) test while wearing inertial sensors before and after exercising inside an environmental chamber (30°C, 70% relative humidity). The exercise protocol included 40-min of treadmill walking at 40% VO_{2max} while wearing FPC. For the TUG, participants were instructed to sit on a chair, stand up upon researcher's command, walk 3-meters, turn around, walk back to the chair, and sit down. Pre- and post-exercise measurements were compared using paired-sample t-test with alpha level set at $p < 0.05$. **Results:** Following the exercise session in a hot environment wearing FPC, subjects' T_c significantly increased (36.92 ± 0.27 vs. 38.25 ± 0.36 °C, $p < 0.01$), exceeding the lower threshold limit of occupational hyperthermia (T_c ≥ 38 °C). Following the exercise session, a significant increase was found in swing velocity of the torso (77.17 ± 27.05 vs. 85.17 ± 25.89 %, $p = 0.03$), right arm (184.33 ± 79.09 vs. 230.50 ± 104.98 %, $p < 0.01$), and left arm (228.92 ± 77.20 vs. 250.75 ± 74.48 %, $p < 0.01$). A significant increase was also found in range of motion of the right arm (184.33 ± 79.09 vs. 230.5 ± 104.98 %, $p < 0.01$), and the left arm (228.92 ± 77.20 vs. 250.75 ± 74.48 %, $p < 0.01$). **Conclusions:** Occupational hyperthermia can result in significant alterations in upper body motion which may contribute in perturbing the dynamic balance associated with gait function. The significant increase in arms and torso motion suggests that exercise in a hot environment while wearing FPC may result in physically exerting the lower extremities and increasing energy demand to maintain the dynamic balance associated with locomotion.

1412 Board #6 May 28 9:30 AM - 11:00 AM
Longitudinal-retrospective 8-weeks Non-periodized, Non-individualized Training Program Effectiveness Of Hialeah Fire Department

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Firefighting requires high fitness. Fire academies assess cadets' fitness. Hialeah Fire Department (HFD) academy utilizes a non-periodized, non-individualized training program to assess its recruits' fitness. **Purpose:** Evaluate HFD's program effectiveness across 4 years. We hypothesized a) each class-years' fitness will be improved; b) there will be no difference in gain across years, after accounting for intra- and inter- individual differences. **Methods:** HFD cadets (age 26 ± 5 SD) from class-years 2016 (N=6), 2017 (N=7), 2018 (N=16), and 2019 (N=15) included in the study. All class-years participated in the same 8-week program. Cadets assessed at week-1 and week-8 on 1.5-mile run time, maximum pull-ups, push-ups, and sit-ups. Delta gain percentage ($\Delta G\%$) calculated as $(((\text{post-pre})/\text{pre}) * 100)$. Analysis of covariance (ANCOVA) by class-year and controlled for the pre-test scores was performed for each dependent variable. Significance was set at $p < 0.05$. All analyses were performed using SPSS[®]. **Results:** Significant effect of $\Delta G\%$ on class-year 1.5-mile ($F_{3,39} = 20.693, p = .000, \eta^2 = .614$); no significant effect of $\Delta G\%$ on class-year pull-ups ($F_{3,38} = 2.722, p = .058, \eta^2 = .177$); significant effect of $\Delta G\%$ on class-year push-ups ($F_{3,39} = 3.338, p = .029, \eta^2 = .204$); no significant effect of $\Delta G\%$ on class-year sit-ups ($F_{3,39} = 1.828, p = .158, \eta^2 = .123$). **Conclusions:** HFD's program improved cadets' fitness levels across 4 year-classes but failed to account for intra- and inter-individual differences. This program may under- or over-estimate cadets' fitness training capabilities. This program is not appropriate to account for between class-years and within cadets' differences and maximize the reported benefits as dictated by the training principles. Specific individualized fitness programs that meet the needs of a broad range of individuals within the Fire Service are needed. Such tailored programs may serve better the firefighters' job-related fitness.

1413 Board #7 May 28 9:30 AM - 11:00 AM
Central And Peripheral Blood Pressure Evaluation In Association With Shift-work Intensity In Brazilian Military Firefighters

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Sudden cardiac death is the leading cause of on-duty death among US firefighters and has been associated with cardiomegaly. Firefighters' job-related activities impose cardiovascular strain that might affect blood pressure (BP) regulation. Central BP (cBP) has been shown to be a better predictor of cardiovascular mortality than peripheral BP (pBP). **Purpose:** To compare the difference between cBP and pBP among Brazilian military firefighters (MFFs) according to the shift-work intensity. **Methods:** We evaluated 20 male MFFs with mean age of 33.6±5.2 yrs, BMI of 27.6±3.1 kg/m². BP was assessed in the sitting position before and after a routine 24h shift-work using the Mobil-O-Graph device[®]. The shift-work intensity was estimated by the number of emergencies calls multiplied by perceived intensity of each occurrence reported on a log as light, median or high intensity. The median (min-max) reported intensity was 10.5 (1.0 - 39.0). Shift-work intensity was categorized as light (<median - Group 1) or high (≥median - Group 2). We compared pBP and cBP, before and after a 24h-work period using the Wilcoxon test at 5% ($p < 0.05$). Data are presented as median (min-max). **Results:** All MFFs showed normal resting BP both before and after a routine 24h-shift work. However, after their shift, Group 2 showed a significant increase in systolic cBP but not in pBP, whereas no difference was found in Group 1 (Table 1). The diastolic cBP and pBP were normal and similar in all time periods in both groups ($p > 0.05$; data not shown). **Conclusion:** A high workload intensity estimated during a routine 24h-shift work was associated with an unexpected increase on systolic cBP as compared to pBP. Even though systolic cBP varied within the normal range, this novel risk factor measurement may provide an opportunity to identify negative early change indicative of higher cardiovascular risk. **Table 1:** Comparisons of peripheral and central systolic BP between groups according to the shift-work intensity.

	Systolic blood pressure		p - value
	Peripheral	Central	
Group 1 (n= 10)			
Before	120 (102 - 157)	120 (107 - 145)	0.61
After	123 (104 - 129)	125 (98 - 139)	0.48
Group 2 (n= 10)			
Before	123 (112 - 149)	123 (112 - 154)	0.55
After	119 (109 - 133)	126 (113 - 139)	0.01*

*Wilcoxon test.

1414 Board #8 May 28 9:30 AM - 11:00 AM

Relationship Between Health-Related Quality Of Life, Aerobic Fitness, And Body Composition In Professional Firefighters

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The firefighting profession requires high levels of physical fitness. Specifically, cardiovascular fitness has shown a strong relationship with the ability to perform occupational tasks. Despite this, not all firefighters maintain ideal fitness levels. Sudden cardiac arrest is the leading cause of on-duty fatalities for firefighters. Recent data suggests the prevalence of obese and overweight firefighters exceeds that of the general US population. Obesity is often correlated with low fitness levels in the general population, however when aerobic fitness improves, favorable outcomes in health related quality of life (HRQoL) have been reported. The relationship between HRQoL, aerobic fitness levels and body composition has not been studied in the professional firefighter population. **PURPOSE:** To determine the relationship of HRQoL, aerobic fitness, and body composition measures in professional firefighters. **METHODS:** 16 professional firefighters (14 male; 36±8 yrs; 178±10 cm; 87.0±20.0 kg; 27.1±3.7 kg/m²) completed baseline HRQoL survey, BodPod, and maximal oxygen uptake (VO_{2max}) test. HRQoL was assessed using the SF-36, with the physical and mental composite scores used for analysis. Body fat percentage was estimated using BodPod. VO_{2max} was assessed using a graded treadmill exercise test. Descriptive statistics (mean ± SD) were reported. Pearson correlation tests were used to assess association between variables. **RESULTS:** Overall participant anthropometrics are as follows: body fat (23.5 ± 6.8 %), VO_{2max} (44.9 ± 6.0 mL/kg/min), physical health composite score (56.5 ± 2.6), and mental health composite score (48.9 ± 6.1). According to BMI classifications 6 firefighters were obese (>30 kg/m²) and 4 were overweight (25-29.9 kg/m²). There were statistically significant negative correlations between VO_{2max} and body fat % (r = -0.88; p < 0.000), and fat mass (r = -0.86; p < 0.001). There was a positive correlation between physical health composite score and age (r = 0.57; p < 0.001). No other relationships were found to be statistically significant. **CONCLUSIONS:** The observed inverse relationship between aerobic fitness and body fat percentage supports prior findings. The novel finding that HRQoL was not correlated with aerobic fitness or body composition measures in this sample may warrant further study.

1415 Board #9 May 28 9:30 AM - 11:00 AM

Relationships Between Resting Heart Rate Variability, Maximal Heart Rate, And VO_{2peak} Among Active-duty Firefighters

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Heart rate variability (HRV) is a non-invasive marker of autonomic nervous system (ANS) function based on the beat to beat variation in heart rate measured by the duration of the R-R interval. Clinically, lower resting HRV has been linked to greater risk for cardiovascular disease and higher HRV is thought to be cardioprotective and reflective of a greater fitness. Firefighters represent a unique population where sudden cardiac death is a high risk of the job that demands the ability to perform high intensity tasks. Resting HRV may provide insight into the contributions of the ANS to maximal capacity of a firefighter. **PURPOSE:** To examine the relationships between resting HRV and heart rate and aerobic capacity (VO_{2peak}) during a maximal treadmill test. **METHODS:** 37 male career active-duty firefighters (mean ± SD, 39.1 ± 8.9 yrs; 178.8 ± 5.4 cm; 87.9 ± 11.2 kg) participated in this study. All participants completed a 5-minute resting HRV sample followed by a maximal graded exercise test

on a treadmill using a modified version of the submaximal Wellness Fitness Initiative test for firefighters. Heart rate and oxygen consumption were monitored throughout the test and maximal HR (MHR) at cessation of the test and VO_{2peak} were recorded for each participant. HRV was determined by measuring the time intervals between R-waves and reflected as the mean RR for the 5-minute resting sample. Bivariate Pearson correlations determined the relationship between resting RR, MHR, and VO_{2peak}. An alpha of 0.05 determined statistical significance. **RESULTS:** Resting RR (864.8 ± 134.0 ms) had a moderate and significant relationship with VO_{2peak} (44.6 ± 7.1 ml/kg/min; r = 0.458, P = 0.004) and MHR (181.5 ± 10.7 bpm; r = -0.360, P = 0.029), but VO_{2peak} was not related to MHR (r = 0.308, P = 0.064). **CONCLUSION:** Higher resting RR was associated with greater VO_{2peak}, but lower MHR. The positive relationship between RR and VO_{2peak} is consistent with prior research suggesting that a higher resting HRV is related to higher fitness. The inverse relationship between HRV and MHR suggests that greater parasympathetic nervous system control at rest (i.e., higher RR) may extend into maximal exercise tasks. Thus, for a firefighter, the benefit of a more favorable resting HRV may not only be cardioprotective, but also influence the relative intensity of a maximal task.

1416 Board #10 May 28 9:30 AM - 11:00 AM

Examination Of Two Different Balance Tests In Active-duty Firefighters

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Approximately 20% of firefighter (FF) injuries are the result of falls, jumps, slips, or trips and poor balance may be a common mechanism. Research has suggested that the Lower Quarter Y Balance Test (LQ-YBT) may be predictive of lower extremity injury, but the LQ-YBT may also be influenced by BMI and movement efficiency. Recently, a Functional Balance Test (FBT) was introduced to better reflect job-specific balance demands in FFs. However, the relationship between the LQ-YBT and FBT as well as with measures of fitness in FFs remains unclear. **PURPOSE:** To identify the relationship between LQ-YBT and FBT performance as well as measures of fitness in active-duty FFs. **METHODS:** 16 (14 male, 2 female) active-duty FFs (35.3 ± 8.0 yrs, 179.1 ± 6.2 cm, 91.1 ± 16.9 kg) volunteered for the study. BMI and percent body fat via skinfolds (%Fat) were determined and each participant performed a Fusionetics™ Movement Efficiency Screen (MES), LQ-YBT, FBT, counter movement jump (CMJ), and a maximal treadmill test (VO_{2MAX}). A composite score (LQ-YBT_{comp}) was formed by averaging the reach distances (normalized to leg length) in each direction across both limbs. The FBT required participants to walk on a wooden beam (2.5 m x 0.09 m x 0.05 m) by walking forward to the center, turning 180°, and walking backwards to the end of the beam before stepping off and repeating the same pattern to the starting point. FBT performance was represented by the total completion time (FBT_{TIME}) and total count for stepping off the beam (FBT_{ERROR}). Bivariate Pearson correlations determined the relationship between LQ-YBT_{comp}, FBT, and FBT_{ERROR} and all physical fitness factors. An alpha of 0.05 determined statistical significance. **RESULTS:** Significant correlations were identified between LQ-YBT_{comp} (97.0 ± 5.9%) and %FAT (r = -0.586, P = 0.017), BMI (r = -0.695, P = 0.003), and VO_{2MAX} (r = 0.594, P = 0.015). FBT_{TIME} (15.5 ± 5.2 sec) and FBT_{ERROR} (1.7 ± 1.1) were not related to any fitness measures or LQ-YBT_{comp}. **CONCLUSIONS:** The lack of relationship between LQ-YBT and FBT may suggest that the tests reflect different aspects of balance. Further, the FBT was not related to any other measure whereas the LQ-YBT was related to measures of fitness (i.e., %Fat, BMI, VO_{2MAX}). Thus, the FBT may have greater generalizability in evaluating balance performance in active-duty FFs.

1417 Board #11 May 28 9:30 AM - 11:00 AM

Relationship Between Muscular Fitness And Health Related Quality Of Life In Professional Firefighters

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High muscular fitness levels are needed to perform occupational tasks for a professional firefighter. Common occupational tasks include heavy equipment carrying, forced entry and securing. However, current evidence suggests fitness levels often decline over the course of a firefighter's career, which in turn impacts occupational task performance capabilities. Additionally, work-related stress occurring during the careers of firefighters contributes to higher rates of posttraumatic stress disorder compared to civilian counterparts. Health related quality of life (HRQoL) considers the elements that impact individual feelings of well-being and its perception may be influenced by components of physical and mental health. Currently, limited research exists describing the relationship between muscular fitness and HRQoL in professional firefighters. **PURPOSE:** To explore the relationship between muscular fitness and HRQoL in professional firefighters.

METHODS: 35 firefighters (31 males, 4 females, 36 ± 7 years, 178 ± 8 cm, 88.5 ± 18 kg) participated in the study. Five muscular fitness assessments were performed: maximum vertical jump, 1-repetition maximum bench press, maximum repetitions of pull-ups, maximum repetitions of push-ups, and the wall sit and reach. HRQoL was measured using the Short-Form (SF) 36 Questionnaire. Physical and mental composite scores were computed for the SF 36. Descriptive statistics (mean \pm SD) were calculated for each variable. Pearson correlation tests were used to assess association between variables ($p < 0.05$).

RESULTS: There was a significant correlation between pull-ups and the mental component of HRQoL ($r = -0.37$; $p < 0.05$). No other statistically significant relationships were found. Mean pull-up and mental health composite scores were 7.1 ± 6.5 repetitions and 80.3 ± 10.8 , respectively.

CONCLUSIONS: It was unexpected that none of the fitness assessments were found to have a significant relationship with the physical composite score. Furthermore, the finding that only a single component of muscular fitness had a significant relationship with mental health is a novel finding. Based on results, HRQoL of professional firefighters might be the product of numerous factors and deserves further study.

1418 Board #12 May 28 9:30 AM - 11:00 AM
Neuromuscular Factors Associated With Stair Climb Performance In Firefighters

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PURPOSE: The weighted stair climb is a critical and essential occupational task for career firefighters. However, limited data is available investigating the influence of neuromuscular function on stair climb performance (SCP). The purpose of this study was to examine the influence of lower extremity strength, power, fatigability, and steadiness on SCP.

METHODS: Forty-one firefighters (32.34 ± 8.20 yrs) completed one laboratory visit where they completed leg extension strength testing of the dominant leg on an isokinetic dynamometer to determine peak torque (PT). Participants then traced a line at 10% (Stead₁₀) and 50% (Stead₅₀) of PT for 30 seconds to determine steadiness (coefficient variation of torque). Fatigability was determined from the reduction in PT following 30 consecutive isotonic contractions (80° of range of motion) at 40% of their PT. Peak power (PP) was determined from the highest value during the first five isotonic contractions. PT and PP were normalized to body mass (kg) prior to analysis (PT/kg and PP/kg). Following a 20-minute rest, participants then completed a weighted (22.73 kg vest) stair climb by ascending and descending 26 steps, four times. Pearson's product-moment correlation coefficients were used to examine the associations between each neuromuscular variable and SCP. A stepwise multiple regression analysis was then completed to determine the relative contributions of all neuromuscular variables on SCP. An *a priori* alpha level of ≤ 0.05 was used to determine statistical significance.

RESULTS: Faster SCP was associated with greater PP/kg ($r = -0.530$; $P = 0.001$), PT/kg ($r = -0.421$; $P = 0.007$), and lower fatigability ($r = 0.389$; $P = 0.014$). The stepwise multiple regression analyses determined that PP/kg and Stead₅₀ were the most significant predictors of SCP ($R^2 = 0.442$; $P = 0.013$).

CONCLUSIONS: Our findings suggest that lower extremity power output and motor control are the strongest neuromuscular predictors of SCP. These findings are impactful considering these variables can be improved with exercise.

1419 Board #13 May 28 9:30 AM - 11:00 AM
Health And Physical Fitness Parameters After 6 Months Of High-intensity Group Exercise In Firefighters

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Cities annually budget thousands of dollars for rehabilitation services due to work-related injuries that affect firefighters. Proper training methods may be used as an effective preventative measure for many of the musculoskeletal injuries sustained as a first responder that are inherent with the profession. The physical demands of firefighting require that the individuals employed in this profession be, at minimum, in good physical condition. The traditionally low fitness levels and poor exercise habits of firefighters may predispose this population to an increased risk of chronic conditions, such as cardiovascular and metabolic disease. **Purpose:** The purpose of this study was to analyze changes in health and fitness parameters of professional firefighters across

North Texas during a 6-month training program. **Methods:** Twenty-five professional firefighters completed 6 months of high-intensity group training, consisting of 2 training sessions per week. These individuals underwent a pre- and post-fitness testing protocol that consisted of body composition, range-of-motion, anaerobic power, muscular endurance, and cardiorespiratory fitness. A repeated-measures MANOVA was used to determine any differences between testing periods. A significance level of 0.05 was used. **Results:** Improvements ($p < 0.05$) in flexibility, anaerobic power, fatigue index, muscular endurance, and aerobic fitness were found following the 6-month training program. No differences in body composition or peak power were observed ($p > 0.05$). **Conclusion:** Six months of high-intensity group exercise may improve measures of physical fitness in firefighters.

Table 1: Health and Physical Fitness Measures Before and After 6 Months of Exercise Training in Firefighters

Test	Pre-Test	Post-Test	Percent Change	p-value
Body Mass (kg)	96.0 \pm 17.9	93.1 \pm 20.1	-3.0%	0.597
Body Fat (%)	30.5 \pm 11.0	29.9 \pm 7.2	-2.0%	0.113
BMI (kg/m ²)	29.2 \pm 5.0	29.0 \pm 5.0	-0.7%	0.597
Flexibility (cm)	24.9 \pm 6.3	34.6 \pm 7.0*	+39.0%	0.001
Pushups	28.8 \pm 14.9	36.4 \pm 18.1*	+26.4%	0.001
Curl ups	22.1 \pm 15.8	53.4 \pm 30.6*	+141.6%	0.002
Peak Power (W)	1052.2 \pm 275.5	1063.3 \pm 287.9	+1.1%	0.815
Mean Power (W)	633.4 \pm 150.4	672.4 \pm 152.2*	+6.2%	0.006
Fatigue Index (%)	60.5 \pm 7.4	52.8 \pm 9.3*	-12.7%	0.001
VO _{2max} (ml/kg/min)	34.7 \pm 4.9	38.4 \pm 5.9*	+10.7%	0.006

All values are mean \pm s.d. *Significantly different than Pre-Test. BMI = body mass index; VO_{2max} = maximum oxygen consumption.

1420 Board #14 May 28 9:30 AM - 11:00 AM
Changes In Pulmonary Function In Us Firefighters Over A 5-year Period

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Acute and chronic changes in pulmonary function have been previously reported in US firefighters. However, the majority of research on pulmonary function in US firefighters was conducted more than three decades ago. Due to the changes in the use of protective equipment and changes in materials that are burning in structure fires, it is important to examine pulmonary function in firefighters and to explore changes in pulmonary function over time.

PURPOSE: To examine pulmonary function and changes in pulmonary function over a 5-year period in US firefighters. **METHODS:** Occupational medical exams separated by 5 years (2009-2016) were examined from a cohort of US career firefighters in Virginia (males, n=603; females, n=69). The exam results were compared to the expected changes over time based on spirometric reference equations generated from NHANES III data. Paired t-tests were used to compare observed changes between Time 1 and Time 2. One-sample t-tests were used to compare the expected with the observed change. **RESULTS:** There were significant decreases ($p < 0.001$) in FEV₁, FVC, and FEV₁/FVC over the 5-year period. There were significant differences ($p < 0.001$) between observed changes in FEV₁, FVC, and FEV₁/FVC and the expected changes over a 5-year period (Table).

CONCLUSION: Pulmonary function declined significantly over time. The observed decreases over the 5-year period in FEV₁, FVC, and FEV₁/FVC were two to four times greater than what would be expected in the general population. Increased efforts are needed to address respiratory protection for US firefighters in order to minimize their risk of pulmonary illnesses and occupational cancer. Supported by FEMA AFG Grant EMW 2017-FP-00445.

Table. 5-Year Changes in Pulmonary Measurements Among US Firefighters

	Time 1	Time 2	Change	Expected Change ^a
FEV ₁ (L)	4.13 \pm 0.03	3.67 \pm 0.03	-0.46 \pm 0.02***	-0.12***
FVC (L)	5.03 \pm 0.04	4.59 \pm 0.03	-0.44 \pm 0.02***	-0.10***
FEV ₁ /FVC (%)	82.2 \pm 0.2	80.1 \pm 0.2	-2.1 \pm 0.1***	-0.98***

Values are means \pm SE

^aExpected change based on NHANES III

***p<0.001

1421 Board #15 May 28 9:30 AM - 11:00 AM
Effects Of Environmental Conditions On Self-selected Work And Physiological Strain During Wildland Firefighting.

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The combination of thermal extremes and metabolic demands associated with wildland firefighter (WLFF) job tasks may elicit acute impairment in work capacity. As heat injuries persist in WLFF and other tactical occupations, field evaluations can gather insight into characteristics of job tasks that may contribute to thermoregulatory challenges. **PURPOSE:** To evaluate the activity and physical demands of wildland firefighting as they relate to the associated environmental conditions. **METHODS:** Direct observation and real-time wireless physiological monitoring allowed for weather and physiological metrics, including heart rate (HR), percentage of HR max (%HRmax), core temperature (T_c) and physiological strain index (PSI), of male (n=301) and female (n=33) WLFFs to be monitored during wildfire management activities. Activity levels (ACT; counts·min⁻¹) were recorded using an ActiCal activity monitor (Mini Mitter) located in the left pectoral pocket. Heat Index estimations (HI) were calculated using temperature (TEMP) and relative humidity (HUM) inputs recorded using an OMEGA Temperature Data Logger. One-way ANOVAs were used to compare means of HI quartiles data using HR, ACT, and PSI as dependent variables. **RESULTS:** TEMP and HUM values were computed to heat index (n = 3891 hours) and divided into quartiles (Q1: 13.3-25.1°C; Q2: 25.2-26.4°C; Q3: 26.5-28.9°C; Q4: 29.0-49.1°C). Average ACT displayed a negative, linear correlation with HI (Q1: 535 ± 731 counts·min⁻¹; Q2: 423 ± 615 counts·min⁻¹; Q3: 384 ± 571 counts·min⁻¹; Q4: 309 ± 416 counts·min⁻¹; p < 0.05). However, this reduction in activity level resulted in only a moderating effect on HR and PSI as average HR (Q1: 113 ± 27 bpm; Q2: 116 ± 26 bpm; Q3: 116 ± 26 bpm; Q4: 111 ± 25 bpm) and PSI values (Q1: 3.5 ± 1.6; Q2: 3.7 ± 1.6; Q3: 3.7 ± 1.5; Q4: 3.5 ± 1.5) were lowest in Q1 and Q4. Average T_c values increased only slightly with increasing HI (Q1: 37.49 ± 0.46°C; Q2: 37.59 ± 0.48°C; Q3: 37.60 ± 0.43°C; Q4: 37.59 ± 0.41°C). **CONCLUSIONS:** Although physical activity occurred for approximately half of a typical 12 to 16-hour work shift, physical exertion was the primary indicator of challenges to thermoregulation in this population. Reductions in activity levels with increasing heat index values suggest adequate regulation of body temperature in the majority of WLFF field operations.

1422 Board #16 May 28 9:30 AM - 11:00 AM
Effects Of Powered Air-purifying Respirators On Relative Inspiratory Time During Rest And Exercise

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Powered air-purifying respirators (PAPRs) approved by the National Institute for Occupational Safety and Health (NIOSH) are preferred respiratory protection among air-purifying respirators due to low inhalation resistance and decreased effective dead space. **PURPOSE:** This study evaluated effects from PAPR hood size (small, medium, and large loose-fitting hoods) and hood type (loose-fitting hood and tight-fitting mask) on relative inspiratory time (expressed as duty cycle) during standing rest and treadmill exercise. **METHODS:** Men (n=12) and women (n=12) were calibrated (same absolute energy expenditure) on a treadmill at VO₂ = 1, 2, and Max (3.0 for men, 2.7 for women) L/min (STPD). Four NIOSH-approved PAPRs from different manufacturers with HEPA filters were randomly selected and worn by each participant for four minutes at standing rest and four minutes at each energy expenditure. Results were averaged during the last minute of each activity period and expressed for both men and women. PAPR results were compared to exercise trials using only the instrument mask (baseline). Repeated measures ANOVA for duty cycle (inspiratory time/total time each breath, x100) was used for Table 1.

RESULTS:

	Energy Expenditure			
	Standing	1 L/min	2 L/min	Max
Baseline (instrument mask only)	34.11 (8.46)	41.07 (6.44)	41.86 (4.69)	44.17 (5.65)
Small loose-fitting PAPR	34.99 (4.77)	42.10 (2.78)	44.06 (3.50)	46.97 (3.43)
Medium loose-fitting PAPR	43.53 (9.37)*	46.32 (5.53)*	46.02 (4.92)	47.41 (3.95)
Large loose-fitting PAPR	46.86 (11.09)*	47.27 (4.59)*	46.41 (3.90)*	48.74 (4.06)*
Tight-fitting PAPR	40.24 (8.66)*	42.30 (3.34)	45.54 (3.43)	44.77 (3.40)

All values are reported as mean (standard deviation). *significantly different than baseline within energy expenditure (p<0.05)
 Significant main effects (p<0.01) included the respirator, energy expenditure, and respirator x energy expenditure interaction. **CONCLUSION:** Relative inspiratory time increased with energy expenditure and with both PAPR hood size and type. This evidence suggests dead space in PAPRs and low tidal volume affect respiratory responses by increasing the relative inspiratory time. Covariate effects by inhaled carbon dioxide and breathing resistance would be useful for future research.

1423 Board #17 May 28 9:30 AM - 11:00 AM
Effect Of Vented Helmets On Heat Stress During Wildland Firefighter Simulation

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Uncompensable heat from wildland firefighter (WLFF) personal protective equipment decreases the physiological tolerance while exercising in the heat. Our previous work demonstrated that the WLFF helmet significantly increases both perceived and actual head heat. **PURPOSE:** This study compared heat accumulation under simulated working conditions while wearing standard non-vented WLFF helmets (H) versus a vented helmet (VH). **METHODS:** Ten male subjects with VO_{2max} of 59.8 ± 3.6 ml·kg⁻¹·min⁻¹ completed two trials. Following a 10-minute seated acclimation period, subjects walked 180 minutes (at 3.5 mph, 5% grade) in a heat chamber (35°C and 30% relative humidity) with three intervals of 50 minutes of exercise and 10 minutes rest followed by a work capacity test to exhaustion. Subjects randomly completed opposing helmet trials separated by a two-week washout. Each trial measured physiological strain index (PSI), visual analog scale (VAS), helmet temperature and relative humidity (Th, Rh), rating of perceived exertion (RPE) and heart rate (HR). Data was analyzed using a 2X6 repeated measures ANOVA. **RESULTS:** All subjects finished all trials. Work capacity was significantly greater in the VH trial (95.9±10.3 KJ H vs. 109.3±8.5 KJ VH, P=0.001). At the end of the 3 hour trial HR (146.8±17.2 bpm H, 144.3±17.9 bpm VH), PSI (6.08±1.45 H, 5.89±1.24 VH), RPE (14.2±1.7 H, 13.3±1.7 VH), Th (35.52±0.47°C H, 35.75±0.50°C VH), and Rh (45.6±5.1% H, 41.0±5.9% VH) showed a significant effect of time (p<0.05) but were not significant between trials. End trial PSI and HR significantly related to work performed (r=-0.8, P<0.001). **CONCLUSION:** Elevated work, trends for RPE, helmet microenvironment, and VAS suggest greater heat dissipation and comfort with the vented helmet. This suggests the standard unvented WLFF helmet may contribute to accumulated heat over time, which may affect work output and safety in the field.
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1424 Board #18 May 28 9:30 AM - 11:00 AM
Muscle Soreness And Damage During Wildland Firefighter Critical Training

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Wildland firefighters (WLFF) undergo a critical training (CT) period immediately prior to the firefighting season. However, the intensive nature of preparatory CT exercise regimen could lead to muscle damage, as previously reported cases of rhabdomyolysis in WLFF have been documented. **PURPOSE:** To establish the effects of a two-week critical training period on acute markers of muscle damage in WLFF. **METHODS:** Eighteen male (29.4±1.1 years, 182.1±1.6 cm) and three female (26.7±2.6 years,

169.5±4.2 cm) Type I Interagency Hotshot (IHC) WLF were studied during an 11-day critical training period. Daily body weight (BW), upper body (US), and lower body (LS) muscle soreness scales were collected. Venous blood was collected from the antecubital region on Days 1, 4, 8, and 11 to measure creatine kinase (CK) and lactate dehydrogenase (LDH). Skin fold measurements were taken on Day 1 and Day 11 to calculate body fat percentage (BF). One-way ANOVA were used to analyze mean differences in CK, LDH, US, and LS. Paired samples t-tests were used to identify differences in BW and BF. Data presented as mean±SEM. **RESULTS:** No differences in body weight were observed between Day 1 and Day 11 ($p=0.065$) of CT. BF significantly decreased from Day 1 and Day 11 ($15.3\pm1.4\%$ vs. $14.1\pm1.3\%$, $p=0.002$). US and LS showed a main effect of time, elevated from baseline for subsequent days, with a peak on Day 3 (US: 3.8 ± 0.5 cm, $p<0.001$; LS: 4.3 ± 0.3 cm, $p<0.001$) of CT. CK showed a significant effect of time, elevated from baseline, with a peak on Day 4 (73.4 ± 14.4 U·L⁻¹ vs. 132.8 ± 15.4 U·L⁻¹, $p=0.001$). LDH showed a significant effect of time, where Day 11 significantly increased from Day 1 (159.4 ± 5.5 IU·L⁻¹ vs. 164.4 ± 6.9 IU·L⁻¹, $p=0.040$). **CONCLUSION:** These data suggest that WLF undergo significant physiological stressors to induce muscle soreness and damage during CT. Although there have been previous case reports of rhabdomyolysis during CT, these IHC WLF remained sub-clinical. Despite this, these data demonstrate that CT presents a stress that may jeopardize WLF performance and safety in the field. Careful preparation and monitoring of the training stimulus is key to avoid clinical ramifications.

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1425 Board #19 May 28 9:30 AM - 11:00 AM
Physical Fitness Maintenance In Members Of A Southeastern United States City Professional Firefighting Department

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PURPOSE: Previous studies report that firefighters lacking an adequate level of physical fitness, even those classified as experts, can experience a severe physiological challenge in unpredictable environmental conditions. The purpose of this study was to assess and track the annual physical fitness performance of the members of a professional firefighting department.

METHODS: As part of the annual health and fitness testing (data from 2002-2017) performed by the Bowling Green Fire Department (BGFD) in Bowling Green, KY, 153 firefighters had their physical fitness evaluated using standardized and recommended protocols published by the International Association of Fire Fighters. A mixed methods analysis was employed to examine differences over time for each of the dependent variables (push-ups, plank hold, handgrip strength, static arm pull, and static leg pull) using SPSS (v25).

RESULTS: Handgrip strength performance significantly improved in the first 4 years after baseline ($p < .05$) followed by a steady, significant decline each following year ($p < .05$), with the exception of year 15 ($p = .504$). Push-up performance significantly declined from baseline ($p < .05$). The plank hold performance was maintained over the first 5 years of testing ($p > .05$) before showing marked improvement in the most recent year ($p < .05$). Although small, flexibility significantly improved from year 1 to year 2 ($p < .05$), but then was maintained over each subsequent year of testing ($p > .05$). Static arm pull and static leg pull both significantly improved for the first 4 years ($p < .05$), but then showed a steady decline thereafter ($p < .05$).

CONCLUSIONS: Based on these results, physical fitness showed a consistent improvement in the first several years tested; however, several of the muscular strength-related variables showed a consistent decline thereafter. It will be important to continue to monitor and adjust the physical training regimen to attempt to alleviate any physical fitness decline.

1426 Board #20 May 28 9:30 AM - 11:00 AM
Impaired Sleep In Volunteer Firefighters Responding To Nighttime Calls

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In Canada and the US, there are approximately 813,000 volunteer firefighters (FFs), a unique subset of shift workers who, despite possessing separate careers, provide 24-hour emergency services. Despite accounting for 67% of North American FFs, volunteers are often overlooked in firefighter research in favour of their career counterparts. It is known that calls at night reduce sleep and that sleep deprivation can adversely affect executive function however, the degree of sleep deprivation among on-call volunteer FFs remains a paucity. **PURPOSE:** To quantify the impact of volunteer FFs' night time call response on sleep volume and stage-specific distribution. **METHODS:** Eight male volunteer FFs (34.76 ± 2.56 years) were validated wristband sleep monitors to track total, stage-specific, and percent distribution of sleep on nights

without a call (CON), and on nights where there was a call response between 1900 and 0700 (CALL). Data was extracted via the device's app to a tablet and recorded via spreadsheet. One firefighter experienced two nights with a call and only one without. Both sets of CALL data were compared to the CON resulting in 9 sets of CON:CALL data which were analyzed using a one-way ANOVA. **RESULTS:** Significant differences were found in total sleep (CON: 417.125 ± 52.044 mins; CALL: 261.111 ± 61.116 mins), time spent in rapid-eye movement (REM) (CON: 109.88 ± 28.47 mins; CALL: 51.44 ± 17.92 mins) and light sleep (CON: 225.75 ± 26.20 mins; CALL: 157.89 ± 37.54 mins), and percentage of sleep spent in REM (CON: 22.25 ± 3.73%; CALL: 16.44 ± 3.17%). This was accompanied by respective effect sizes (η^2) of .570, .537, .429, and .511. Despite comprising 22.57% of total CON sleep, REM sleep decreased disproportionately, accounting for 37% of CALL sleep loss. **CONCLUSIONS:** Volunteer firefighters responding to overnight calls experience significant total sleep deprivation at levels previously shown to impede cognitive performance. Significant and disproportionate decreases in total and percentage of REM sleep were also observed on nights with a call. Considering the impact of REM sleep on optimal executive function, this degree of sleep deprivation has the ability to impact critical decision-making events, not only on the fire ground, but at the firefighter's day job, thereby increasing risk of injury/death.

1427 Board #21 May 28 9:30 AM - 11:00 AM
Physical Activity And Health In Career Firefighters In A Low-income Area

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Fifty percent of firefighter (FF) line-of-duty deaths result from cardiovascular incidents. Factors including physical stress, sleep patterns, and sedentary behavior between runs may contribute to increased cardiovascular risk in firefighters and other first responders. Wellness programs have been shown to increase health in firefighters, but departments in low-income communities are often unable to provide wellness programming. This provides opportunities for institutions like Central State University to fill the needs of those departments as part of our land-grant mission.

PURPOSE: To determine health and cardiovascular disease (CVD) risk of local career FF in a low-income community for use in developing ongoing wellness interventions. **METHODS:** We used physical activity surveys shown to be reliable and valid, and collected anthropometric measurements [waist circumference (WC), weight, height, and body fat percentage (PBF)]. Raw data was used to assess overall fatness of the department, as well as any correlations between physical activity and fatness. **RESULTS:** Almost 84% of the participants were obese/overfat, with body mass index (BMI; $r=0.806$) and WC ($r=0.615$) strongly correlated with PBF. Frequency of cardiovascular exercise (CVE; $r=-0.269$) and strength training (ST; $r=-0.257$) were negatively associated with PBF, which remained true when the data was corrected for age. **CONCLUSION:** The data collected suggest a strong need for health interventions, which is in agreement with national fire service reporting. We hope to use this information (along with other data gathered in this pilot study) to develop educational and fitness interventions to increase the wellness of this population and other first responders in our area.

1428 Board #22 May 28 9:30 AM - 11:00 AM
Comparison Of Three Internationally Certified Firefighter Protective Clothing On Mobility, Comfort And Physiological Responses

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Firefighting, being one of the most dangerous jobs, requires specialized equipment and strategies to safely and effectively respond to fire emergencies. It is essential for this profession to wear firefighter protective clothing (FPC) to provide barrier protection from the dermal contact of hazardous materials such as heat, flame, and combusted product (Kim et al. 2017). However, the mobility, comfort and physiological responses using FPC are affected by its mass and bulkiness. Purpose: The aim of this study was to compare three internationally certified FPC from USA, European Union (EU) and South Korea (SK) on mobility, comfort and physiological responses. Methods: 10 male professional firefighters performed a battery of exercises in the laboratory following the ASTM F3031 to evaluate range of motion (ROM) for shoulder and trunk, subjective fit comfort. After these exercises, participants walked on a treadmill for 20 min at 3.2 mi/h and 5% incline. Weight, heart rate (HR) and core temperature (Tco) measurements were taken prior and after walking. All participants carried out the evaluation wearing each of the FPC in a random order. Results: There were no significant differences on any of the ROM evaluated for trunk and shoulder. Overall comfort shows no significant differences, however on a scale from 1 (worst) to 10 (best) the EU FPC was rated 7.2±1.0, SK 6.5±1.7, and USA was rated 6.0±1.1. There

were no significant differences on weight, HR or Tco between the 3 FPC but there was a significant decrease in weight and increase in HR and Tco from the start to the end of the 20 min exercise. Participants showed an elevated Tco (38.2°C US vs 38°C SK/EU) and HR (142.7 US vs 136.9 SK/137.2 EU) at the end of exercise while wearing the USA FPC. Conclusion: These findings suggest that the EU FPC might be the most comfortable and that the USA FPC creates more physiological burden. Comparing the materials and burn prediction data (Kim et al, 2017) with our comfort and physiological data, we could observe the inverse relationship between total heat loss (THL) and thermal protective performance (TPP) suggesting that comfort increases as THL increases and TPP decreases. The EU FPC, clothing material that certified to the EU standards, is more comfortable but may not protect at the same level as the other two FPCs.

1429 Board #23 May 28 9:30 AM - 11:00 AM
Electrolyte Balance And Hydration Status During Wildland Fire Suppression

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INTRODUCTION: Our laboratory has previously demonstrated the total energy fluid demands of wildland firefighters (WLFF) during arduous fire suppression. However, it remains unclear how current hydration strategies, occupational activity, and fire line provisions may alter overall hydration and electrolyte balance. **PURPOSE:** To determine WLFF fluid retention and urine production as influenced by environmental conditions, self-selected hydration practices, and work output during fire suppression shifts. **METHODS:** 59 WLFF (9 female, 50 male; 29±6 yr) from various crew types were deployed to fire incidents across the United States during the 2019 fire season and were observed throughout a single work shift. Before and after shifts, a measure of nude body weight was obtained. In a subset of subjects (n=25), pre and post-shift blood samples were also drawn to evaluate serum electrolytes. Fireline-certified researchers monitored fluid intake and urine output parameters (frequency, specific gravity [USG], volume) in real-time via observational data capture using graduated cylinder, refractometer, and mobile tablets. Dependent t-tests were performed for all comparative analyses and statistical significance was established at p<0.05. **RESULTS:** WLFF worked shifts of 13.9±1.1 hr, during which 4.7±1.6 L of water was consumed. WLFF eliminated 2.3±1.1 L via 5.7±2.7 voids (412±192 mL void⁻¹). There were no noted differences in USG from morning voids compared to those measured post meridiem (1.0106±0.0147 and 1.0106±0.0187 for AM and PM USG, respectively; p>0.05). No changes in nude body weight were observed across the work shift (80±13.4 and 79.8±13.2 kg for pre- and post-shift, respectively; p>0.05). Serum sodium and potassium did not change between pre- and post-shift blood draws (pre = 142±2 and 4.3±0.3, post = 141±2 and 4.2±0.3, respectively; p>0.05). **CONCLUSION:** These results demonstrate adequate fireline electrolyte provisions and currently employed WLFF hydration strategies. Moreover, the uniformity of pre- and post-shift measures (body weight, serum electrolytes) demonstrates that USG alone is not adequately indicative of hydration status during extended occupational stress.

1430 Board #24 May 28 9:30 AM - 11:00 AM
Comparison Of Physical Activity And Cardiorespiratory Fitness In Midwest Firefighters

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 (No relevant relationships reported)

Firefighters are at an increased risk for cardiovascular events (e.g., heart attack) due to increased incidence of physical inactivity and obesity. **PURPOSE:** To compare objectively measured physical activity and cardiorespiratory fitness between two independent fire departments. **METHODS:** Two independent fire departments from the Midwest participated in the study. Waist circumference (WC) and body mass index (BMI) were used to classify obesity status. Firefighters were classified as obese if they had a WC ≥102 cm and BMI ≥ 30 kg/m². Firefighters wore an accelerometer to track physical activity and associated intensities for the duration of their department's tour, which consisted of on- and off-duty days. Additionally, firefighters completed a stage-graded treadmill exercise test in their bunker gear (pants, boots, and jacket) to determine maximal oxygen uptake (VO_{2max}). **RESULTS:** Fire department one (FD1) had 29 firefighters complete the study (age: 34.45 ± 7.15 years; BMI: 28.97 ± 2.52 kg/m²; WC: 96.48 ± 7.45 cm) and fire department two (FD2) had 11 complete the study (age: 36.18 ± 4.29 years; BMI: 27.79 ± 4.00 kg/m²; WC: 94.95 ± 6.41 cm). Six firefighters were classified as obese (five from FD1 and one from FD2). There were

no significant differences between the two departments for sedentary ($t(38) = -0.485$, $p > 0.63$), light physical activity ($t(38) = 0.167$, $p = 0.87$), and moderate-to-vigorous physical activity (MVPA) ($t(38) = 0.046$, $p = 0.96$). Where the average daily MVPA was 31.3 ± 15.96 and 31.6 ± 18.28 minutes/day for FD1 and FD2, respectively. Similarly, there was no significant difference in cardiorespiratory fitness between FD1 and FD2 with VO_{2max} of 40.82 ± 6.95 and 39.51 ± 4.77 mL·kg⁻¹·min⁻¹, respectively ($t(38) = -0.576$, $p = 0.58$). Overall, both departments met the American College of Sports Medicine's recommendation of at least 30 minutes of MVPA per day. However, they did not meet the National Fire Protection Association's (NFPA) cardiorespiratory fitness recommendation of VO_{2max} = 42 mL·kg⁻¹·min⁻¹. **CONCLUSION:** This data demonstrates the need for increased focus on improving physical activity levels to improve overall health and wellness in firefighters. As part of the NFPA's Wellness Fitness Initiative, fire departments should strive to have at least one hour per day of dedicated time for physical activity.

C-34 Free Communication/Poster - Military/Firefighters/Police

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

1431 Board #25 May 28 9:30 AM - 11:00 AM
Determinants Of Performance And Comparison Of Army Physical Fitness Test And Combat Fitness Test Scores

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 (No relevant relationships reported)

The Army Combat Fitness Test (ACFT) will replace the Army Physical Fitness Test (APFT) on 1 October 2020. The three-event APFT measures muscular and aerobic endurance, but is notably missing measurements of strength, power, and anaerobic endurance. The ACFT is designed to assess each of the aforementioned components of fitness, but the relationship between performance on the ACFT and APFT is unclear. Furthermore, while the relationship between height, weight, gender and APFT performance is well-researched, researchers have not compared those physical traits to performance on the ACFT.

PURPOSE: To determine the relationship between performance on the APFT and ACFT; to establish the relationship between height, weight, gender, and ACFT performance.

METHODS: Researchers used data from 685 Cadets (age, 22.1±1.11 years; height, 1.77±0.09 m; weight, 80.3±12.8 kg) at the United States Military Academy recorded during the 2019 Academic Year. To determine the relationship between APFT and ACFT performance, researchers conducted an analysis of the variation in ACFT scores using overall APFT performance and gender. To determine the relationship between height, weight, and ACFT performance, researchers conducted statistical analysis of Body Mass Index (BMI), overall ACFT performance, and performance on each singular ACFT event.

RESULTS: Pearson correlation showed a significant ($p \leq 0.05$) correlation between APFT performance and ACFT performance; however, APFT scores as a single explanatory variable only accounted for 4% of the variation in ACFT scores while gender accounted for 69% of the variation. Further analysis suggested a significant correlation ($p \leq 0.05$) between BMI and ACFT performance, which led to the development of a strength-to-BMI ratio that accounted for 60% of the variation in ACFT scores.

CONCLUSION: Despite a significant correlation between APFT and ACFT performance, the two tests appear to provide different assessments of fitness; the inclusion of muscular strength, anaerobic endurance, and upper body pulling events in the ACFT likely contribute to the lack of ACFT variation described by the APFT.

1432 Board #26 May 28 9:30 AM - 11:00 AM
The Influence Of Age On The Recovery From Worksite Resistance Exercise In Firefighters

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Worksite resistance training may reduce injuries and improve performance in firefighters, however aging may prolong the recovery process. **PURPOSE:** This

study examined the influence of age on recovery following an acute bout of worksite resistance training. **METHODS:** Nineteen young and 19 older career firefighters (FFs) completed an acute bout of resistance exercise in addition to pre- and post-testing 24, 48, and 72 hours post-exercise. A work-related fatigue (WRF) survey was completed to assess daily fluctuations in work demands. Ultrasonography was used to assess cross-sectional area (CSA) and echo intensity (EI) of the vastus lateralis, in addition to muscle thickness (MT) and EI of the biceps brachii. To determine maximal jump height and associated velocity, participants completed 3-4 countermovement jumps while standing on a jump mat with a linear transducer attached at the waist. Upper-body peak force (PF) was measured during an isometric upright row task, using a calibrated tension-compression load cell. Lower body PF was examined with the participants seated in a custom-built, calibrated isometric dynamometer and their right knee flexed at 60 degrees. Following 3 submaximal warm-up contractions, participants performed 3 maximal voluntary contractions for each strength assessment lasting 3-4 s. The FFs completed the circuit-style resistance exercise bout following pre-testing, which included 3 sets of 8-10 repetitions at 80% of their predicted 1-repetition maximum of the deadlift, shoulder press, lunge, and upright row. Linear mixed models, controlling for WRF, were used to analyze all primary outcomes, with subject as the random effect and group and time as fixed effects. Alpha level was set *a priori* at 0.05. **RESULTS:** There was a significant group by time interaction effect for WRF ($P=0.002$) and was controlled for in subsequent analyses. There were no other significant group by time interactions ($P>0.171$). Collapsed across time, young FFs showed greater lower body PF ($P=0.006$), jump performance ($P<0.024$), and lower VL EI ($P=0.008$) values. Across time points, upper-body PF ($P=0.023$) and jump performance ($P<0.029$) decreased as muscle size increased ($P<0.006$) for both groups. **CONCLUSION:** These results indicate that age may not influence the recovery from a bout of worksite resistance exercise in FFs.

1433 Board #27 May 28 9:30 AM - 11:00 AM
THE EFFECTS OF A 16-DAY COURSE ON IMPROVEMENT IN ARMY PHYSICAL FITNESS TEST SCORES

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Despite guidelines on the benefits of physical activity on improved quality of life and reduced levels of stress, an increasing number of adults do not meet the guidelines of at least 150-minutes of moderate physical activity per week. This may be a contributing factor relating to a growing population of military personnel who are unable to pass the Army Physical Fitness Test (APFT). **PURPOSE:** With this challenge in mind, we aimed to determine how attitudes, motivation, and knowledge of general health and wellness influenced a soldier's ability to successfully pass the APFT. **METHODS:** Thirty-six national guard reservist men and women (age = 27 ± 5 yrs; weight = 91.2 ± 17.4 kg; height = 1.7 ± 0.1 m) attended a 16-day course on health, wellness, and physical training. During the course, subjects had their body composition assessed via bioelectrical impedance. The APFT was completed five times over the course of four months with the first test occurring at the beginning of the course. At the start of the course and the final APFT, participants completed three questionnaires (BLOCK Fat Dietary Screener, Paffenbarger Physical Activity Questionnaire, and a modified Sports Motivation Scale-II). **RESULTS:** Passing rate in the APFT increased from 8.3% at the first test to a 22.7% passing rate after four months with the 2-mile run having the highest failure rate of the three events (push-ups, sit-ups, 2-mile run). On average, subjects lost 2.6 ± 3.9 kg which was statistically significant ($p < 0.05$) and saw a mean reduction of 1.6 ± 2% body fat percentage. There was no change in BLOCK Fat Dietary scores (31.8 ± 11.4 vs. 31.2 ± 12.5, $p > 0.05$) or the Paffenbarger physical activity index (2,184 ± 1548 vs. 2890 ± 1938 kcal/week, $p > 0.05$). Intrinsic motivation significantly increased pre to post-testing (12.9 ± 3.4 vs 16.6 ± 4.6, $p < 0.001$). **CONCLUSION:** The educational course was successful in increasing the passing rate of the APFT. More importantly, an increase in intrinsic motivation suggests a greater interest in the variety of training methods included in the curriculum which would decrease the monotony of the training and encourage their improvement in the APFT. Future studies need to explore the challenges of improving the two-mile run.

1434 Board #28 May 28 9:30 AM - 11:00 AM
Association Of Caloric Intake With Physical Fitness And Low Back Pain In Firefighters

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Firefighters are at high risk of developing numerous health conditions, such as obesity, cardiovascular disorders, and low back pain (LBP), which negatively impact physical fitness, job performance, and quality of life. The influence of caloric intake on physical

fitness and injury prevention has not been fully assessed in firefighters. **PURPOSE:** To assess the association of caloric intake with physical fitness and LBP in firefighters. **METHODS:** A cross-sectional study was conducted in career firefighters ($n = 134$ males) from 12 departments in southern California who presented for baseline assessments for a regional wellness initiative. A 3-day food record was collected to determine caloric intake using the percent of the Harris-Benedict estimated energy requirement. LBP history, LBP current status, and job function (Firefighter Functional Task Questionnaire, FFTQ) were assessed with questionnaires. Back and core muscular endurance was assessed with the Ito and Plank tests. Movement quality was assessed with the Functional Movement Screen. Relationships between caloric intake and the dependent variables were explored using Pearson's correlation and analysis of variance. **RESULTS:** Significant ($p \leq 0.05$) correlations were noted between caloric intake and core endurance ($r = 0.20$), FMS ($r = 0.22$), and FFTQ ($r = 0.17$). Firefighters without a history of low back pain consumed more calories than those with a history of low back pain (87.1% ± 25.7% vs 74.8% ± 21.9%, respectively, $p = 0.02$). No significant relationships were observed between caloric intake with back endurance or current LBP. **CONCLUSION:** This preliminary suggests that adequate caloric intake is associated with physical fitness, job performance, and LBP in firefighters. Prospective trials are needed to confirm these relationships and assess the effectiveness of nutrition interventions in firefighters.

1435 Board #29 May 28 9:30 AM - 11:00 AM
PHYSICAL FITNESS, PHASE ANGLE AND BODY FAT DISTRIBUTION OF YOUNG MALE ARMY CADETS

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 (No relevant relationships reported)

A military career demands a routine of physical training to induce adequate levels of physical fitness (PF) and body composition. Body fat distribution (*i.e.* android and gynoid fat) are related to increase metabolic risk also observed in military populations. Phase angle (PhA) is used to evaluate nutritional status and is an indicator of cellular health. However, it is unclear if PhA is influenced by changes in PF induced by physical training. **PURPOSE:** a) to verify the association between PF and PhA, android and gynoid fat, and b) if PF changes have an association with changes in PhA, android and gynoid fat in the army cadets. **METHODS:** 385 young male army cadets (18.7 ± 0.7 yrs) were evaluated before (M1) and after (M2) 6-mo of military training. PhA (°) was calculated by bioelectrical impedance parameters. Dual-energy absorptiometry evaluated android fat in kg ($A_{\%}$), in % ($A_{\%}$), gynoid fat in kg ($G_{\%}$) and % ($G_{\%}$). PF was assessed with specific military test, in which participant must run 3000m distance as fast as he can. The PF test was measured in the day after the body composition measures, both in M1 and M2. Bivariate correlation was used to verify the association between PF and PhA, $A_{\%}$, $A_{\%}$, $G_{\%}$, and $G_{\%}$ in M1 and M2. Wilcoxon test was used to compare variables between M1 and M2. Linear regression analysis was used to verify if changes (Δ) on independent variables influenced the PF changes among participants. **RESULTS:** In M1, PF was associated ($p < 0.001$) with PhA ($r = -0.16$), $A_{\%}$ ($r = 0.39$), $A_{\%}$ ($r = 0.41$), $G_{\%}$ ($r = 0.45$), and $G_{\%}$ ($r = 0.46$). In M2, PF was associated ($p < 0.001$) with $A_{\%}$ ($r = 0.36$), $A_{\%}$ ($r = 0.37$), $G_{\%}$ ($r = 0.41$), and $G_{\%}$ ($r = 0.40$), but not with PhA ($r = -0.10$, $p = 0.057$). The PhA ($\Delta = 0.3^\circ$) and $G_{\%}$ ($\Delta = 0.2\%$) increased ($p < 0.001$), and $A_{\%}$ ($\Delta = -0.3\%$) decreased ($p < 0.05$) compared to M1. In addition, male army cadets improved ($p < 0.001$) the PF test ($\Delta = -1.1$ min) compare to M1. The PF improvement was associated ($p < 0.001$) with $\Delta A_{\%}$ ($r = 0.38$), $\Delta A_{\%}$ ($r = 0.36$), $\Delta G_{\%}$ ($r = 0.42$), and $\Delta G_{\%}$ ($r = 0.40$), but not with ΔPhA ($r = -0.06$, $p = 0.209$). Linear regression of the ΔPF had an effect ($p < 0.001$) of $\Delta A_{\%}$ ($\beta = -0.39$), $\Delta A_{\%}$ ($\beta = -0.38$), $\Delta G_{\%}$ ($\beta = 0.41$), and $\Delta G_{\%}$ ($\beta = 0.42$), but not of ΔPhA ($\beta = -0.07$, $p = 0.179$). **CONCLUSION:** PF was associated with PhA, $A_{\%}$ and $G_{\%}$. The improvement on PF seems to be more influenced by $\Delta A_{\%}$ and $\Delta G_{\%}$ but not by ΔPhA in young male army cadets. Supported by CAPES (No.23001.000422/98-30)

1436 Board #30 May 28 9:30 AM - 11:00 AM
Assessing Injury Susceptibility At Marine Corps Recruit Depot, San Diego, California

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 (No relevant relationships reported)

Individuals enlisting at the Marine Corps Recruit Depot (MCRD) San Diego undergo a physically demanding training regimen. As such, musculoskeletal injury (MSKI) rates during training remain high and account for costly increases in attrition and delays in graduation, thereby impacting force readiness. Earlier injury detection is needed, and functional movement tests such as the functional movement screen (FMS), Y-balance test lower quarter (YBT-LQ) and ankle dorsiflexion range of motion (AD-ROM) can provide predictive value for MSKI incidence.

PURPOSE: To test the hypothesis that functional movement assessments are beneficial tools for movement analysis and injury prediction.
METHODS: Male MCRD recruits (N = 407; mean ± SD: age, 20 ± 2 y; height, 174.5 ± 7.3 cm; weight, 76.1 ± 11.4 kg) underwent testing of FMS, YBT-LQ, and AD-ROM prior to beginning training. Injury incidence during training and graduation outcomes were tracked by instructors.
RESULTS: Twelve recruits (3%) were dropped from their class due to a lower body stress fracture or strain, delaying graduation for eight, and separating four from enlistment. A one-way analysis of variance revealed statistical group differences (MSKI vs no MSKI) for the FMS hurdle step (HS; $F(1,400) = 4.314, p = 0.038$) and trunk stability (TS; $F(1,394) = 14.600, p = 0.000$) assessments, with lower scores in the MSKI group (HS: 1.9 ± 0.5 vs 2.2 ± 0.5 , TS: 1.3 ± 1.2 vs 2.4 ± 0.9). During the YBT-LQ anterior direction, the MSKI group showed a greater difference ($F(1,394) = 6.536, p = 0.011$) between legs (5.5 ± 4.7 cm vs 3.3 ± 2.8 cm). For both leg-ankle-foot complexes, the MSKI group demonstrated higher AD-ROM scores (right: $44.1 \pm 4.7^\circ$ vs $40.5 \pm 6.5^\circ$; left: $43.3 \pm 5.4^\circ$ vs $41.6 \pm 6.5^\circ$) with the right side trending toward significance ($F(1, 399) = 3.692, p = 0.055$).
CONCLUSIONS: MCRD recruits who incurred a lower body MSKI during training had a movement analysis of inferior lower body mobility and stability, weaker core stabilization, and poorer single limb stance and imbalance. The increase in ankle flexibility observed in the MSKI group may be a risk factor for overuse Achilles tendon injuries. Results not only apply to MCRD recruits, but could also apply to recruits in other military branches, athletic communities, and first responders seeking screening tools for movement analysis and injury prediction.

1437 Board #31 May 28 9:30 AM - 11:00 AM
Physiological Differences Of Us Army Cadets Comparing A Loaded And Unloaded 6-mile Ruck March
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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the differences between a loaded 6-mile ruck march (LRM) versus an unloaded 6-mile ruck march (ULRM).
METHODS: Nine cadets (8 male, 1 female) from the Leadership Development Program participated in this study. The two ruck marches studied occurred in the early morning hours ten days apart with the first ruck being a LRM, followed by the ULRM on the same course ten days afterwards. The 6-mile course consisted of three 2-mile paved loops of rolling hills on the campus of UNG. The subjects wore a TICKR X (Wahoo Inc.) which is a wearable device with advanced motion analytics using an accelerometer and heart rate monitor connected via Bluetooth to an iPhone application.
RESULTS: The average finish time for the weighed 6-mile LRM was 1 hr 15 min, 14 s ± 7 min, 7 s and for the ULRM was 56 min, 18 s ± 8 min and 13 s. These results were statistically significant at a $p < .000$, average HR for the LRM was 181.17 ± 13.32 bpm and 169.67 ± 10.35 for the ULRM, maximal HR for the LRM was 196.83 ± 7.33 bpm and 187.67 for the ULRM, total caloric expenditure for the LRM was $1341.3 \text{ cal} \pm 204.5$ and for the ULRM was $922.0 \pm 181.4 \text{ cal}$, average cadence for the LRM was 135.0 ± 7.4 steps per minute and 157.0 ± 11.7 steps per minute, maximal cadence for the LRM was 202.8 ± 16.8 steps per minute and the ULRM was 193.0 ± 16.8 steps per minute, average smoothness score for the LRM was 98.17 ± 22.59 and 94.83 ± 24.23 for the ULRM, oscillation score for the LRM was 3.425 ± 1.49 and $3.45 \pm .31$ for the ULRM and RPE for the LRM was 15.0 ± 1.7 and 11.78 ± 2.0 for the ULRM. The principle findings from our study was that six of the nine metrics demonstrated significant differences between the LRM and the ULRM.
CONCLUSIONS: These results give us a better understanding of the cardiovascular and physical demands of the LRM versus the ULRM.

1438 Board #32 May 28 9:30 AM - 11:00 AM
Functional Movement Profiles Of Police Officers From A Rural U.S. Based Law Enforcement Agency
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(No relevant relationships reported)

Police officers may be required to perform dynamic movements such as running, jumping, and lunging as part of their duties. Early identification of poor movement patterns in this population may mitigate injury risks associated with these dynamic movements. **PURPOSE:** To profile movement patterns in a police force and identify specific movement patterns associated with injury risk. **METHODS:** Thirty-eight ($n=38$; age = 39.4 ± 7.9 years; Height = 180.3 ± 8.1 cm; Weight = 101.3 ± 20.2 kg; Body mass index = $30.5 \pm 5.1 \text{ kg.m}^2$) full-time police officers volunteered to participate in this study. Participant movement ability was assessed using a screening tool which incorporated seven movement patterns: overhead squat, hurdle step, in-line lunge, active-straight leg raise, trunk-stability push-up, and rotary stability. Each movement is scored from '0' to '3' for a total of 21 points. A score of '0' was given if there was pain during the movement or corresponding clearing test. A score of '1' indicated

inability to complete the movement, '2' completed the movement with compensation, and '3' completed the movement correctly. Frequency and descriptive analysis were used for each of the dependent variables (i.e., each movement). Previous research has suggested that a total score of <14 points may indicate an increased risk for sustaining an injury, so this benchmark was noted. **RESULTS:** Overall, 89.7% ($n=38$) of officers scored below 14 points on their assessment. Greater than 85% ($n=33$) of participants were unable to perform movement patterns, performed them with compensation, or had pain throughout the movement for six out of the seven movement assessments. **CONCLUSION:** Specific movement patterns that may contribute to an increased injury risk within this police population include functional mobility of the hips, knees, ankles, and shoulder. Specific mobility and strength and conditioning programs may reduce injury risk by improving movement quality.

1439 Board #33 May 28 9:30 AM - 11:00 AM
The Physical Parameters Of Tactical Climbing And Performance Characteristics Of NSW Operators
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PURPOSE: In tactical settings vertical elevation is critical for advantage to Special Operation Forces. Climbing proficiency in various settings (alpine, urban, and maritime) requires strength, power, endurance, and technique. This research seeks to 1) study differences in physical capacities and anthropometrics of US SEAL lead climbers from non-lead climbers, and 2) catalogue the types and weights of the various climbing systems to assess total system mass to lead climber's body mass. Our hypothesis is that there would be no differences in physical performance on Combine tests or anthropometrics between lead climbers and non-lead climbers as they are the same Special Operations population.
METHODS: Climbing surveys were collected from lead climbers. Retrospective Combine data (standing long jump, pro-agility test, 25-lb pull-up, body mass bench press, 1-RM deadlift, 300-yd shuttle, 3-mile run, and 800-m swim) were compared between 13 SEAL lead climbers (age: 30.9 ± 5.4 yr; height: 180.3 ± 11.6 cm; mass: 89.6 ± 10.3 kg; body fat: $15.8 \pm 4.4\%$) and 305 non-lead climbers (age: 28.4 ± 5.0 yr; height: 178.4 ± 6.2 cm; mass: 86.0 ± 9.1 kg; body fat: $17.3 \pm 4.5\%$).
RESULTS: Lead climbers performed significantly better than non-lead climbers in the Pro Agility, 1-RM dead lift and the 800-m swim. There were no significant differences between lead climbers and non-lead climbers in anthropometrics and the remaining Combine tests. The total mass reported for the climbing equipment for each tactical scenario was up to 5.8 kg for Urban climbing, up to 14.0 kg for Alpine climbing, and up to 8.0 kg for maritime climbing. With a typical combat load of 22 kg, adding this climbing equipment exceeds one-third of the lead climbers' own body mass. This combined load is more than double that used in the weighted pull-up test.
CONCLUSIONS: Lead climbers were not significantly different than non-lead climbers in most physical tests. Strength and conditioning programming for this population should take into consideration the combined mass of combat load and climbing gear for testing and training purposes and should also assess climbing-specific strength and endurance. The views and opinions expressed are the authors' and do not reflect those of Naval Special Warfare Command, the US Navy or the Department of Defense.

1440 Board #34 May 28 9:30 AM - 11:00 AM
Assessing Value Of Physical Training For Tactical Athletes
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(No relevant relationships reported)

PURPOSE: Population physical fitness (PF) levels have steadily declined over the past 20 yrs. PF is the strongest predictor of injuries among military personnel, after gender. Military and paramilitary organizations continue evaluating physical training (PT) methods to improve tactical athletes' performance on physical fitness tests (PFT). Similarly, many tactical units are evaluating PFT standards to determine their ability to predict physical readiness for service. However, evidence on the efficacy and effectiveness of PT for passing a PFT and being fit for service remains equivocal. The purpose of the current study was to develop and test the psychometric properties of an objective instrument for assessing attitudes towards PT as it relates to current PF, lifelong PF, and ability to pass a military PFT.
METHODS: Data were collected on 892 cadets from a senior military college who participate in military PT at least two d/wk. The sample was split into two sub samples for the purpose of establishing and confirming the psychometric properties of the scale. In sample one, coefficient alpha was calculated for six a priori subscales and a

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confirmatory factor analysis was conducted using maximum likelihood estimation with missing variables. Modification indices were consulted following estimation. Analyses were repeated with sample two. All analyses were conducted in Stata 15.1.

RESULTS: In sample one, all six subscales indicated acceptable internal consistency ($\alpha = .69-.89$) and the initial measurement model was a good fit for the data (Chi-square=558.15 (215), RMSE=0.060, CFI=0.947, TLI=0.937). Modification indices suggested adding two additional covariances, which resulted in a superior fit to the data (Chi-square=445.63 (213), RMSE=0.050, CFI=0.964, TLI=0.957). In sample two, all subscales indicated acceptable internal consistency ($\alpha = .69-.86$) and the final measurement model was a good fit for the data (Chi-square= 395.83 (213), RMSE=0.044, CFI=0.968, TLI=0.962).

CONCLUSIONS: The current data provide support for the factorial validity and internal consistency of the instrument. Thus, this instrument can be employed as an objective assessment of PT programs within tactical settings and can be used to conduct impact evaluations in the presence or absence of formal military and paramilitary PFT.

1441 Board #35 May 28 9:30 AM - 11:00 AM

Prevalence Of Hypohydration In Military Servicemembers Before A Multi-day Field Training Exercise

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(No relevant relationships reported)

It is well established that hypohydration negatively impacts physical and cognitive performance. Despite the importance of hydration, athletes frequently participate in training or competition hypohydrated. While data exists in athletes, there is a lack of data on Military servicemembers' (SM) hydration status prior to field training exercises or combat. For our nation's Warfighters, starting a mission hypohydrated can put their lives at risk. Performance decrements can have profound consequences on mission readiness and decrease survivability and lethality on the battlefield. While the recently revalidated Military fluid replacement guidelines (TB MED 507) have been shown to effectively replenish known fluid losses without causing overhydration, they do not address hydration status before training events. **PURPOSE:** To describe the hydration status of Military SMs prior to a physically rigorous, multi-day field training exercise. **METHODS:** Data was collected from three training iterations from 2017-2019. In total, first morning void urine samples were collected from 93 Military SMs (2017, n=23; 2018, n=33; 2019, n=37). Hydration status was determined by urine specific gravity (USG) with cutoffs according to the American College of Sports Medicine (ACSM) and the National Athletic Trainers' Association (NATA) guidelines: euhydration <1.010, minimal hypohydration 1.010-1.020, hypohydration 1.021-1.030, severe hypohydration >1.030. For each cohort, only USG data was collected. **RESULTS:** The mean (SD) USG for the sample was 1.020 (0.009). Using the ACSM cutoffs (hypohydration >1.020), 50.5% of Military SMs were hypohydrated at the start of the field training exercise. Using the NATA cutoffs, 18.3% (n=17) were euhydrated; 31.2% (n=29) were mildly hypohydrated; 40.9% (n=38) were hypohydrated; 9.7% (n=9) were severely hypohydrated. **CONCLUSIONS:** Despite the Military's emphasis on appropriate hydration strategies, just over half of the SM cohort were hypohydrated, while approximately 10% were severely hypohydrated. Future studies need to explore these findings. Although this evidence is preliminary, TB MED 507 may need to be updated to provide specific and clear guidance on strategies for hydration assessment and fluid replenishment prior to participation in operational training events or combat.

1442 Board #36 May 28 9:30 AM - 11:00 AM

Differences In Fitness Between Law Enforcement Cadets And Officers: A Retrospective Study Of Two Agencies

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(No relevant relationships reported)

INTRODUCTION: Research suggests that police officers progressively become less fit during their careers which may impact their ability to perform job-specific physical tasks. However, as tasks may vary between different law enforcement agencies (LEAs), there may be differences in both fitness levels and changes in fitness between different LEAs. **PURPOSE:** To identify differences in fitness parameters between cadets and incumbent police officers across two independent LEAs. **METHODS:** Retrospective analysis of data from two separate LEAs were analyzed. The study cohort consisted of 388 male incumbent police officers (LEA 1 n = 72; mean age = 39.43 ± 8.28 yrs; mean weight = 87.47 ± 11.60 kg; LEA 2 n = 316; mean age = 37.92 ± 7.71 yrs; mean weight = 88.80 ± 12.93 kg) and 157 cadets (LEA 1 n = 66; mean age =

29.95 ± 5.73 yrs; mean weight = 85.65 ± 11.92 kg; LEA 2 n = 91; mean age = 30.14 ± 6.93 yrs; mean weight = 86.50 ± 12.23 kg). Fitness measures included 1 min maximum push-up repetitions (PU), and sit-up repetitions (SU), a vertical jump (VJ), and either a 1.5 mile run or a 20m multistage fitness test (20m MSFT), with the latter measures converted to VO_{2max}. Independent samples t-tests were used to compare, both combined and individual, LEA cadet cohorts against incumbent officer cohorts. Alpha levels were set at p<0.05. **RESULTS:** When combined, cadets were found to be significantly younger (p<0.01) and lighter (p<0.05) than incumbent police officers. When divided into respective LEAs only differences in age remained between cadets and officers. When comparing fitness measures, cadets achieved higher PU, SU, VJ, and VO_{2max} scores as a cohort (p<0.001 respectively) and as LEA 2 (p<0.01, p<0.001, p<0.01 and p<0.001, respectively). However, only PU, SU and VO_{2max} (p<0.001 respectively) were significantly higher in LEA 1 with no differences in VJ between cadets and incumbent officers. **CONCLUSIONS:** Cadets were generally more fit than incumbent police officers, whose fitness may decrease over time due to job demands (e.g. shiftwork and stress), age-related declines, and changes in physical activity. Police officer fitness appears to peak during their time as cadets and decreases regardless of LEA. Maximizing fitness levels during cadet training and minimizing fitness loss after training is vital if incumbent officers are going to remain fit for duty.

1443 Board #37 May 28 9:30 AM - 11:00 AM

Effects Of Non-mandated Physical Readiness Training On Fitness And Performance In Army Officers

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(No relevant relationships reported)

To prepare military personnel for occupational operations, Army captains are responsible for implementing, participating and mandating physical readiness training (PRT) for their respective units. However, the fitness of Army leadership is often not assessed, especially in periods where PRT is not mandated. **PURPOSE:** To observe body composition and fitness in United States Army Captains after 5 months of non-mandated PRT. **METHODS:** Twenty-two captains volunteered to participate (age; 27±1y, height; 1.8±0.6m, and weight; 83.1±11.1kg). Eleven participants remained in active units with mandated training (PRT) while 11 participants were in positions where training was not mandated (NMT). Both groups logged exercise performed during the intervention. Body composition, cardiorespiratory fitness, anaerobic power, and muscular endurance were measured before and after the intervention period (18±2 weeks). **RESULTS:** At pre-intervention, PRT and NMT were not different in body fat percent (22.0±4.6 vs. 20.3±4.4%), peak aerobic capacity (VO_{2peak}; 45.7±2.4 vs. 48.8±3.8ml·kg⁻¹·min⁻¹), mean power output (566±47 vs. 542±91W), sit-ups (72±5 vs. 77±11reps) or push-ups (59±6 vs. 60±15reps) (P>0.05). There was no time by group interaction in body fat percent (P=0.28), mean power output (P=0.17), or sit-ups (P=0.71). VO_{2peak} (P<0.001) and push-ups (P=0.01) increased across both groups after the intervention. **CONCLUSIONS:** Captains maintained cardiorespiratory fitness, body composition and anaerobic power after 5 months regardless of PRT being mandated or not. Participants may have had freedom to perform exercise they found enjoyable as opposed to being confined to PRT which focuses on strength and endurance, thus leading to increased aerobic capacity. Duties related to the rank and combat experience as well as pressure of rank may influence Captains to maintain their fitness.

1444 Board #38 May 28 9:30 AM - 11:00 AM

Associations Between Physical Fitness Characteristics And The Candidate Physical Ability Test (CPAT)

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(No relevant relationships reported)

Firefighting is a physically demanding occupation, with significant physiological stresses well documented in the literature. The Candidate Physical Ability Test (CPAT) is a firefighting-task specific test designed to screen firefighter candidates. Previous research has correlated physical attributes with performance on individual tasks. However, few studies have examined the association between fitness characteristics and performance on a series of tasks designed to mimic the demands of firefighting, such as the CPAT. **PURPOSE:** To examine the associations between physical fitness characteristics and performance on the CPAT. **METHODS:** Ten healthy male firefighters (age= 31.8 ± 11.3; Body Mass Index (BMI)= 30.0 ± 4.3; percent body fat (%BF)= 20.4 ± 7.1; VO_{2max} (ml·kg⁻¹·min⁻¹) = 42.1 ± 6.9) completed a fitness assessment which included: 1) a graded exercise test (GXT), 2) measures of body composition (height, weight, bioelectrical impedance analysis, circumferences), 3) muscular fitness (pushup test, curl up test, hand grip strength), and 4) flexibility (sit and reach, back scratch). Additionally, each firefighter completed a CPAT, comprised of eight events (stair climb, hose drag, equipment carry, ladder raise and extension, forcible entry,

search, rescue, ceiling breach and pull) with total time (sec) as a primary outcome. Pearson correlations were used to determine the associations between CPAT time (sec) and physical fitness characteristics. **RESULTS:** Data revealed significant moderate correlations between CPAT time (sec) and waist to hip ratio (WHR) ($r=0.668$; $p=0.049$), and the pushup ($r=-0.647$; $p=0.043$). Additionally, the association between CPAT time (sec) and %BF ($r=0.608$; $p=0.082$), and the sit and reach ($r=-0.625$; $p=0.053$) approached significance. **CONCLUSION:** Results of the current study suggest that increased upper body strength and decreased body composition are associated with improved performance on the CPAT. Although the current study was limited by a small sample size, the results highlight the potential importance of these fitness characteristics in these occupation specific tasks. Future research should investigate these relationships in a larger and more diverse population, and between physiological responses observed during CPAT and physical fitness.

C-35 Free Communication/Poster - Soccer

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

**1445 Board #39 May 28 9:30 AM - 11:00 AM
 IN-GAME PHYSIOLOGIC RESPONSES OF A DIVISION I COLLEGIATE MASCOT COMPARED TO VARSITY SOCCER ATHLETES**

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The physiologic responses collegiate athletes experience during practice/competition are reasonably well understood; however, an important yet understudied group who also exerts substantial effort during sporting events are team mascots. Mascots typically wear heavy suits/uniforms that create an environment not conducive to effective temperature regulation, thus putting the wearer under high physiologic stress. Although physiologic responses experienced by collegiate athletes and mascots during athletic competitions have been studied previously, it is unknown how these responses compare with one another. **PURPOSE:** To compare in-game heart rate (HR) responses and accelerometer data of a collegiate mascot with those of collegiate soccer athletes. **METHODS:** A physiological tracking system was used to evaluate HR and movement from three groups: a mascot while "in suit" [N=7 (1 female)] during a football game, and players in the first half of a varsity men's (N=9) and women's (N=9)] soccer game, separately. All games were played under similar ambient conditions (avg 21°C, 60% rh, 5 mph wind). Prior to the study, individuals' HRmax values were determined during graded treadmill tests performed to volitional exhaustion or an on-field intermittent recovery test. Variables analyzed were time "in suit"/on the field, distance traveled (meters/min), and percent of time in pre-established HR zones [HRzone1 (50-59%HRmax), HRzone2 (60-69%HRmax), HRzone3 (70-79%HRmax), HRzone4 (80-90%HRmax), and HRzone5 (>90%HRmax)]. Differences between groups were evaluated via a one-way ANOVA. **RESULTS:** There were no differences between groups for time spent "in suit"/on the field (~47 min); however there was a significant difference between groups for distance traveled ($p<0.001$), with the mascot traveling less distance (35±6 m/min) than the soccer players (men, 115±25 m/min, women, 107±4 m/min). All three groups spent over 90% of time "in-suit"/on the field in HRzones 3, 4 or 5, and 75% of time in HRzone 4 or 5. There were no significant differences between groups for time spent in various HRzones. **CONCLUSION:** The mascot suit environment created a physiological strain on the wearer similar to that of a varsity collegiate soccer athlete, despite much less movement performed per session.

**1446 Board #40 May 28 9:30 AM - 11:00 AM
 Analysis Of Intense Actions Are Dependent Of Tactical Function In Soccer Players**

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PURPOSE: A determining factor during a soccer game is the intense action, which can be perceived by the number of sprints, accelerations, decelerations. One possible hypothesis is that there are differences between the tactical functions during the soccer match. Thus, this study examined the differences between the indicators of the intense actions by tactical functions. **METHODS:**

Activities of 20 full official matches were collected and analyzed using GPS Polar Team Pro System. In this study were used five positional roles in soccer players (side-backs, full-backs, defensive midfielders, offensive midfielders, attackers) within the tactical scheme 4-4-2. The indicators of the intense actions were number of sprints, % of intense actions (speed of 14 to 25.1 km/h-1), amount of accelerations and decelerations, maximum speed in addition to the total distance of displacements. A repeated measures analysis of variance (Kruskal-Wallis) was performed for distances covered at different intensities between positions. **RESULTS:** Significant differences were found for the full-backs with side-backs, defensive, midfielders, offensive midfielders, attackers (H=53.52; $p<0.01$), referring to total distance traveled during a game. It was shown that the indicators of the intense actions between the side-backs and full-backs with defensive and offensive midfielders, and attackers, was relative to the % intense actions (H=75.17; $p<0.01$), sprints (H=58.07; $p<0.01$), amount of decelerations (H=77.54; $p<0.01$) and accelerations (H=55.61; $p<0.01$). However, for the execution of the maximum speed were observed in side with full-backs and midfielders ($p<0.01$). Significant differences were found between intense actions between side-backs and full-backs with defensive and offensive midfielders and attackers, allowing to emphasize that the midfielders and attackers need to be more intense than side-backs and full-backs, mainly in the tactical scheme 4x4x2. The main finding was that offensive, defensive midfielders and attackers had higher activity at all intensities, including intense sprinting, high-intensity actions, and in accelerations and decelerations. **CONCLUSIONS:** These results show that intense actions are highly dependent on positional role and relative tactical organization in a soccer team.

**1447 Board #41 May 28 9:30 AM - 11:00 AM
 Pre-season Training Loads Of Elite NCAA Division 3 Female Soccer Players: A Descriptive Study**

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Field-based sports training traditionally revolves around the "art of coaching", where coaches use experience and educated guesses as a primary means of conditioning players. With the advent of GPS technology, field sports have the capability to monitor external training loads more accurately thus allowing the coaching staff to design better conditioning programs in order to match sport-specific demands seen during practices and competitions, potentially improving performance. NCAA rule limitations for Division III preseason training accentuates the need to determine the training loads of these practices.

Purpose: The purpose of the descriptive study was to examine the external training loads of elite NCAA Division III soccer players during preseason training. **Methods:** 17 NCAA female Division III soccer players (20.41±1.12 years; 64.44±6.76 kg; 166.06±4.74cm) wore a portable GPS device, operating at 10Hz and incorporated with a 100Hz triaxial accelerometer, prior to every practice (n = 8) and scrimmage (n=1) during the preseason (Aug 19 - Aug 27) in central Virginia. To start the preseason, VO_{2max} was estimated via the YOYO test. GPS collected total distance (km), work rate (m/min), hard running (>4.5 m/s; m), zone 6 running (>6 m/s; m), top speed (km/h), and intensity during practices and scrimmages during the Division III preseason. **Results:** Estimated VO_{2max} was reported to be 44.90±1.90 ml·kg⁻¹·min⁻¹. During practices, athletes covered 4.35±2.04 km, had a work rate of 42.31±10.05 m/min, covered 157.38±143.38 m of hard running, ran 33.19±56.70m in Zone 6, had a top speed of 24.54±4.59 km/h, and had an intensity of 26.66±14.13. During the scrimmage, athletes covered 6.33±2.24 km, had a work rate of 38.13±13.72 m/min, covered 227.80±194.841 m of hard running, ran 28.47±45.17 m in Zone 6, had a top speed of 25.96±4.15 km/h, and had an intensity of 40.33±17.69. **Conclusion:** The external loads of elite Division III female soccer players were found to be similar to previously reported in-season loads of Division I and Division II athletes. The short preseason training period and high external loads present a number of concerns for Division III athletes as it pertains to preseason conditioning needs and the potential for overload injury risks.

**1448 Board #42 May 28 9:30 AM - 11:00 AM
 Speed Comparisons Between Match Outcomes By Position In NCAA Women's Soccer**

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PURPOSE: The purpose of this study was to determine if performance measures differed dependent on game outcomes and field position during a full NCAA collegiate

women's soccer season. **METHODS:** Average speed [km·hr⁻¹] was monitored in 89 female soccer athletes across 5 NCAA Division 1 teams (mean ± SD; age, 19.8 ± 1.1 y; body mass, 81.57 ± 32.66 kg; height 158.78, ± 20.34 cm) using GPS-enabled player tracking devices during the competitive season. Athletes were categorized into three groups, depending on field position (forwards (FWDs), midfielders (MIDs), and defenders (DEFs)). Within group comparison for wins, losses, and ties were determined using mean differences (MD) with 95% confidence interval (95% CI) and effect sizes (ES). This was assessed post-hoc with a Tukey HSD, with alpha set at 0.05 for all analysis. **RESULTS:** Average speed across all positions was 3.35 ± 1.17 km·hr⁻¹ in wins, 3.06 ± 1.05 km·hr⁻¹ in ties, and 3.5 ± 1.31 km·hr⁻¹ in losses. Within group, FWDs, MIDs, and DEFs achieved a significantly greater average speed in games that resulted in a loss versus a tie (MD[95%CI]; FWDs=0.69[0.20,1.18] km·hr⁻¹; ES=0.63, p=0.003; MIDs=1.18[0.62,1.74] km·hr⁻¹; ES=0.82, p<0.001; DEFs=0.82[0.38,1.26] km·hr⁻¹; ES=0.65, p<0.001). There was also a significantly greater average speed achieved in games that resulted in a win versus a tie for all positions (MD[95%CI]; FWDs=0.50[0.03,0.98] km·hr⁻¹; ES=0.45, p=0.034, MIDs=0.78[0.23,1.32] km·hr⁻¹; ES=0.62, p=0.003, DEFs=0.58[0.16,1.00] km·hr⁻¹; ES=0.53, p=0.004). For all positions, average speed was greater in games that resulted in a loss versus a win, however this difference was only significant for MIDs=0.40[0.08,0.73] km·hr⁻¹; ES=0.29, p=0.011 and not for FWDs (p=0.25) and DEFs (p=0.06). It should also be noted that the effect sizes between wins and losses were 0.17 (FWDs), 0.29 (MIDs), and 0.20 (DEFs). **CONCLUSION:** Average speed across all positions were greatest in games that result in a loss. This novel data can provide insights to coaches on how game results impact physiological demands by position. Tailored recovery strategies may be derived from this type of data to create a positional specific plan.

1449 Board #43 May 28 9:30 AM - 11:00 AM
An Intermittent Cardiorespiratory Fitness Protocol For Soccer Players

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 (No relevant relationships reported)

Cardiorespiratory fitness (CRF) is important for soccer players who need to sustain intervals of high and low intensity during a match. However, there are few intermittent graded exercise testing protocols integrating high and low intensity intervals to determine CRF. **PURPOSE:** To evaluate a new intermittent treadmill protocol developed to test CRF (maximum oxygen consumption or VO₂max) and recovery in soccer players. **METHODS:** The intermittent CRF protocol consisted of multiple stages of progressively high intensity 2-min intervals interspersed with low intensity 1-min intervals. High intensity intervals were kept at 6.5 mph, with inclination starting at 2.5% with increments of 2.5% with each stage. Low intensity intervals were kept at 4 mph with no inclination. Average VO₂ and heart rate (HR) were determined during the final 15 seconds of the high and low intensity interval of the last 3 stages completed by all participants. Descriptive statistics (mean, standard deviation, proportions) were obtained for all study variables. **RESULTS:** A group of 11 soccer players training and competing in local teams under the Puerto Rico Soccer Federation (Age= 23.0±3.7 yrs) completed the intermittent VO₂max protocol until volitional fatigue. Maximal duration during the intermittent protocol ranged from 13-19 min. Maximal values for VO₂, HR, and respiratory exchange ratio (RER) were 51.1±6.5 ml kg min, 186.6±6.6 bpm, and 1.3±0.2 respectively. In the last high intensity intervals, mean VO₂ was 41.2±3.8, 44.9±4.9, and 48.6±4.5 ml kg min; and mean HR was 161.5±11.4, 171.5±9.2, and 178.1±8.6 bpm. During the last low intensity intervals, mean VO₂ was 35.3±3.2 (37.8±4.4, and 41.6±3.5 ml kg min; and mean HR was 147.2±13.3, 159.6±12.4, and 170.5±9.7 bpm. Recovery intervals represented approximately 85% of VO₂max, and 93% of HRmax. **CONCLUSIONS:** The newly developed intermittent exercise protocol allowed the achievement of VO₂max while providing information about the capacity to recover between high intensity intervals, an important aspect for optimal performance during intermittent events of relatively long duration such as soccer.

1450 Board #44 May 28 9:30 AM - 11:00 AM
Multi-Year Physiological And Performance Profile Of An NCAA Division I Women's Soccer Team

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 (No relevant relationships reported)

The physiological profile of men's soccer players has been well documented; however, there are limited data on women. Therefore, the physiological and performance differences between playing positions within a collegiate women's team is not fully understood. **PURPOSE:** To compare physiological and performance characteristics between the four main soccer positions in a cohort of women. **METHODS:** 53

Division I women soccer players (18.5 ± 1.2 yrs., 168.6 ± 5.3 cm, 64.6 ± 7.4 kg) across four seasons were included in the study, and classified into the following groups; Goalkeepers (GK, n = 6), Defenders (D, n = 17), Midfielders (M, n = 17), and Forwards (F, n = 13). Physiological assessments were performed on the first day of preseason each year and included anthropometric and performance measures (10, 20, and 30m sprint, agility (arrowhead), lower-body power (countermovement jump), aerobic capacity (Yo-Yo IR1 test), and repeated sprint ability). **RESULTS:** Goalkeepers (18.8 ± 1.7 yrs., 172.1 ± 7.3 cm, 68.4 ± 9.0 kg, 20.5 ± 6.4% body fat), defenders (18.4 ± 1.0 yrs., 168.1 ± 3.4 cm, 65.9 ± 8.5 kg, 23.5 ± 7.2% body fat), midfielders (18.9 ± 1.3 yrs., 167.3 ± 5.5 cm, 63.1 ± 5.5 kg, 22.0 ± 4.4% body fat), and forwards (17.9 ± 0.8 yrs., 169.2 ± 5.8 cm, 62.8 ± 7.1 kg, 19.4 ± 3.6% body fat) had similar body composition. There were no significant differences in performance measures based on position; vertical jump (GK 34.9 ± 7.9, D 31.7 ± 4.5, M 32.1 ± 4.0, F 30.8 ± 3.9 cm), 30m speed (GK 4.668 ± 0.232, D 4.669 ± 0.180, M 4.714 ± 0.224, F 4.573 ± 0.149 s), repeated sprint ability (GK 0.973 ± 0.329, D 0.747 ± 0.318, M 0.738 ± 0.516, F 0.616 ± 0.246 s), and aerobic capacity (GK 1070 ± 369, D 1101 ± 311, M 1179 ± 312, F 1142 ± 391 m) (p > .05). **CONCLUSION:** The lack of differences in performance measurements across playing position could be due to team-based training methods selected by the coaches.

1451 Board #45 May 28 9:30 AM - 11:00 AM
Effects Of High-carbohydrate Versus Mixed-macronutrient Meals On Soccer Physiology And Performance

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 (No relevant relationships reported)

PURPOSE: Nutrition guidelines often call for restricting fat, fiber, and protein in pre-competition meals (mainly to limit gut distress), yet there is a lack of direct evidence to support these recommendations. This study compared the effects of pre-competition high-carbohydrate (HCHO) and mixed-macronutrient (MM) meals in division I soccer players during simulated competition. **METHODS:** Fifteen female players participated in this randomized, investigator-blinded, crossover study involving two ~1,000-kcal meals (HCHO and MM) consumed 4 hours prior to 70-minute simulated scrimmages. Assessments included global positioning system (GPS) tracking (total distance covered [TDC], high-speed running [HSR]), heart rate (HR), ratings of perceived exertion (RPE), ratings of fatigue (ROF), gut symptoms, and perceptions of satiety, hunger, and fullness. GPS data were available for a subset of 12 participants. Differences between conditions for HR, RPE, ROF, and gut symptom data were evaluated with Wilcoxon signed-rank tests. GPS data and data from hunger, satiety, and fullness scales were compared using within-subjects repeated measures ANOVAs. Significance was at the p < 0.05 level. **RESULTS:** During the first half, TDC was 3.44 ± 0.30 km for HCHO and 3.43 ± 0.22 km for MM. During the second half, TDC was 3.24 ± 0.25 for HCHO and 3.18 ± 0.18 for MM. A within-subjects ANOVA revealed a time effect (F = 27.3, p < 0.001) but no condition effect (F = 0.18; p = 0.684) or condition x time interaction (F = 0.34; p = 0.571) for TDC. Players did 433 ± 204 m of HSR during the first half for HCHO, in comparison to 416 ± 159 m for MM. The values for the second half were 385 ± 211 and 330 ± 141 m, respectively. A within-subjects ANOVA showed a time effect (F = 6.93, p = 0.023) but no condition effect (F = 0.59; p = 0.459) or condition x time interaction (F = 1.47; p = 0.251) for HSR. No significant differences were found between conditions for HR, RPE, ROF, and gut symptoms during scrimmages. Significant time effects were found for hunger, fullness, and satiety, but there were no condition or condition x time interactions. **CONCLUSION:** This study provides evidence that a MM meal consumed 4 hours prior to soccer competition does not lead to more gut symptoms and can be equally as ergogenic for performance and perceptual responses as a high-carbohydrate meal.

1452 Board #46 May 28 9:30 AM - 11:00 AM
Analysis Of 180 Degree Turn Strategies In Elite Soccer Players

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BACKGROUND: Ability to accelerate, decelerate, and change directions among soccer players are not well studied, especially at elite level. **PURPOSE:** To analyse speed and agility among elite soccer players, especially acceleration, deceleration and change directions at 180 degree turn by each leg, dominant leg (DL) and non-dominant leg (NL).

METHODS: A cross-sectional study was performed. The study participants consisted of 35 soccer players (age = 20.2 ± 0.9 years, height = 187.0 ± 6.5, body mass = 82.1 ± 3.3 kg) who play at top league at Czech professional male soccer league. The participants performed two trials of the agility 505 test, and each leg was used per trial. In addition to time to complete the agility 505 test, movement kinematics were also assessed using 2D kinematic analysis.

Main outcome variables included: initial speed at which a player enters the measured section (v1); final speed at which a player leaves the measured section (v2); deceleration speed before the turn - speed in the third step before the turn (vd3), in the second step before the turn (vd2) and the first step before the turn (vd1), and acceleration speed after the turn in the first step (va1), second step (va2) and the third step (v3). We used Pearson correlation coefficient for analysing the data.

RESULTS: In turning off the right and left leg the subjects' performance times revealed low correlation ($r=.24$ and $p=.165$). Total time to complete the agility 505 test had significant correlations with following parameters when turning with DL: v1 ($r=.79$, $p=.00$), va2 ($r=-.38$, $p=.03$), va3 ($r=-.42$, $p=.01$), vd2 ($r=-.40$, $p=.02$), vd3 ($r=-.50$, $p=.00$) and v2 ($r=-.61$, $p=.00$). Conversely, no significant correlation was found for the remaining variables. However, we found significant correlations between va2 vs vd2 ($r=.69$, $p=.00$) and va3 vs vd3 ($r=.37$, $p=.03$) when DL was used. Interestingly, higher correlations were detected on NL: va1 vs vd1 ($r=.60$, $p=.00$), va2 vs vd2 ($r=.69$, $p=.00$) and va3 vs vd3 ($r=.61$, $p=.00$) compared to DL.

CONCLUSIONS: Findings of this study revealed low correlation between compared sides. The better deceleration phase before 180 degree turn is a key for improving the acceleration phase following the cut. Supported by GACR 19-12150S, UNCE HUM32

1453 Board #47 May 28 9:30 AM - 11:00 AM
Tracking Athlete Wellness And Its Relationship With Activities During A Season In Female Soccer Players
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Performance analysis creates a foundation for performance staff to display findings to coaches and aid in understanding how training loads impact the wellness of each player. Applying an appropriate training load and allowing sufficient recovery will improve an athlete's performance, while reducing the risk of overtraining, injury, and illness. Monitoring individual load and recovery is a critical part of this process and not solely dependent on physical observations. Overtraining can manifest in an array of symptoms that also includes changes in mood, sleep disturbances, stress, and more generalized fatigue. **PURPOSE:** To examine the effects of different activities during a season on daily wellness dimensions. **METHODS:** 25 female soccer players (21±2y) completed daily morning self-administered questionnaires consisting of 5 dimensions of wellness (i.e. fatigue, sleep, muscle soreness, stress, and mood) on a 0 (feeling the worst) - 100 (feeling the best) scale on their computers or mobile devices. Activity on the previous day (i.e. off-day, game, practice, or double practice) was used as an independent variable in assessing wellness scores. **RESULTS:** Type of day did not have a significant effect on fatigue ($p=0.842$), sleep ($p=0.395$), or mood ($p=0.499$). Post hoc analyses revealed self-reported muscle soreness to be significantly worse ($p=0.029$) after game days ($n=8$) than off-days ($n=19$) (difference score = 12) and self-reported stress to be significantly worse ($p=0.049$) after practice days ($n=11$) than after off-days ($n=19$) (difference score = 7). In all dimensions, there was a trend for positive self-reports to be best after off-days and worst after days of double practice. **CONCLUSION:** This study provides evidence that a quick self-administered questionnaire can provide important information about an athlete's wellness. Moreover, off-days (i.e. no activity) are important parts of programming as they generally positively affect the physical and mental health recovery of athletes. Nonetheless, adherence to survey completion declined and value assigned to activities changed throughout the season. As such, future research is needed to further the understanding of how athlete wellness is impacted by and can impact performance during activities across a competitive athletic season.

1454 Board #48 May 28 9:30 AM - 11:00 AM
DIFFERENCES IN HEIGHT AND PERFORMANCE AMONG PLAYERS IN THE 2019 FIFA WORLD CUP
 Ciara N. Manning¹, Yasuki Sekiguchi¹, Courtney L. Benjamin¹, Erin E. Dierickx¹, McKenna R. Spaulding², Jayson R. Spaulding³, Dayshia M. Davenport⁴, Jillian R. Picard-Busky⁵, Douglas J. Casa, FACSM¹. ¹Korey Stringer Institute, University of Connecticut, Storrs, CT. ²Dickinson College, Carlisle, PA. ³Ithaca College, Ithaca, NY. ⁴Louisiana State University, Baton Rouge, LA. ⁵Sacred Heart University, Fairfield, CT. (Sponsor: Douglas J. Casa, FACSM)
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Identifying what constitutes performance in elite athletes is critical in developing a basis and understanding of what to strive for, for athletes and coaches. Next College Student Athlete (NCSA), a recruiting company, lists minimal height provisions for elite female soccer players of 165cm (5'4") across positions. Proclaiming height, an inalterable characteristic, as a measure of performance, is detrimental to athletes and the sport. **PURPOSE:** The purpose of this study is to determine if differences in performance exist among players of different height, ≥165cm and <165cm.

METHODS: Age, height, position, number of assists, and number of goals for 288 female soccer players from the 2019 World Cup were recorded. Players were only included if they played an average of ≥60 minutes when entered into a match. Independent t-tests were used to examine differences between players >165cm and <165cm. Data are reported as mean difference [95% confidence interval] (MD [95%CI]). Statistical significance was set at $p<0.05$, a priori. **RESULTS:** Of athletes <165cm, 31 of 109 (28.44%) were defenders, 18 of 66 (27.27%) were forwards, and 44 of 84 (52.38%) were midfielders. 20.34% of goals and 28.77% of assists were made by players <165cm. Among number of goals made by players <165cm, 58.33% were by forwards and 41.67% by midfielders. Among number of assists made by players <165cm, 42.86% were by forwards, 28.57% by midfielders, and 28.57% by defenders. There were no significant differences between players >165 and players <165 in regard to the number of assists made between forwards and defenders (MD [95%CI], forwards, 0.17[-0.21,0.54], $p=0.908$; defenders, 0.03[-0.19,0.24], $p=0.589$). A statistically significant difference was found in the number of goals scored among forwards of the two height groups (MD [95%CI], 0.41[-1.02,0.20], $p=0.012$). Among midfielders in the two height groups, a significant difference was found in the number of assists and the number of goals made (MD [95%CI], number of assists, -0.44[-0.76,-0.11], $p=0.005$; number of goals -0.35[-0.69,-0.01], $p=0.000$). **CONCLUSION:** Height contributed to performance in number of goals scored by midfielders and forwards, but not in assists among forwards and defenders. 20.34% of goals and 28.77% of assists were by players <165cm.

1455 Board #49 May 28 9:30 AM - 11:00 AM
Height Is Not Predictive Of Starting Nor Playing Time In FIFA World Cup Female Athletes
 McKenna R. Spaulding¹, Yasuki Sekiguchi², Courtney L. Benjamin², Erin E. Dierickx², Ciara N. Manning², Jayson M. Spaulding³, Dayshia M. Davenport⁴, Jillian R. Picard-Busky⁵, Douglas J. Casa, FACSM². ¹Dickinson College, Carlisle, PA. ²University of Connecticut, Storrs, CT. ³Ithaca College, Ithaca, NY. ⁴Louisiana State University, Baton Rouge, LA. ⁵Sacred Heart University, Fairfield, CT. (Sponsor: Douglas J. Casa, FACSM)
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PURPOSE: At the present time, adolescent female athletes are being fed with misinformation on minimal height expectations for attaining elite level soccer success. This is particularly concerning because most adolescent athletes are yet to fully physically mature, and believing the validity of statements on minimal height expectations for elite level success without evidence to substantiate these claims may negatively affect future aspirations of many adolescent females. This study determined if the minimal height criterion of 165cm (5'4"), referenced from Next College Student Athlete (NCSA), is an important part of the female phenotype for playing soccer at the elite level.

METHODS: Descriptive data were collected on the heights, matches played, and minutes played for 552 female 2019 World Cup athletes across 24 team rosters. The data were categorized into those below and those at or above the 165cm height criterion. Odds ratios were calculated to determine if differences existed in the likelihood of being a starter for those players on the team <165cm tall and those on the team ≥ 165cm tall.

RESULTS: On average, 32.25% of players on the 2019 World Cup team rosters were <165cm, ranging from China with 4.35% to Thailand with 60.87%. Of the starters, 30.05% were under 165cm. For players on the team rosters, the odds of starting if they were <165cm (47.43%) were equivalent to the odds of starting if they were ≥ 165cm (47.58%), or .996:1. There were no differences in the number of matches

played (MD=-0.09, ES=-.05; $p=0.59$), minutes played (MD=-15.60, ES=0.09; $p=0.29$), average minutes per game entered (MD=2.01, ES=0.06; $p=0.53$), nor average minutes per total team matches played (MD=2.86, ES=0.08; $p=0.38$) in those <165cm and those ≥ 165 cm.

CONCLUSIONS: This work provides clear evidence that being <165cm in height does not preclude reaching elite World Cup status as a professional female soccer player nor does it impact whether or not a player on the roster serves as a starter, the matches played, or the minutes played. The findings indicate that the 165cm minimal height standard is an ill-informed, biased criterion which has the potential to inhibit successful recruitment efforts for future female elite soccer players.

1456 Board #50 May 28 9:30 AM - 11:00 AM

Energy Availability In Association With Biomarkers During A Division I Soccer Season In Female Athletes

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(No relevant relationships reported)

Low energy availability (EA) is related to adverse physiological effects including hormonal disruption. **PURPOSE:** To evaluate in-season changes in EA and to assess biomarkers related to EA, macronutrient intake, body composition (BC), and exercise energy expenditure (EEE). **METHODS:** Prior to preseason and weeks 2, 4, 8 & 12, female collegiate soccer players (N=11) underwent blood draws to assess thyroid hormones, leptin (LEP), growth hormone (GH), IGF-1, total cortisol (TC) and prolactin (PRL), and BC tests to determine fat free mass (FFM) and percent body fat (%BF). Heart rate monitoring was used to assess EEE/kg during all training. Energy intake (EI), protein (PRO), carbohydrate (CHO) and FAT per kg were tracked via 3-day diet logs. EA was calculated as $EI_{AVG} - EEE_{AVG} / FFM$ for each time block. RM-MANOVAs with univariate follow-ups assessed change in energy status, BC and EEE. Area under the curve (AUC) was calculated for biomarkers, EA, macronutrients and BC. Pearson-product correlations assessed AUC relationships with significance set at $P<.05$. Trends were considered $P<0.1$. **RESULTS:** Time main effects were seen for all macronutrients, EA, EI and EEE, with the highest values seen during preseason ($P<.05$). Time main effects were seen with increases in FFM and declines in %BF ($P<.05$). EA correlated with FFM ($r=-.67$), GH ($r=-.63$), PRL ($r=-.65$) and $FreeT_4$ ($r=-.69$). %BF correlated with TC ($r=.70$) and LEP ($r=.71$), with a trend for T_4 ($r=.55$). FFM correlated with PRO ($r=-.65$), with trends for FAT ($r=-.57$), IGF-1 ($r=-.58$), $FreeT_4$ ($r=-.53$) and CORT ($r=-.57$). PRO correlated with GH ($r=.73$), PRL ($r=.75$) and $FreeT_4$ ($r=.61$), with a trend for EEE ($r=.53$). FAT correlated with GH ($r=.65$), PRL ($r=.76$) and $FreeT_4$ ($r=.60$), with a trend for IGF-1 ($r=-.57$). CHO correlated with LEP ($r=.60$) and PRL ($r=.62$). EEE correlated with LEP ($r=-.63$) and trended with PRL ($r=.56$). **CONCLUSIONS:** EA was reportedly highest in preseason and declined as the season progressed, despite increases in FFM. Adherence and accuracy challenges with self-reported EI limits the feasibility of this method in teams. Associations between BC, EEE and markers of stress/metabolism point to the efficacy of biomarker monitoring as a method to assess metabolic status and recovery in athletes, thus enabling in-season adjustments to training and nutrition. Funding by Quest Diagnostics

1457 Board #51 May 28 9:30 AM - 11:00 AM

The Relationship Between Time-lagged Acute:Chronic Work Ratios And Physical Performance In Collegiate Soccer Players

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Acute:chronic work ratios (ACWR) reflect the balance between fitness and fatigue. To allow for athlete recovery and preparation for match play, training load tends to decrease prior to a match. Training load and ACWR has been related to injury risk in elite athletes, but the relation with physical performance is not well defined. **PURPOSE:** To assess the relation between training load trends and ACWR in the three days prior to competitive matches and match-related physical performance. **METHODS:** Male (n=26) collegiate soccer players (Mean \pm SD; 20 \pm 1y; 75.83 \pm 5.90kg; 178.5 \pm 6.8cm) wore GPS enabled heart rate monitors during training and match days over two collegiate seasons. Exponentially weighted moving averages were calculated from training load (TL) where acute (7 d), chronic (28 d), and ACWR (7/28 d) parameters were computed. ACWR was time-lagged by -1 (ACWR₋₁), -2 (ACWR₋₂), and -3 (ACWR₋₃) days relative to each match. The linear trend of training load (TL_{trend}) in the three days prior to a match was calculated for each player. Physical performance was assessed by total distance (TD), and number of sprints (SP), maximal accelerations (AC), and maximal decelerations (DC). Conditional growth models assessed the relations between match performance and ACWR at each lag and TL_{trend}. **RESULTS:**

ACWR₃ produced the most robust relations with physical performance. One SD above a given player's mean ACWR₃ resulted in increased performance in the match relative to their mean within-match performance, with an additional 948m ($p<0.001$) of TD, 2.27 ($p<0.01$) additional SP, and 1.77 ($p<0.01$) more AC. TL_{trend} was independently and negatively associated with TD ($p<0.001$), SP ($p<0.001$), and AC ($p<0.001$). On average, players decreased training load by 17.80 \pm 64.90 units per day leading into a match. When applying this average, model results suggest players would complete 265.75m additional TD ($p<0.001$), 0.71 additional SP ($p<0.01$), and 0.53 additional AC ($p<0.001$) above their mean within match performance. **CONCLUSIONS:** The ACWR appears to be associated with additional within-match external load. Greater decreases in TL prior to a match may allow improved recovery, leading to increased physical capacity within the match. This study was funded in part by the National Collegiate Athletics Association.

1458 Board #52 May 28 9:30 AM - 11:00 AM

Monitoring Recovery Via Salivary Testosterone And Cortisol Changes In Collegiate Soccer Athletes

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Changes in testosterone and cortisol have been evaluated as physiological markers of the physical demands of a competitive event. The testosterone to cortisol ratio (T:C) ratio has been used as indicator of anabolic-catabolic imbalances, with a high T:C representing a positive anabolic state whereas a decline in T:C serving as a marker of overtraining. **PURPOSE:** To evaluate changes in salivary testosterone and cortisol immediately prior to pre-season training (PS), before (PreGame) and after (PostGame) a competitive game and at 12 (Recovery12hr) and 36 hours (Recovery36hr) following the competitive event in Division I men's soccer athletes. **METHODS:** 19 male soccer athletes (age: 18 \pm 1yrs; body fat: 11.0 \pm 3.1%). PS salivary samples were collected in August. PreGame and PostGame salivary samples were collected an hour before the start of the fourth game of the season and within 15 minutes after the game's completion. Recovery12hr samples were collected 12 hours later, prior to next morning practice and Recovery36hr were collected prior to the subsequent day's practice. Salivary samples were analyzed via ELISA to measure testosterone, cortisol and the T:C. ANOVAs were used for analysis with significance accepted at $p<0.05$. **RESULTS:** PostGame testosterone levels (244 \pm 108pg/mL) were similar to PreGame levels (174 \pm 69pg/mL; $p=0.056$). Recovery12h (410 \pm 92pg/mL) and Recovery36hr (398 \pm 147pg/mL) were both significantly greater than PreGame (174 \pm 69pg/mL) and PostGame (244 \pm 108pg/mL) levels ($p<0.001$). When compared to PreGame levels (0.204 \pm 0.10 μ g/dL), cortisol was significantly greater at PostGame (0.704 \pm 0.51 μ g/dL), Recovery12h (0.510 \pm 0.21 μ g/dL), and Recovery36hr (0.484 \pm 0.21 μ g/dL) ($p<0.05$). There were no differences in cortisol levels between PostGame, Recovery12h, and Recovery36hr. The T:C was significantly lower at PS than all other timepoints ($p<0.001$). T:C significantly declined from PreGame to PostGame (-501 \pm 140; $p=0.028$), but returned to PreGame levels at Recovery12h, and Recovery36hr. **CONCLUSIONS:** The PreGame to PostGame decline in T:C suggests that the demands of the game placed the athletes in a catabolic state. However the rise in T:C back to PreGame levels at Recovery12h, and Recovery36hr indicates the athletes were able to optimally recover in the days following competition.

1459 Board #53 May 28 9:30 AM - 11:00 AM

Fat Mass Index Is Associated With Lower Anaerobic Power In Professional Soccer Players

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(No relevant relationships reported)

PURPOSE: To analyze the association between fat mass index (kg/m²) and anaerobic power.

METHODS: We evaluated 24 professional male soccer players aged 18 to 35 y. We assessed their fat content with a whole-body dual-energy x-ray absorptiometry (DXA) scan, and then we adjusted the fat mass (kg) by squared height in meters (m²) to calculate the fat mass index for the whole body, legs, and trunk. Anaerobic power was assessed with a 30s Wingate test to obtain three variables: peak power, average power, and power drop. All adjusted for body mass. The association between the fat mass index and anaerobic power was analyzed with linear regression. Descriptive statistics were reported as median (25th - 75th percentiles).

RESULTS: Fat mass index for the whole body, legs, and trunk were 2.9 (2.6 - 3.7), 1.1 (1.0 - 1.5), and 1.4 (1.2 - 1.9), respectively. For peak power, average power, and power drop, the participants showed 12.2 (11.6 - 13.2) W/kg, 9.2 (8.8 - 9.7) W/kg, and 0.21 (0.18 - 0.24) W/kg/s, respectively. The fat mass index was not significantly

associated with peak power nor power drop for any of the analyzed sections (whole body, legs, and trunk). However, it was significantly associated with average power for all sections. This association was better described by the fat mass index at trunk than for the whole body and legs.

CONCLUSIONS: Higher fat mass index is associated with lower average anaerobic power in professional soccer players. Nonetheless, the trunk fat mass index appears to be more relevant to explain this association.

		Slope	Intercept	R ²	SEE	p
Whole body	Peak power (W/kg)	-0.81	15.3	0.09	2.23	0.15
	Average power (W/kg)	-0.52	10.8	0.41	0.55	<0.001
	Power drop (W/kg/s)	0.005	0.198	0.01	0.055	0.71
Legs	Peak power (W/kg)	-2.32	15.5	0.11	2.21	0.12
	Average power (W/kg)	-1.09	10.5	0.25	0.61	0.012
	Power drop (W/kg/s)	0.002	0.211	0.01	0.055	0.94
Trunk	Peak power (W/kg)	-1.07	14.4	0.05	2.28	0.29
	Average power (W/kg)	-0.96	10.7	0.44	0.23	<0.001
	Power drop (W/kg/s)	0.016	0.189	0.02	0.055	0.051

1460 Board #54 May 28 9:30 AM - 11:00 AM
Implications Of Accurate Maximal Heart Rate Parameters In Soccer Players Using Team Monitoring System
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(No relevant relationships reported)

Team heart rate monitors system is widely used in sport and fitness settings. Determining accurate HR_{max} parameters is essential for proper exercise prescription and evaluation of training sessions. **PURPOSE:** To examine the implications of accurate maximal heart rate assessment methods on training intensity determined by team heart rate monitoring system for a single soccer training session. **METHODS:** Nineteen female college soccer players were monitored using heart rate team system during a 114-minute tactical technical training session. Heart rate was recorded in beats per minute (bpm) every 0.1 sec. Maximal heart rate (HR_{max}) was determined using three methods: age-predicted 220-age formula, during iopreseason and post-season graded treadmill maximal exercise protocols (GXT). Time spent in ≥80% and ≥90% of HR_{max} was calculated for each HR_{max} assessment value for the training session. Descriptive statistics were performed for all variables. Paired t-test was used to determine differences in peak heart rate values obtained from pre- and post-season GXT protocols. Time spent in ≥80% and ≥90% of HR_{max} was calculated for each player and reported in percentages of the entire training session. Alpha was set at <0.05. **RESULTS:** HR values from pre and post season GXT testing were significantly different (192±7.7 bpm vs 198 ±5.9 bpm respectively, p=0.02). Mean time spent in ≥90% was 21.5±11.8% vs 13.9±10.6% vs 10.8±11.8% bpm for HR_{max} for from preseason, postseason and age predicted formula respectively and difference significantly between the groups (p=0.02). Mean time spent in ≥80% was 42.9±15.8% vs 36.6±15.3% vs 36.4±15.7% bpm for HR_{max} for from preseason, postseason and age predicted formula respectively with no significant differences between the groups. **CONCLUSIONS:** Maximal GXT more useful than age-prediction formula for HR_{max} parameters when establishing player physiological parameters in preseason player profile when using team heart rate monitoring system. High intensity sessions above 90% of HR_{max} can be incorrectly evaluated impacting training and player recovery.

C-36 Free Communication/Poster - Winter Sports

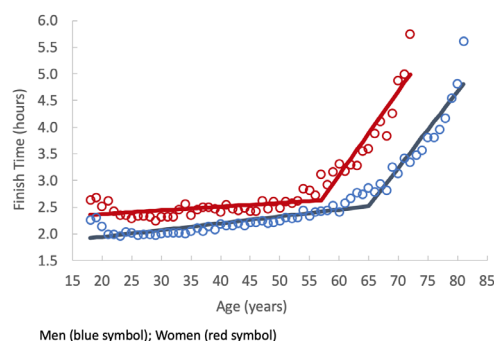
Thursday, May 28, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

1461 Board #55 May 28 9:30 AM - 11:00 AM
The Effect Of Age On Finish Time In The American Birkebeiner
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(No relevant relationships reported)

The American Birkebeiner (AB) is the largest annual Nordic ski event in the United States showcasing the long-course competitions of the 50K freestyle and 55K classic technique. **Purpose:** The purpose of this investigation is to describe the effect of aging on the finish times of skiers who have completed at least one AB race from 1999 to 2019 inclusive. **Methods:** We followed 22,004 (3.3 men:1 women) individual skiers ≥18yo using publicly available data. Finish times were standardized to 50K for freestyle and 55K for classic. A subset of the top 3 finish times at each year of age was selected and mean (N=3) finish times were fit to multivariate adaptive regression splines (MARS) in R for sex and technique. A single knot was iteratively fit to the model with the lowest mean square error (MSE) to show the age at which finish times increase significantly (Table 1). **Results:** Freestyle finish times for women are significantly higher compared to men at each year of age becoming progressively more pronounced at age 57 compared to age 65 in men (Fig. 1). Similarly, women skiing classic style (Fig. 2) reach an earlier breakpoint at age 61 compared to men at age 70. **Conclusion:** Overall, women's AB finish times are higher than men and begin a sharp increase in finish time 8-9 years before men.

Technique	Sex	Age_Span	Slope	R ²
Freestyle	Men	18-65	0.013	0.95
		65-81	0.143	
	Women	18-57	0.007	0.93
	57-71	0.157		
Classic	Men	18-70	0.017	0.96
		70-83	0.248	
	Women	18-61	0.013	0.90
	61-72	0.196		

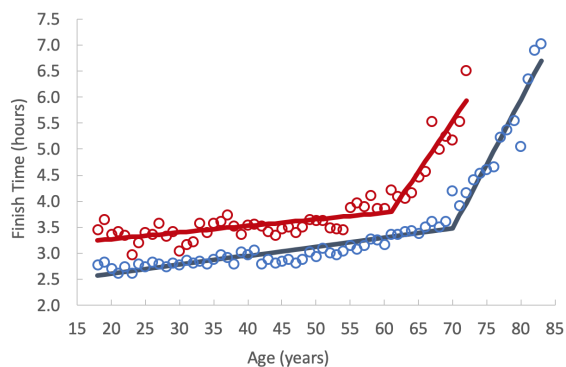
Figure 1: Freestyle



Men (blue symbol); Women (red symbol)

THURSDAY, MAY 28, 2020

Figure 2: Classic



Men (blue symbol); Women (red symbol)

1462 Board #56 May 28 9:30 AM - 11:00 AM
Biometric And Performance Data In American Junior Nordic Combined And Ski Jumping Athletes
 Brian Sutterer, Jonathan T. Finnoff, FACSM, John H. Hollman. *Mayo Clinic, Rochester, MN.* (Sponsor: Jonathan T. Finnoff, FACSM)
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Nordic Combined (NC) and Ski Jumping (SJ) require particular athletic abilities and physical attributes for optimal performance. For instance, SJ requires particular focus on jumping technique and explosiveness, whereas the cross country ski portion of NC involves aerobic energy delivery, skiing efficiency, and power generation. Coaches and athletes monitor various performance metrics throughout the year to determine response to training and, hopefully, predict future performance. Normative data for these metrics has been analyzed in elite SJ and NC athletes but there is limited information regarding junior athletes. **PURPOSE:** Present normative biometric and performance testing data of American junior NC and SJ athletes and compare differences between age and sex.

METHODS: A retrospective cohort study was completed evaluating data collected on 299 NC and SJ athletes ages 7-19 tested as part of USA Nordic's normal preseason evaluations between 2012-2018. Body mass index, static standing jump and countermovement jump height, various broad jump distances, timed agility testing, and 20 meter sprint times were collected and analyzed for differences between age and sex. **RESULTS:** Body mass index was greater in females than males. The interaction between age and sex was significant for static jump height, all broad jump metrics, time agility testing, and 20 meter sprint time. Jump power was greater in females than males. No difference was found between sex or across age in countermovement jump height.

CONCLUSIONS: This was the first study to report biometric and performance data in junior American NC and SJ athletes. Our findings provide valuable normative information and identified several age and sex related differences in these athletes. These findings can be used by other junior athletes and their coaches for comparison purposes and when developing training programs.

1463 Board #57 May 28 9:30 AM - 11:00 AM
Physiological Demand Of Ice Hockey Officiating Across Competition Levels And Officiating Systems
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Ice hockey is an intense sport that requires a combination of anaerobic power and aerobic capacity. Traditionally, research has focused on the athletes, but on-ice officials are also subjected to a large physical demand during games. Across all hockey competition age levels, officials serve in various configurations (two-, three-, and four-official systems) and perform roles as a referee (REF) or linesman (LIN). Different systems and roles lead to varying physiological demands and responsibilities. Currently, no previous study has examined the demand placed on hockey officials across various competition levels. **PURPOSE:** To examine the demand on hockey

officials across competition levels, officiating systems, and officiating roles.

METHODS: Ice hockey officials ($n = 17$, 37.7 ± 9.3 yr, 175.6 ± 4.9 cm, 86.1 ± 9.1 kg) were monitored during USA Hockey youth games, and collegiate hockey games. Chest-worn heart rate monitors with built-in accelerometry were used to record heart rate (HR), caloric expenditure (CE), speed, and distance during hockey games. Lower age classifications utilize a two-official system, while higher-level games utilize three officials (one REF, two LIN). The collegiate games in this study all utilized a four-official system (two REF, two LIN). Analyses of variance and *t*-tests were used to detect significant differences across competition levels, systems, and roles. Alpha of 0.05, 2-sided was set *a priori* as a significance level. **RESULTS:** Significant differences were detected across competition levels for distance, training load, and CE ($p \leq .001$). Mean values for each variable increased as competition level increased. Across officiating systems, distance, training load, and CE significantly increased ($p \leq .010$) from two- to three-official systems. However, the four-official system had significantly lower values for average HR and CE ($p \leq .030$). **CONCLUSION:** Hockey officiating is physiologically demanding and impacted by competition level and systems. Across competition levels, no significant differences were found for calories/hour ($p = .498$), indicating a similar rate of demand on officials in all levels of play. Demands on REF are greater in three-official systems compared to four-official systems, where demands are similar between REF and LIN, justifying its use in higher-level games.

1464 Board #58 May 28 9:30 AM - 11:00 AM
Practice And Game Internal Demands Of Men And Women Varsity Ice Hockey Players
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Purpose: The purpose of this study was to quantify and compare internal load, using training impulse (TRIMP) and sessional rating of perceived exertion (sRPE), of men and women varsity ice hockey players during a practice and game. **Methods:** Data (mean \pm SD) were collected for 26 male (22.1 ± 1.1 yr, 85.9 ± 5.4 kg, 181.3 ± 5.1 cm) and 24 female (19.8 ± 1.4 yr, 68.0 ± 6.9 kg, 168.1 ± 5.9 cm) varsity ice hockey players. On-ice internal load was reported TRIMP (Arbitrary Units, AU), measured using HR monitors worn on the upper arm, and sessional rating of perceived exertion (sRPE, AU), using the Borg 10 RPE scale with time on-ice during one practice and one home game of the regular season. **Results:** During the 75 min practices, the mean HRmax values for males and females were 183 ± 8 and 177 ± 14 bpm, indicating a high intensity for both with no significant difference between sexes ($p=0.124$). During the games (15-min warm-up and 3 X 20-min periods), the mean HRmax values for males and females were 178 ± 24 and 190 ± 5 bpm, with the females significantly higher than the males ($p=0.044$). The TRIMP scores for the males were 109 ± 49 and 91 ± 57 AU for the game and practice and not significantly different ($p=0.263$) and the sRPE scores were significantly ($p=0.044$) higher during the game (457 ± 234) vs. practice (346 ± 222 AU). The TRIMP scores for the females were 79 ± 25 and 94 ± 56 AU for the practice and game and not significantly different ($p=0.261$) and the sRPE were also not significantly different ($p=0.445$) between the practice (348 ± 152 AU) and game (390 ± 225 AU). Males had a significantly greater TRIMP ($p=0.012$) and sRPE ($p=0.029$) compared to females during the practices but there were no significant differences in TRIMP ($p=0.875$) or sRPE ($p=0.487$) between males and females during the game. Overall, there was a significant positive correlation between TRIMP and sRPE ($p=0.029$) but when separated into males and females, there was a significant correlation for the males ($p=0.032$) but no significant correlation for the females ($p=0.770$). **Conclusion:** Preliminary data suggests no differences in internal loads between practices and games for females, but game loads exceeded training loads for males. Furthermore, training loads were higher for males compared to females, however game loads were similar.
 Supported by a grant from Mitacs and PepsiCo.

1465 Board #59 May 28 9:30 AM - 11:00 AM
External Loads Of Men'S And Women'S Varsity Ice Hockey Players During A Practice And Game
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 (No relevant relationships reported)

Purpose: To quantify and compare the external load demands of men's and women's varsity ice hockey players during one practice and game using a local positioning system (LPS). **Methods:** Female ($n = 24$, 19.8 ± 1.4 yr, 68.0 ± 6.9 kg, 168.1 ± 5.9 cm) and male ($n = 26$, 22.1 ± 1.1 yr, 85.9 ± 5.4 kg, 181.3 ± 5.1 cm) varsity ice hockey players consented to wear a player-tracking sensor (accelerometer, gyroscope, and magnetometer) during one practice (P) and one game (G) in an arena outfitted with an

LPS. On-ice measures (mean ± SD) included accelerations, decelerations, accumulated acceleration load, distance travelled, and skating speed. **Results:** The average number of accelerations per skater were not different for females (P: 30.7 ± 12.6 vs. G: 26.6 ± 10.3; p=0.259) but were significantly greater in P than G for males (71.6 ± 26.7 vs. 48.0 ± 23.2; p=0.004). The average number of decelerations followed a similar trend between P and G for females (38.9 ± 14.7 vs. 47.5 ± 18.6; p=0.101) and males (79.6 ± 27.8 vs. 56.0 ± 24.8; p=0.006). Average peak acceleration did not differ between P and G for females (3.7 ± 0.7 vs. 3.6 ± 0.5 m/s²; p=0.586) or males (4.2 ± 0.5 vs. 4.3 ± 0.8 m/s²; p=0.591), while accumulated acceleration load was higher for P vs. G only for females (138.4 ± 23.1 vs. 165.0 ± 40.5; p=0.012). There was no difference in P or G distance travelled for females (4577.7 ± 1127.7 vs. 5332.6 ± 1614.5 m; p=0.084) or males (6439.8 ± 1456.0 vs. 7485.3 ± 2495.2 m; p=0.096). Although P and G peak skating speed was similar for females (29.3 ± 5.0 vs. 27.7 ± 3.9 m/s; p=0.236) and males (32.6 ± 3.6 vs. 30.8 ± 4.1 m/s; p=0.128), average P skating speed was lower than G for both females (3.7 ± 0.9 vs. 7.0 ± 2.0 m/s; p<0.001) and males (5.4 ± 1.5 vs. 6.7 ± 1.9 m/s; p=0.005). Males had significantly greater accelerations (count and peak), accumulated acceleration load, distance travelled, and peak skating speed in P and G compared to females (p<0.019). Peak decelerations and average speed in P and G did not differ between females and males (p>0.05). **Conclusion:** Preliminary data captured using an LPS suggests that several components of external load are different between P and G for female and male ice hockey players. Furthermore, the external load of ice hockey appears to be greater in males than females. This research was funded by a grant from Mitacs and PepsiCo.

1466 Board #60 May 28 9:30 AM - 11:00 AM
Comparison Of Off-ice And On-ice Performance Tests In Collegiate Ice Hockey Players

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(No relevant relationships reported)

Ice hockey is a high-intensity sport that requires optimally performing energy systems to compete at an elite level. Typically, off-ice performance tests are used to evaluate player fitness, but little is known about their relationships to on-ice tests.

PURPOSE: To compare performance, blood lactate (LAC), and heart rate (HR) obtained during off- and on-ice fitness tests in collegiate ice hockey players.

METHODS: Nineteen male, collegiate ice hockey players, (age=18-24 yr; ht=1.81±0.05m, wt=84.9±4.74 kg) were assessed off-ice using a discontinuous, incremental treadmill (TM) test. 3-min run stages were separated by 90-sec rest, until players reached volitional exhaustion. The on-ice test, in full gear, was a repeated shift ability (RSA) test consisting of eight, ~22-sec stages of maximal effort skating with 90-sec rest between stages. Fatigue decrement index (FDI) was calculated by subtracting fastest from slowest RSA stage times. During both tests, fingerstick LAC was obtained during rest intervals and HR was measured continuously. Spearman correlations were used to assess the relationship between TM completion time and FDI, as well as the relationships in Stage4 LAC and HRrecovery between off- and on-ice tests.

RESULTS: TM times to exhaustion averaged 19.8±1.1 min, and RSA times averaged 22.0±0.4 sec. Correlations revealed no relationship between TM time and FDI (r=0.301, ns). Average HRmax during the TM tests was 192±6 bmin⁻¹ versus highest achieved HR of 175±9 bmin⁻¹ (91% of TM HRmax) during the RSA tests. For the TM tests, Stage4 LAC and HRrecovery averaged 10.2±2.8mmol and reduction to 76±8% HRmax, respectively. For the RSA tests, Stage4 LAC and HRrecovery averaged 13.3±1.9mmol and reduction to 74±4%HRmax. Stage4 TM and RSA LAC values were significantly related (r=0.52, p<0.05); however no significant relationship existed between Stage4 TM and RSA values for HRrecovery (r=0.34, ns).

CONCLUSION: The lack of relationship between TM time and FDI was expected given the two tests' emphases on different energy systems and the homogeneity of the athletes' overall fitness. Moderate to high correlation found between LAC measures, regardless of test modality, supports previous research from our lab indicating the predictive value of LAC measures on ice hockey player performance.

1467 Board #61 May 28 9:30 AM - 11:00 AM
Collegiate Club Figure Skater Lower Extremity Performance Assessment Bilaterally In And Out Of Skates

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Prior research has demonstrated that the most prominent injury among all figure skaters involved the ankle. This finding is surprising in that the skate boot itself is quite stiff with lateral rigidity meant to offer medial-lateral support to the ankle joint. A clinical literature review suggested that there should be emphasis placed on properly fitting skate boots, intrinsic foot and ankle strengthening, and lower extremity

flexibility. **PURPOSE:** To determine if the skate boot plays a role in ankle range of motion, balance or lower extremity power, all three of which may be linked to ankle injuries. **METHODS:** 20 members of the Merrimack Figure Skating Team participated in the study. Testing was conducted with skates on followed by skates off. Odd numbered participants started with their dominant leg, even numbered participants started with their non-dominant leg. Weight bearing dorsiflexion (DF), Y-balance test (YB), and single leg hop for distance (SL) were performed and measured bilaterally. **RESULTS:** No significant interaction was reported for DF, YB, or SL between skate type (no skate vs. skate) and leg dominance (dominant vs. non dominant), (p >.05). DF, YB, and SL were significantly higher when subjects were in no skates (MDF-NOSK = 28.8; MYB-NOSK = 93.61; MSL-NOSK = 123.45) compared to when in skates (MDF-SK = 11.15; MYB-SK = 85.89; MSL-SK = 101.51), (p = .00). SL was also higher on the dominant leg (MSL-DOM = 114.21) compared to the non-dominant leg (MDF-NONDOM =110.75) (p = .01). DF and YB were not statistically different between the dominant and non-dominant leg. **CONCLUSION:** The results suggest with lower extremity performance testing in collegiate figure skaters leg dominance does not impact ankle range of motion or balance. However, with lower extremity power, leg dominance does play a role. The findings that range of motion, balance, and power are greater without skates than with the skates, it is plausible to conclude that the skate boot does in fact play a role in these three measurements. Further research is needed in order to examine the specifics of how the skate boot affects each of these measurements.

1468 Board #62 May 28 9:30 AM - 11:00 AM
Differences In Absolute And Relative On-ice Workload Metrics Among National Junior Ice-hockey Teams

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PURPOSE: Use player worn sensors (PWS) to measure and compare absolute and relative training load metrics for U17 and U18 Junior National ice hockey teams during practices and games.

METHODS: 90 total members of two teams (U17, n= 45 and U18, n= 45) of the National Team Development Program (16.6±2.1y, 17.5±2.7y) consented to procedures approved by the EMU-HSRC. Zephyr BH-3 (Zephyr, MD) PWS measured triaxial accelerations (g's) for all on ice practices (P) and games (G). Dynamic Accelerations (DYNA) were generated from exponentially weighted accelerations and Dynamic Functional Threshold (DFT) from peak 30 min DYNA within a 2 week moving window. Intensity Factor (IF) and Individual Hustle Score (IHS) were derived from session and 30 min DYNA relative to DFT, respectively. Dynamic Training Load (DTL) for a single session was derived from the IF and the session duration. DTL was used as the input for a model to calculate Chronic Training Load (CTL), Acute Training Load (ATL) over a given amount of time. MANOVA was used to compare metrics by session type, (G) vs (P), and between teams for main effects (α=.05).

RESULTS: : For G, duration was not different between teams. However, 30 minute and session DYNA, as well as DTL and IHS, were lower for U18 (0.360±0.056, 0.293±0.052, 176.2±55.2, 0.904±0.131) than U17 (0.372±0.044, 0.307±0.038, 187.3±44.3, 0.928±0.092; p<0.05). In P, duration was higher in U18 (1.93±0.53) than U17 (1.74±0.50; p<0.05). 30 minute and session DYNA were not different between teams, but IHS and IF were lower for U18 (0.894±0.112, 0.768±0.098) than U17(0.897±0.101, 0.790±0.096; p<0.05). Despite lower IHS and IF, DTL was higher for U18 (114.4±35.9) than U17(109.8±38.6; p<0.05). Overall, for P and G, duration was longer for U18 than for U17 (2.35±0.79, 2.21±0.83; p<.05). IF and IHS were lower for U18 (0.757±0.111, 0.895±0.119) than U17 (0.783±0.094, 0.907±0.100; p<0.05). CTL and ATL were higher for U18 (69.9±14.8, 85.1±24.4) than U17 (63.5±17.3, 77.2±25.3).

CONCLUSIONS: Relative intensity measures, such as IHS and IF, were more sensitive in determining load than absolute, unnormalized measures such as DYNA. Duration of training sessions were longer for U18, leading to higher CTL even with lower intensity. This may be of importance as higher CTL has been associated with higher fitness and resilience to injury.

1469 Board #63 May 28 9:30 AM - 11:00 AM
Comparative Analysis Of Major Junior Hockey Athletes During Pre-season Off-ice Performance Assessments

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(No relevant relationships reported)

Ice hockey is a physiological challenge; stressing the metabolic systems, power, speed, agility, strength, and endurance. These components are commonly assessed with off-ice performance evaluations featured at the National Hockey League (NHL) combine. **Purpose:** Evaluate pre-season, off-ice combine assessments in major junior

ice hockey athletes. **Methods:** During 2018 and 2019 pre-season training camps, prospective athletes participated in NHL combine style assessments. Tests included vertical jump via Vertec, broad jump via meter tape, timed 20m dash, timed pro-agility run, timed 300m shuttle, timed 2-mile run, hand-grip dynamometer, pull-up repetitions, and 135lbs bench press repetitions. Height and weight were measured via stadiometer and scale, respectively, with values used to calculate body mass index. For data analysis, athletes were categorized into offense and defense with goalies removed due to position specificity and small sample size. Descriptive statistics and comparative analysis, mixed methods regressions, were performed using SPSS (version 24.0) with significance at $p \leq 0.05$. **Results:** Athletes selected ($n=48$) had higher bench press repetitions (19 ± 6 ; $F=26.023$, $P=0.000$), pull-up repetitions (11 ± 4 ; $F=11.810$, $P=0.001$), faster pro-agility values (4.78 ± 0.23 sec. right, 4.75 ± 0.23 sec. left; only left was significantly different ($F=5.473$, $P=0.022$), and had greater grip strength values (59 ± 10 kgs right, 61 ± 9 kgs left; only left was significantly different; $F=5.489$, $P=0.022$) than athletes dismissed ($n=26$; 11 ± 7 rep, 8 ± 3 rep, 4.89 ± 0.22 sec. right, 4.88 ± 0.25 sec. left, 55 ± 9 kgs right, 56 ± 11 kgs left). Further, athletes selected were older (17.8 ± 1.4 yrs.; $F=13.904$, $P=0.000$), and achieved greater broad jump values (103.2 ± 6.7 ins.; $F=20.699$, $P=0.000$) than athletes dismissed (16.6 ± 1.0 yrs., 96.4 ± 5.1 ins.). Defensive athletes were taller (73.2 ± 2.2 in.; $F=4.283$, $P=0.040$) and had greater left (67 ± 8 kgs.; $F=13.915$, $P=0.001$) and right (67 ± 8 kgs.; $F=16.027$, $P=0.000$) grip strength values than offensive athletes (70.9 ± 2.7 in., 58 ± 8 kgs. Left, 55 ± 10 kgs. Right). **Conclusion:** Selected athletes were older and exhibited superior power output, muscular endurance, and muscular strength. Defensive athletes were taller, and excelled in areas of muscular strength, endurance, and power.

1470 Board #64 May 28 9:30 AM - 11:00 AM
On-ice Energy Cost And Lactate Production During An All-out Anaerobic Test In Ice Hockey Players

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The lack of ice hockey-specific lactic anaerobic assessment tools limits the ability of coaches to better track and develop their players. **PURPOSE:** Establish two predictive equations for assessing indirectly 1) the O_2 energy expenditure, and 2) the maximum lactate concentration following an all-out on-ice skating effort. **METHODS:** Twenty male elite ice hockey players participated in this study (age=15.7±1.0 year). The maximal anaerobic skating test (MAST) consisted of skating back and forth on an 18.2m course at maximal speed with abrupt stops at each end for a total of 12 shuttles (average time=52.0±2.0s). The O_2 energy cost was measured using a portable metabolic analyzer (Cosmed K_4^2) and the maximum post-exercise lactate concentration at 1, 3, 5, 15, and 20 min was measured with a Lactate Pro analyzer. The independent variables used to estimate O_2 consumption were body mass, time, heart rate, and the number of skating strides and skating stride index both measured at the 2nd shuttle. For the lactate concentration estimation, the independent variables used were time, heart rate, and the number of skating strides and skating stride index both measured at the 6th shuttle. **RESULTS:** Correlation coefficients for both equations were $r=0.87$ and standard error of estimate (SEE) were 6.2% and 6.8% respectively for O_2 uptake and lactate production, indicating that validity of the regression algorithms were excellent. Particularly for the estimation of the lactate level, the removal of variables in relation to the skating efficiency reduces the correlation to 0.49 and increases the SEE to 10.5% thus indicating the importance of considering an index of skating efficiency during this type of evaluation. **CONCLUSIONS:** To our knowledge, there is no specific ice hockey field test allowing the indirect estimation of O_2 cost and lactate concentration in a purely anaerobic test. Thus, using simple and easy-to-measure variables, coaches will be able to monitor more effectively their players' progress in an effort to optimize their individual on-ice anaerobic performance.

1471 Board #65 May 28 9:30 AM - 11:00 AM
Analysis Of Test Battery For Elite Ice Hockey Players

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PURPOSE: The purpose was to conduct a test battery on elite ice-hockey players to better understand the relationships between the different assessments. **METHODS:** Subject's ($n=41$) physical characteristics were measured prior to testing session. Countermovement Jump (CMJ) height was estimated with a Bosco mat. Stationary Broad Jump (BJ) distance was measured from toes (starting line) to the closest heel. The best of 2 completed attempts was retained for both jump tests. On-ice repeated sprints' time was measured with photo cells timing gates (TCi Smart Start, Brower Timing System, Utah, USA). Protocol consisted of 9 sprints of 40 m with 3 seconds

of recovery between sprints that permitted subjects to turn around and return to the finish line which now became the starting line for the next sprint. Heart rate was measured with a heart rate (HR) monitor (RS400, Polar, FI). Local muscle oxygenation (SmO_2) was measured on vastus lateralis with a muscle oxygen monitor (MOXY, Minnesota, USA). Blood lactate ($[La^-]$) was measured with a lactate analyzer (Lactate Pro, Akray, Japan). Rated Perceived Exertion (RPE) was measured with a Borg Scale (6-20). Correlations were calculated (SPSS Ver 25) using a 2-tailed Pearson correlation analysis. Significance was set at $p < 0.05$. Subjects characteristics are presented as means and standard deviations. **SUMMARY OF RESULTS:** Multiple significant ($p < 0.05$) relationships were observed ($r = -0.47$ -0.81). Findings show that age ($r = -0.53$ -0.51), years of experience in resistance training ($r = -0.32$ -0.48), weight ($r = -0.33$ -0.47) and lean body mass (-0.38 -0.46) were significantly correlated with jump and on ice sprint performance (Speed, Time, $[La^-]$ and RPE). The CMJ seems to be more important than the BJ for on ice sprint performance ($r = -0.53$ -0.40 vs -0.19 -0.28). Maximal HR is significantly correlated with fatigue index ($r = 0.41$). The Borg scale seems to be a good tool to see if hockey players gave a maximal effort as it presents multiple significant correlations with sprint performance ($r = -0.37$ -0.34). SmO_2 was significantly correlated with $[La^-]$ ($r = -0.35$). **CONCLUSION:** Results of the present study should be utilised by ice-hockey strength and conditioning coaches to improve their testing battery. Further research should include resistance training exercises in their analysis.

1472 Board #66 May 28 9:30 AM - 11:00 AM
Ice Hockey Repeated Sprint Ability: The Relationship Between Peak Oxygen Consumption, Skating Speed And Fatigue

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Although ice hockey is mainly considered as an anaerobic sport, oxygen consumption is a key aspect in hockey performance. In fact, several studies have shown a relationship between maximal oxygen consumption and repeated sprint ability for hockey players. **PURPOSE:** The purpose of the present study was to assess the relationship between peak oxygen consumption, skating speed and fatigue while performing on-ice repeated shifts. **METHODS:** Ten male elite ice-hockey players [age: 20.20 ± 1.81 years; height: 176.70 ± 6.75 cm; weight: 76.20 ± 11.48 kg] completed an on-ice repeated shift test (Peterson et al., 2015). The latter consisted of 5 maximal skating bouts including accelerations, crossovers and change-of-direction manoeuvres. Skating bouts occurred at 120 seconds intervals, which represented approximately 90 seconds of passive recovery between each bout. Total shift time and split durations were measured using four photocell timing gates (FusionSport, SmartSpeed Pro Timing System, Colorado, USA). Skating speed was then computed. Breath-by-breath analysis was performed in order to measure peak oxygen consumption (VO₂ peak) and heart rate was monitored (K4B2, Cosmed, Italy). **RESULTS:** In average, VO₂ peak varied from 35.76 ± 5.00 ml/kg/min on the first shift to 32.04 ± 4.49 ml/kg/min on the last shift whereas skating speed varied respectively from 5.98 ± 0.31 m/s to 5.53 ± 0.33 m/s. The average time to complete the skating bouts ranged from 23.70 ± 1.22 seconds for the first sprint to 25.67 ± 1.59 seconds for the last sprint. The average performance decrement (i.e. fatigue index) was of 4.81 ± 2.47 percent. The coefficient of determination (r^2) was 0.204 ($r = 0.451$, $p = 0.001$) for VO₂ peak as a function of skating speed and $r^2 = 0.196$ ($r = -0.442$, $p = 0.200$) for VO₂ peak versus the fatigue index. **CONCLUSION:** The aerobic capacity partially explains the players' repeated sprint ability and shows that it is a fitness component that cannot be neglected in ice hockey. Our results are consistent with other studies that have investigated the link between aerobic capacity and linear repeated sprints, whereas, the approach herein used repeated sprints with direction changes.

1473 Board #67 May 28 9:30 AM - 11:00 AM
Validation Of The Alpine Ski Racing 90 Seconds Box Jump Field Test

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Practitioners have utilized sport specific alpine ski racing field tests for lower limb power assessment for many years. **PURPOSE:** The purpose of this study was to validate the alpine ski racing 90 s box jump field test with the 90 s Wingate. **METHODS:** Elite alpine ski racers ($n=15$) were tested during their annual post-season physical testing combine. The box 90s box jump test was conducted on a foam plyo

box of 0.45m x 0.75m x 0.9m (14 kg Plyosoft box from Escape Fitness). Subjects started at one side of the box and had to do a side jump and make contact with the top of the box and then jump back down to the other side back and forth. Final score being the total number of hits in 90 s. The Wingate test was conducted on a cycle ergometer (Ergonomic 894 E Monark). Subjects had to pedal with no resistance until they reached maximum RPM (about 5-10 s). The load (7.5% of bodyweight) was then manually dropped and subjects had to pedal at a maximal effort for 90 s. Wingate peak and mean power was measured in W and W/kg of bodyweight. Both tests were performed in a random order. Correlations between the different test results were calculated with a 2-tailed Pearson correlation analysis. Statistical significance was set at $p < 0.05$. Subject characteristics are presented as means and standard deviations.

RESULTS: Results present significant ($p < 0.05$) correlations between the total number of hits on the 90 s box jump and Wingate peak W ($r = 0.73$), peak W/kg ($r = 0.68$), mean W ($r = 0.77$) and mean W/kg ($r = 0.79$). Results also present significant correlations with the number of hits between the following time slots: 0-15 s mean W ($r = 0.49$), 0-15 s mean W/kg ($r = 0.72$), 15-30 s mean W ($r = 0.66$), 15-30 s mean W/kg ($r = 0.71$), 30-45 s mean W ($r = 0.59$), 30-45 s mean W/kg ($r = 0.66$), 45-60 s mean W ($r = 0.82$), 45-60 s mean W/kg ($r = 0.77$), 60-75 s mean W ($r = 0.83$), 60-75 s mean W/kg ($r = 0.65$), 75-90 s mean W ($r = 0.75$) and 75-90 s mean W/kg ($r = 0.71$). A predictive regression equation using the total hits during the 90s Box Jump Test was established, where mean W/kg = $0.055 * \text{Total Hits} + 1.080$ ($r = 0.79$, $p < 0.01$; Total Hits with mean W/kg).

CONCLUSIONS: The 90s box jump test is well correlated to the power output obtained with the Wingate test. Nonetheless, further research should include subjects at the national and international level in order to update the formula.

C-37 Free Communication/Poster - Cerebrovascular

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

1474 Board #68 May 28 10:30 AM - 12:00 PM Physical Activity, Autonomic Function And Cerebral Pulsatility In Young Women

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(No relevant relationships reported)

Cerebral pulsatility increases stress on the microvasculature of the brain causing damage. Age-related increases in arterial stiffness augment cerebral pulsatility via effects on large artery buffering capacity. Autonomic nervous system function also affect cerebral pulsatility by altering vascular tone. Physical activity (PA) may have a favorable effect on both vascular and autonomic function, and in turn, cerebral pulsatility. **PURPOSE:** 1) Determine the relationship between aortic stiffness and autonomic function with cerebral pulsatility index (PI) in young women. 2) Explore the role of PA as a potential correlate. **METHODS:** Eighty-two women (21 ± 4 years) participated in this study. Moderate-to-vigorous physical activity (MVPA) was measured for 7 days using an accelerometer. Body composition was assessed using air displacement plethysmography. Middle cerebral artery PI was determined via transcranial Doppler. Aortic stiffness was measured via carotid-femoral pulse wave velocity (cf-PWV) using applanation tonometry. Autonomic function was assessed via heart rate variability (HRV). Low frequency (LF) power of HRV was used as a measure of sympathetic activity, while high frequency (HF) power of HRV was used as a measure of parasympathetic activity. **RESULTS:** PI was not significantly correlated with cf-PWV ($r = -0.03$, $p = 0.82$) or lnHF ($r = 0.25$, $p = 0.06$). There was a significant, positive association between lnLF and PI ($r = 0.39$, $p = 0.002$). MVPA was not associated with cf-PWV ($r = -0.18$, $p = 0.13$), lnLF ($r = 0.01$, $p = 0.95$) or PI ($r = -0.04$, $p = 0.79$).

CONCLUSION: Sympathetic activity is a more prominent correlate of cerebral pulsatility than large artery stiffness in young women. Sympathetic tone may increase vasoconstriction of the cerebral vasculature resulting in augmentation of cerebral pulsatility. Physical activity was not associated with vascular or autonomic correlates of cerebral pulsatility in young women.

Supported by NIH Grant 1R03MD011306-01A1

1475 Board #69 May 28 10:30 AM - 12:00 PM Interpretive Complications Underlying Cerebrovascular Response To Hypercapnia; Significance Of The Central Respiratory Chemoreflex Transient

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Cerebral blood flow (CBF) is sensitive to changes in the arterial partial pressure of carbon dioxide (CO₂) with cerebrovascular reactivity an established risk factor for stroke and neurodegenerative disease. However, its interpretation can be complicated given subtle differences in cerebrovascular and central respiratory chemoreflex response transients.

PURPOSE: To examine to what extent exposure time to CO₂ influences CBF response.

METHOD: We measured CBF response to hypercapnia (F_ICO₂ = 5%) in five healthy participants for 10 min in the supine position. End-tidal partial pressures of CO₂ (P_{ET}CO₂), minute ventilation (V_E), and middle cerebral artery blood velocity (MCAv) were assessed during both the early (3-4 min) and late phases (9-10 min) of exposure.

RESULT: We observed elevated V_E larger during the late compared to the early phase of exposure (from 11 ± 2 to 29 ± 8 vs. 23 ± 4 L/min, $P = 0.047$) despite no differences in P_{ET}CO₂ ($P = 0.304$). The corresponding increase in MCAv during the late phase was suppressed compared to the early phase (from 48 ± 11 to 58 ± 14 vs. 63 ± 13 cm/sec, $P = 0.029$). Thus, the response of CBF to change in P_{ET}CO₂ at late phase was lower than that of early phase ($1.1 \pm 1\%$ /mmHg vs. $1.7 \pm 1\%$ /mmHg, $P = 0.07$).

CONCLUSION: These findings highlight the importance of considering the central respiratory chemoreflex transient during the clinical assessment of cerebrovascular reactivity.

1476 Board #70 May 28 10:30 AM - 12:00 PM Traumatic Brain Injury (tbi) Attenuates Arterial Smooth Muscle Vasorelaxation In Pressurized Cerebral Arteries

Jacob A. Goldsmith, Cathy W. Levenson, Kirk W. Evanson. *Florida State University, TALLAHASSEE, FL.* (Sponsor: Dr. Lynn Pantan, FACSM)
(No relevant relationships reported)

Traumatic Brain Injury (TBI) Attenuates Arterial Smooth Muscle Vasorelaxation in Pressurized Cerebral Arteries

Jacob A. Goldsmith, Cathy W. Levenson, and Kirk W. Evanson. Florida State University, Tallahassee, FL
Maintenance of cerebral blood flow (CBF) is impaired following traumatic brain injury (TBI), increasing the incidence of both ischemic and hemorrhagic events. Vascular tone is controlled by neurogenic, endothelial, and myogenic responses. **PURPOSE:** This work was designed to specifically determine the extent to which the myogenic response of vascular smooth muscle in the middle cerebral artery (MCA) is altered following TBI. **METHODS:** TBI was induced by controlled cortical impact (CCI) in 2-month-old male Sprague-Dawley rats. Twenty-four hours following injury or sham surgery, pressurized arterial myography was performed on endothelium-denuded MCA to examine the effect of TBI on smooth muscle-specific vasorelaxation using pharmacologic activators of the adenylyl cyclase (AC)-cAMP-PKA/PKG pathway (10^{-8} M to 10^{-5} M, $n = 6$ at each dose). **RESULTS:** Myogenic tone was attenuated following TBI ($25 \pm 1.1\%$ vs. $18 \pm 1.2\%$, $n = 12$; $p < 0.001$). The mean change in myogenic tone in response to activators (10^{-6} M) was reduced to 35% (AC), 33% (PKA), and 30% (PKG) in TBI as compared to sham controls. **CONCLUSION:** Attenuation of smooth muscle myogenic tone and resulting vasorelaxation following TBI may serve as a compensatory mechanism to protect sensitive brain tissue from cerebral ischemia. Future work will be needed to elucidate the role of pathways that could serve as potential targets for therapeutic intervention to reduce damaging vascular events. Supported by The Florida State University Graduate School Dissertation Award Grant.

1477 Board #71 May 28 10:30 AM - 12:00 PM Mechanisms Of Akap150 In Aerobic Exercise-induced Improvement Of Cerebral Arterial Function In Essential Hypertension

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A-kinase anchoring protein AKAP150, facilitating transduction events by binding protein kinase Ca (PKCα) to specific cellular microdomains, plays a central role in

voltage-gated L-type Ca^{2+} channel (LTCC) remodeling in vascular smooth muscle during hypertension. Emerging evidence have demonstrated the beneficial effects of regular exercise on reducing blood pressure and improving arterial function in hypertension, however, less is known regarding the cellular mechanisms underlying the vascular changes with exercise. **PURPOSE:** To investigate the mechanism of AKAP150/PKC α signaling pathway in exercise-mediated LTCC function of cerebral arteries during hypertension. **METHODS:** 12-week-old male spontaneously hypertensive rats (SHR) and Wistar-Kyoto (WKY) rats were randomly assigned to sedentary (WKY-SED, SHR-SED) and exercise training (WKY-EX, SHR-EX) groups. Exercise groups were performed a moderate-intensity treadmill running (about 55-65% VO_{2max} , 20 m/min, 0 grade, 60 min, 5 days/week). After 12 weeks, artery contraction myography, patch-clamp electrophysiology, Ca^{2+} image, Western blot and immunofluorescence were used to detect cerebral vascular tone, LTCC whole-cell and single channel currents, Ca^{2+} sparklets, and AKAP150/PKC α signaling pathway. **RESULTS:** Exercise attenuated LTCC contribution to cerebral vascular tone regulation (39.0 ± 1.3 vs. 27.5 ± 2.0 % K_{max}) and LTCC currents in cerebral arterial myocytes of SHR (-13.2 ± 1.7 vs. -9.6 ± 1.5 pA/pF, both $P < 0.05$). The LTCC channel open probability (nP_o) and persistent Ca^{2+} sparklet activity (nP_s) of cerebral arterial myocytes were significantly reduced in SHR-EX as compared with SHR-SED (nP_o : 0.08 ± 0.01 vs. 0.12 ± 0.01 ; nP_s : 0.65 ± 0.15 vs. 0.82 ± 0.10 ; both $P < 0.05$). The protein expression of AKAP150 in cerebral artery was significantly up-regulated in SHR-SED (4.9 ± 0.6), while down-regulated in SHR-EX (1.4 ± 0.2 , $P < 0.05$). The colocalization rate of AKAP150 and PKC α at the sarcolemma were lower in cerebral arterial myocytes from SHR-EX than those from SHR-SED (20.1 ± 1.1 vs. 30.0 ± 1.6 %, $P < 0.05$). **CONCLUSIONS:** Chronic exercise inhibits LTCC channel activity and persistent Ca^{2+} sparklets in vascular smooth muscle via suppression of AKAP150/PKC α signaling pathway, and ameliorates the dysfunction of cerebral arteries during hypertension.

1478 Board #72 May 28 10:30 AM - 12:00 PM
Peripheral And Cerebral Vascular Function With Advancing Age: Evidence Of A Link

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Peripheral vascular dysfunction has been documented to progress with advancing age, and age itself is the greatest risk factor for developing dementia. However, the likely link between peripheral and cerebral vascular function with aging has yet to be clearly investigated. **PURPOSE:** Therefore, the purpose of this study was to assess peripheral and cerebral vascular function in both young and old healthy adults and examine the relationship between the responsiveness of these vascular beds. **METHODS:** Peripheral vascular function was assessed with passive leg movement (PLM: blood flow Δ peak and AUC), and cerebral vascular function was assessed by the breath hold acceleration index (BHAI) in 11 healthy adult males (7 old: 68 ± 3 yr; 4 young: 23 ± 3 yr). Doppler ultrasound was used to measure both common femoral artery blood flow and middle cerebral artery velocity. **RESULTS:** Peripheral vascular function was significantly attenuated in the old adults compared to the young (PLM AUC: 116 ± 83 vs. 424 ± 118 ml, $p = 0.001$; PLM Δ peak: 378 ± 124 vs. 950 ± 64 ml/min, $p < 0.001$). Cerebral vascular function tended to be lower in the old compared to the young with a large effect size (BHAI: 1.36 ± 67 vs. 2.4 ± 1.4 ; $d = 0.95$, $p = 0.132$). However, even with a relatively limited sample size, there was a significant positive relationship between PLM AUC and BHAI ($r = 0.65$, $p = 0.03$). **CONCLUSIONS:** The identification of a relationship between the function of the peripheral and cerebral vascular beds (leg and brain) is an important step toward a better understanding of the global mechanisms of aging on the vasculature and likely age-related dementia.

1479 Board #73 May 28 10:30 AM - 12:00 PM
Handgrip Exercise Modulates Cerebrovascular Response To Hypercapnia In The Anterior And Posterior Circulation

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The response of posterior cerebral blood flow (CBF) to exercise is different from that of anterior cerebral circulation; however, its physiological mechanism remains poorly understood. Regarding this unresolved question, we hypothesized that the cerebrovascular response to carbon dioxide (CO_2), which is one of CBF regulatory mechanism, in the posterior cerebral circulation is different from that of the anterior cerebral circulation during exercise. **PURPOSE:** To test our hypothesis, we examined the cerebrovascular response to CO_2 in the anterior and posterior circulation during isometric handgrip (IHG) exercise. **METHODS:** The cerebrovascular response to CO_2 was evaluated in seven young healthy males via the two levels of hypercapnic stimulus

(target end-tidal partial pressure of CO_2 , +5 and +10 mmHg from individual baseline values) at rest and during a 2-min IHG exercise at 30% of maximum voluntary contraction. Middle and posterior cerebral artery blood velocities (MCAv and PCAv) were measured using a transcranial Doppler continuously throughout the experiment. **RESULTS:** During IHG exercise, PCAv increased (10.3 ± 9.0 %, $P = 0.023$) but MCAv remained unchanged (6.9 ± 4.5 %, $P = 0.18$). Interestingly, the cerebrovascular response to CO_2 in both cerebral arteries increased during IHG exercise ($P = 0.06$) but there was no difference in the cerebrovascular response to CO_2 between MCA and PCA ($P = 0.733$). **CONCLUSIONS:** These findings suggest that cerebrovascular response to CO_2 may not contribute to the heterogeneous CBF response to exercise between anterior and posterior circulation.

1480 Board #74 May 28 10:30 AM - 12:00 PM
Impact Of 6-month Exercise Training On Cerebrovascular Function In Persons With Spinal Cord Injury

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Impact Of 6-Month Exercise Training on Cerebrovascular Function in Persons with Spinal Cord Injury

Persons with spinal cord injury (SCI) have a four-fold greater risk for cerebrovascular disease, suggesting that they cannot maintain steady cerebral perfusion. While disruption in autonomic control after SCI may impact cerebral vascular function, chronic physical deconditioning may also play a substantial role. If so, full-body aerobic exercise may improve cerebrovascular function in persons with SCI. **PURPOSE:** To assess the impact of injury and habitual, whole-body functional electric stimulation (FES)-assisted aerobic exercise training on cerebrovascular function in persons with SCI. **METHODS:** Baseline hemodynamic (heart rate, blood pressure, CO_2) and cerebral blood flow (CBF) responses to oscillations in arterial blood pressure via low-resistance breathing (i.e. autoregulation) and progressive increases in arterial CO_2 via rebreathing (i.e. vasoreactivity) were measured in 16 able-bodied controls and 30 participants with SCI (n = 15 cervical and n = 15 thoracic). Nineteen participants with SCI (n = 9 cervical and n = 10 thoracic) completed 6-months of a FES-assisted rowing exercise training program. Changes in autoregulatory function, vasoreactivity, and VO_{2max} were compared before and after aerobic exercise training via linear mixed effect model. **RESULTS:** Individuals with higher level SCI had slightly lower hemodynamic variables in comparison to able-bodied and those with lower level SCI and able-bodied. Greater VO_{2max} was related to increased vasoreactivity ($R^2 = 0.45$, $p < 0.01$) at baseline. Overall, VO_{2max} increased significantly after training ($p < 0.01$). Vasoreactivity also tended to increase with training, but the change was not statistically significant due to high variability. Given this, we assessed the relation between the change in VO_{2max} and vasoreactivity in exercise "responders," defined as those with $>10\%$ change in VO_{2max} ; n=8. In responders, an increase in VO_{2max} was strongly associated with an increase in vasoreactivity ($R^2 = 0.72$, $p < .01$) regardless of the level of SCI. **CONCLUSION:** Cerebral vasoreactivity is impaired in individuals with SCI. This impairment is primarily due to physical deconditioning, and can be improved by habitual aerobic exercise.

1481 Board #75 May 28 10:30 AM - 12:00 PM
Aerobic Exercise Acutely Improves Dynamic Cerebral Autoregulation During Brain Activation

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PURPOSE: Cognitive function is temporarily improved by acute aerobic exercise, especially clinical high-intensity interval exercise (cHIIIE; four 4 min bouts of high-intensity exercise) (Tsukamoto et al. 2016). Meanwhile, dynamic cerebral autoregulation (dCA) is an important cerebrovascular mechanism to maintain relatively constant cerebral blood flow (CBF) against the rapid fluctuations in perfusion pressure, but it is impaired during cognitive tasks (causing brain activation) due to cerebral vasodilation (Ogoh et al. 2018). Although it has been demonstrated that dCA is not changed by aerobic exercise (Tsukamoto et al. 2019), which improves cognitive function (Tsukamoto et al. 2016), the impact of aerobic exercise on the brain activation-induced dCA impairment remains unclear. The purpose of the present study was to investigate the changes in dCA during a cognitive task prior to following different types of aerobic exercise. **METHODS:** Nine healthy male subjects performed three trials in a randomized crossover order; moderate-intensity continuous exercise (for 40 min), low-volume HIIIE (1vHIIIE; ten 1 min bouts of high-intensity exercise), and cHIIIE protocols. The participants performed a 5 min color-word Stroop

task (cognitive task) before, immediately after, and 30 min after each exercise bout. Middle cerebral artery blood flow velocity (Transcranial doppler ultrasonography) and arterial pressure (Finger photoplethysmography) were continuously measured to determine dCA using transfer function analysis, and dCA was estimated at rest and during each cognitive task. **RESULTS:** Before exercise, transfer function phase in the very low-frequency (VLF) was decreased during cognitive task compared to the resting measurement ($P < 0.01$), indicating that there was brain activation-induced dCA impairment. However, VLF phase during the cognitive task immediately after exercise was higher than before ($P < 0.01$) and 30 min ($P < 0.01$) after exercise regardless of exercise protocol, indicating that dCA impairment during the cognitive task was blunted immediately after exercise. **CONCLUSIONS:** The brain activation-induced dCA impairment is attenuated immediately after exercise. This result implies that aerobic exercise improves dynamic CBF regulation in response to brain activation during a cognitive task.

1482 Board #78 May 28 10:30 AM - 12:00 PM
Cardiorespiratory Fitness And The Cerebrovascular Response To A Metabolic Stimulus Following Cyclooxygenase Inhibition

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Cardiorespiratory fitness (CRF) is positively associated with cerebrovascular function and cognition. We have previously shown that prostaglandins play an important role in regulating the cerebral vasodilator response to hypercapnia, and that the magnitude of change in cerebral vasodilator responses during cyclooxygenase (COX) inhibition is associated with CRF in older adults. However, it is unknown if CRF also influences the cerebrovascular response to a metabolic stimulus in older adults. **PURPOSE:** To determine the effects of CRF on the cerebrovascular response to a metabolic stimulus before and during COX inhibition in older adults. **METHODS:** Thirty-five participants completed a maximal exercise test on a cycle ergometer. Participants were split into two groups, High CRF (10 men, 8 women, age = 62 ± 5 y) or Low CRF (7 men, 10 women, age = 66 ± 7 y), based on the median $\dot{V}O_{2max}$ (ml/kg/min). All participants completed two levels of the Stroop Color Word Test. Beat-to-beat mean arterial pressure (MAP) and middle cerebral artery velocity (MCAv) were measured at baseline and in response to each level of the Stroop test before and after administration of the COX inhibitor Indomethacin (INDO). The maximum MAP, MCAv, and cerebral pulsatility index (PI) responses were calculated as the highest 3-beat average during each cognitive challenge. **RESULTS:** There were no differences between high and low CRF groups in MCAv at rest or in response to the metabolic stimulus. There was a trend for lower PI at rest ($p = 0.09$) and in response to the Stroop test ($p = 0.09$) in the high CRF group compared with the low CRF group. During INDO, MCAv decreased (Low CRF: $-29 \pm 4\%$, High CRF: $-27 \pm 3\%$; $p < 0.01$) and PI increased (Low CRF: $22 \pm 3\%$, High CRF: $17 \pm 3\%$; $p < 0.01$). During INDO, MCAv at rest was not different between groups; however, PI was lower in the high CRF compared to low CRF group (Low CRF: 0.98 ± 0.05 , High CRF: 0.87 ± 0.03 ; $p < 0.05$). Lastly, the change in MCAv and PI in response to the metabolic stimulus did not differ between groups. **CONCLUSION:** In older adults, elevated levels of CRF may lead to a lower PI at rest and in response to a metabolic stimulus. Additionally, COX inhibition did not alter the cerebrovascular response to a metabolic stimulus.
 Supported by NIH Grant HL118154.

1483 Board #77 May 28 10:30 AM - 12:00 PM
THE ACUTE EFFECTS OF PROLONGED SITTING WITH OR WITHOUT A HIGH GLYCEMIC INDEX MEAL ON CEREBRAL BLOOD FLOW IN HEALTHY ADULTS

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 (No relevant relationships reported)

PURPOSE: Exposure to acute prolonged sitting reportedly leads to decreased cerebral blood flow. However, it is unclear whether or not a high glycemic index meal will exacerbate the detrimental effects of prolonged sitting on cerebral blood flow. The study purpose was to determine if prolonged (3-hr) sitting resulted in a decreased total brain blood flow (QBF) and whether this decrease is exacerbated by a high glycemic index meal (HGI). **METHODS:** Twenty participants (22.6 [3.1] y, 33% F, 24.3 [3.7] kg/m²) were recruited to participate in an HGI and low glycemic index

(LGI) condition. Using Doppler Ultrasound, total brain blood flow (QBF, ml/min) was calculated using the equation: (internal carotid artery [ICA] blood flow + vertebral artery [VA] blood flow) \times 2. **RESULTS:** For QBF, there was no interaction effect ($P = 0.189$) or time effect ($P = 0.340$), however, there was a significant, small condition effect ($P = 0.04$, ES: -0.06). For LGI, QBF decreased by -2203.2 ml/min (95% CI: -5136 to 730), and for HGI, QBF increased by 74 ml/min (95% CI: -2571 to 2719). Most of this change was driven by the internal carotid artery BF, where there was no interaction effect or time effect, however, there was a significant, small condition effect ($P = 0.043$, ES: -0.11).

CONCLUSIONS: Prolonged sitting does decrease total brain blood flow, but contrary to expected, an HGI meal results in an increase in total brain blood flow.

1484 Board #78 May 28 10:30 AM - 12:00 PM
Effect Of Exercise Training On Cerebrovascular Impedance In Amnesic Mild Cognitive Impairment Patients

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Cerebrovascular hypoperfusion is associated with cognitive impairment in older adults. **PURPOSE:** To test the hypotheses that 1) patients with amnesic mild cognitive impairment (aMCI), a prodromal stage of Alzheimer's disease, have higher cerebrovascular impedance than age-matched cognitively normal individuals; 2) 1-year endurance exercise training reduces cerebrovascular impedance in aMCI patients. **METHODS:** In the cross-sectional study arm, cerebrovascular impedance was estimated in 58 patients with aMCI (67 ± 7 years) and 25 normal control subjects (65 ± 6 years) with cross-spectral analysis between dynamic changes in cerebral blood flow velocity (CBFV) in the middle cerebral artery (via transcranial Doppler) and carotid arterial blood pressure (via applanation tonometry). In the longitudinal study arm, cerebrovascular impedance was evaluated in randomly-assigned 37 aMCI patients who completed 1-year endurance ($n = 17$) or stretching exercise ($n = 20$). **RESULTS:** After adjustment for age and sex, aMCI patients exhibited higher impedance modulus in the range of the first harmonic oscillations (0.78 - 1.56 Hz, Z_1) than NC (1.18 ± 0.34 vs. 1.01 ± 0.35 mmHg/cm/s, $P = 0.037$). There was an inverse correlation between Z_1 and mean CBFV ($r = -0.673$, $P < 0.0001$). Linear mixed model analysis of exercise training revealed that Z_1 was significantly decreased after 1-year exercise intervention irrespective of exercise modes (time effect: $P = 0.001$; interaction between time and exercise modes: $P = 0.410$). **CONCLUSION:** Our findings suggest that aMCI is associated with higher cerebrovascular impedance when compared to cognitively normal older adults, and that regular physical activity ameliorates cerebrovascular impedance in patients with aMCI.
 Supported by the NIH (5R01AG033106-01, RZ) and JSPS (16KK0011, JS).

1485 Board #79 May 28 10:30 AM - 12:00 PM
The Relation Between Cardiorespiratory Fitness And Cerebral Blood Flow Regulation

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Contradictory relationships have been reported between cardiorespiratory fitness levels and cerebral blood flow regulation. Some studies report an inverse relationship between cardiorespiratory fitness and cerebrovascular reactivity to carbon dioxide (CO₂), and an inverse relationship between cardiorespiratory fitness and dynamic cerebral autoregulation. Other studies have found a positive relationship. **PURPOSE:** The purpose of this study was to assess the relation between objectively measured cardiorespiratory fitness and cerebrovascular reactivity to CO₂ and to dynamic cerebral autoregulation. **METHODS:** Twenty-three healthy, normotensive adults (13M/10F; age: 26 ± 4 yrs; BMI: 24 ± 5 kg/m²; BP: $105 \pm 9/58 \pm 6$ mmHg, mean \pm SD) participated in this study. Mean $\dot{V}O_{2max}$ was 40.0 ± 9.7 ml/kg/min (range, 17.9 - 62.3 ml/kg/min). Each participant completed a maximal graded exercise test on a treadmill until volitional fatigue. Heart rate was measured using a heart rate monitor (Polar H7, Polar, USA). Oxygen consumption and CO₂ production were measured and averaged in 15-second intervals using indirect calorimetry via an automated open circuit system (Parvo Medics, Sandy, UT) throughout the exercise test. Transcranial Doppler of the right middle cerebral artery was measured. We measured cerebrovascular reactivity to two minutes of hypercapnia (via 8% CO₂, 21% oxygen, balance nitrogen). We assessed dynamic cerebral autoregulation during eight minutes of supine rest. The relation between cerebral blood flow regulation and cardiorespiratory fitness were analyzed using Pearson's correlations. **RESULTS:** Cerebrovascular reactivity to hypercapnia was not significantly correlated with cardiorespiratory fitness ($r = 0.35$, $P = 0.10$). There

was no correlation with cardiorespiratory fitness in very low frequency gain ($r=-0.22$, $P=0.92$) or phase ($r=-0.03$, $P=0.87$). There was no correlation with cardiorespiratory fitness and low frequency gain ($r=0.3$, $P=0.13$). Interestingly, low frequency phase was inversely correlated with cardiorespiratory fitness ($r=-0.4$, $P=0.04$). **CONCLUSION:** These preliminary data suggest that cardiorespiratory fitness may not impact cerebrovascular reactivity to hypercapnia. However, a relation may exist between cardiorespiratory fitness and dynamic cerebral autoregulation.

1486 Board #82 May 28 10:30 AM - 12:00 PM
Effect Of Different Exercise Modes On Cerebrovascular Shear In Humans

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PURPOSE: To what extent exercise impacts the cerebrovasculature is dependent on exercise mode. This difference may be attributable to shear stress in the cerebral vasculature that effects improvements in vascular endothelial function. For the first time, we determined if an acute bout of isovolume interval exercise compounds cerebrovascular shear rate. **METHODS:** Eleven young men were randomly assigned to perform continuous exercise (Continuous Ex) or interval exercise (Interval Ex) of semi-recumbent cycling. During the Continuous Ex, subjects performed continuous cycling at 80W for 12 mins. During the Interval Ex, subjects performed 3 bouts of interval cycling (2 mins at 60W and 2 mins at 100W) that was volume matched with Continuous Ex. Shear rate in the internal carotid artery (ICA) was determined using Doppler ultrasound. **RESULTS:** Time averaged ICA shear rate was higher during Int Ex compared to Continuous Ex (351 ± 75 vs. 330 ± 61 /s, $P=0.038$) and the elevation was maintained throughout recovery (327 ± 86 vs. 290 ± 56 /s, $P=0.014$). **CONCLUSION:** These data are the first to highlight that a single acute bout of interval exercise compounds cerebrovascular shear, providing a mechanistic basis underlying its superior neuroprotective benefits.

1487 Board #81 May 28 10:30 AM - 12:00 PM
The Association Between Ambulatory Blood Pressure Monitoring, Cerebrovascular Pulsatility, And Cognitive Performance In Young Adults

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 (No relevant relationships reported)

Ambulatory blood pressure monitoring (ABPM) is the gold standard for blood pressure (BP) assessment. In older adults, ambulatory pulse pressure (PP), mean pressure (MP), and BP dipping have been associated with altered cerebrovascular blood flow, increased cerebrovascular disease, and cognitive decline. Moderate-to-vigorous physical activity (MVPA) has favorable effects on BP and reduces cognitive decline in older adults. As hypertension rates increase in young adults, cerebrovascular pulsatility may damage white matter and accelerate cerebral aging; MVPA may combat these effects. **PURPOSE:** Determine if ABPM is associated with middle cerebral artery (MCA) pulsatility and cognitive performance in a group of young adults. **METHODS:** 68 adults (21 ± 4 yrs; $26.6\pm8.0\%$ fat; $n = 53$ women) underwent ABPM every 20 min between 0700 - 2200 hr and every 30 min from 2200 - 0700 hr. Transcranial Doppler measured MCA pulsatility at rest and during 3 min of cognitive stress (Stroop). MVPA was assessed over 9 days via accelerometry. Pearson correlations were run for PP, PP variability, MP, BP dipping, BP variability ratio (BPVR = standard deviation of systolic/standard deviation of diastolic pressure), and the ambulatory arterial stiffness index (AASI = 1 - regression slope of systolic and diastolic BP) with MCA pulsatility and cognitive performance (accuracy) controlling for MVPA. **RESULTS:** Nighttime systolic dipping was inversely associated ($r = -0.25$, $p = 0.049$) and there was a trend for diastolic dipping to be inversely associated with resting pulsatility ($r = -0.23$, $p = 0.06$). No other ABPM measures were related with resting MCA pulsatility. MCA pulsatility during cognitive stress was associated with daytime systolic pressure ($r = 0.38$, $p < 0.01$), average daily PP ($r = 0.33$, $p = 0.01$), and systolic and diastolic dipping ($r = -0.34$, $p = 0.01$ and $r = -0.25$, $p = 0.04$, respectively). Accuracy during the cognitive stress task was not associated with any ABPM measure ($p \geq 0.09$). **CONCLUSION:** These data suggest that nighttime BP dipping may be related to reduced cerebrovascular pulsatility at rest and during cognitive stress. Additionally, greater daytime systolic BP and PP may be associated with increased MCA pulsatility during cognitive stress. ABPM is associated with cerebral pulsatility but not cognitive performance in young adults.

1488 Board #82 May 28 10:30 AM - 12:00 PM
Effect Of Breath Holding On Cerebral Blood Flow Response To Isometric Exercise

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 (No relevant relationships reported)

For resistance training, breath holding is prohibited to prevent an increase in arterial blood pressure (ABP) and consequently cerebral hyper-perfusion. However, it is unclear how breath holding during resistance exercise affects arterial blood pressure or cerebral blood flow. **PURPOSE:** The purpose of this study was to examine the effect of breath holding on the responses of ABP and cerebral blood flow (CBF) to isometric exercise. **METHODS:** Six young male adults performed 30-s isometric handgrip exercise at 40% of maximum voluntary contraction during normal breathing (control) or breath-holding condition (BH). ABP was measured using Finapres, and CBFs at internal carotid and vertebral arteries (ICA and VA, respectively) were continuously measured using Doppler ultrasonography at rest and during exercise. **RESULTS:** The change in MAP from rest to exercise was larger in BH compared with that in control ($P < 0.05$). The relative response of ICA blood flow to exercise was larger in BH ($18.9 \pm 14.6\%$) compared with that in control ($8.1 \pm 17.2\%$, $P < 0.05$), whereas the relative response of VA blood flow to exercise did not differ between both BH ($3.1 \pm 5.8\%$) and control ($0.9 \pm 10.9\%$, $P > 0.05$). **CONCLUSIONS:** These results indicated that during isometric exercise, breath holding enhances exercise-induced increase in arterial blood pressure and CBF. Therefore, it should be considered mode of respiration during isometric exercise, especially in rehabilitation for elderly and patients with hypertension.

C-38 Free Communication/Poster - Respiratory

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

1489 Board #83 May 28 10:30 AM - 12:00 PM
Impact Of Work Of Breathing On Cardiac Output In Patients With Incomplete Spinal Cord Injury

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 (No relevant relationships reported)

PURPOSE: The influence of alterations in the ventilatory response and work of breathing (WOB) on cardiac output (Qt) during upper extremity exercise, resulting from Spinal Cord Injury (SCI) are not well understood. This study characterized the response of Qt and WOB during a maximal exercise arm-ergometer test in people with incomplete cervical SCI in contrast to able-bodied controls.

METHODS: A 2-group convenience sample was used to compare respiratory muscle strength, WOB, and Qt during an incremental arm ergometer exercise test to volitional exhaustion. Subjects were 8 males with incomplete cervical SCI (icSCI: age 39 ± 14 yrs) and 8 able-bodied males (CON: age 38 ± 13 yrs). Maximal expiratory pressure (MEP) and maximal inspiratory pressure (MIP) were measured using a respiratory pressure meter, while breathing patterns were captured using breath-by-breath ventilatory gas exchange system. Qt was measured during exercise by bioimpedance cardiography. Data were analyzed using t tests to determine differences between group mean values. Linear regression analysis and Pearson's correlation coefficient were used to examine the relationships among variables.

RESULTS: All the variables were compared between groups at the average peak workload achieved by icSCI (30 watts). Both MIP (69.0 ± 17.8 mmHg vs. 89.7 ± 15.4 mmHg, $p=0.020$) and MEP (59.6 ± 16.4 mmHg vs. 83.4 ± 14.8 mmHg, $p=0.008$) were significantly lower in icSCI compared to CON. Minute ventilation (32 ± 3.4 L/min vs. 23 ± 5.5 L/min, $p=0.001$) and WOB (2.8 ± 0.5 vs. 1.6 ± 6.8 kg/m/min, $p=0.001$) were significantly higher in icSCI compared to CON, respectively. A significant difference in tidal volume (icSCI: 1.03 ± 0.3 L vs. CON: 1.2 ± 0.3 L, $p=0.800$) was not observed. Qt was lower in those with icSCI compared to CON (8 ± 3 L/min vs. 11 ± 1 L/min, $p=0.003$), and correlated significantly with WOB in icSCI ($r^2=0.73$, $p=0.006$).

CONCLUSIONS: A concurrent decrease in respiratory muscle strength and an increase in WOB relative to metabolic demand may be reflective of impaired respiratory performance. In people with icSCI, a potential moderating effect of WOB may partially explain the decline in Qt during arm exercise.

1490 Board #84 May 28 10:30 AM - 12:00 PM
Expiratory Pressure Generation In Adult Survivors Of Preterm Birth

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 (No relevant relationships reported)

Adult survivors of preterm birth (PRE) have arrested lung development resulting in lower pulmonary function compared to their counterparts born at full term (CON). PRE have normal lung volumes, but lower expiratory airflow, which could be caused, in part, by a lesser driving (alveolar) pressure. During forced expiration alveolar pressure is the sum of pleural pressure, a function of respiratory muscle effort/strength, and lung recoil pressure. Whether or not PRE have normal respiratory muscle strength and/or lung compliance (CL) has not yet been explored. **Purpose:** The purpose of this study was to quantify respiratory muscle strength and CL in PRE and CON. Based upon the existing literature, we hypothesized that PRE and CON will have equivalent respiratory muscle strength and CL. **Methods:** To date, n = 8 PRE and n = 5 CON, visited the lab on two occasions. First, subjects performed standard spirometry (e.g. fast and slow vital capacity maneuvers). Next, to assess respiratory muscle strength, subjects performed maximal inspiratory and maximal expiratory pressure maneuvers (MIP and MEP, respectively). For MIP, subjects inhaled maximally against an occluded mouthpiece at residual volume. For MEP, subjects exhaled maximally against an occluded mouthpiece at total lung capacity. Each maneuver was performed 3-5 times. On the second visit, CL was measured. To do so, subjects were instrumented with an esophageal balloon catheter and performed quasi-static expiratory deflation curves (i.e., very slow exhalations from total lung capacity to residual volume). To test for differences in MIP, MEP, and CL between groups we computed multiple independent samples t-tests with significance set to $p < 0.05$. **Results:** We found no difference in MIP (-130.6 ± 29.3 vs. -106.5 ± 36.1 cm H₂O; $p = 0.24$) or MEP (165.7 ± 42.9 vs. 121.0 ± 51.6 cm H₂O; $p = 0.14$) between CON and PRE, respectively. Likewise, CL was comparable between CON (0.29 ± 0.11 L/cm H₂O) and PRE (0.33 ± 0.10 L/cm H₂O; $p = 0.53$). **Conclusion:** Our data suggests no effect of birth status on the ability to generate expiratory pressure during forced expiration. Likewise, results suggest that the lower pulmonary function in PRE is not the result of a lesser driving pressure, but instead may be the result of excessive airflow resistance. Support: Hooper Undergraduate Research Award from NAU.

1491 Board #85 May 28 10:30 AM - 12:00 PM
Exhaled Volatile Organic Compounds In Ultra-endurance Runners

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PURPOSE: Volatile organic compounds (VOCs) measured in exhaled breath can provide a metric of various physiologic and metabolic processes, such as airway inflammation from environmental contaminants (e.g., 3-methylfuran) or pathological lung conditions (e.g., 3-methylhexane). To date, limited studies have examined exhaled VOC profiles in response to a physiologic stressor such as ultra-endurance exercise. Accordingly, this study evaluated VOC production in exhaled breath in response to running an ultramarathon.

METHODS: Breath samples were collected from 20 ultra-endurance runners before and after participating in either the 2018 Ultra-Trail du Mont-Blanc (171km) or the 2018 Courmayeur-Champex-Chamonix (100km) ultramarathon. Unfortunately, 30 of the 40 samples were saturated and therefore the relative abundance of VOC's in these samples were estimated by extrapolating the rate at which the signal decayed. A Wilcoxon signed-rank test was performed to evaluate changes in the intra-participant exhaled VOCs between the pre- and post-race breath samples.

RESULTS: Participants completed the ultra-marathons in 27.2 ± 12 hours. In total, 203 unique VOCs were identified and studied for differences between the pre- and post-race participant breath samples, with 68 having significant ($P < 0.05$) changes pre to post-race (e.g., Propanal: pre $7.8 \times 10^6 \pm 2.3 \times 10^6$ vs post $1.1 \times 10^7 \pm 2.9 \times 10^6$, $P = 0.002$). The exhaled VOCs displaying a significant increase in post-race abundance were determined to be structurally related to each other, with 21 of these arising from probable biological origins. These VOCs were predominately comprised of methyl- and ethyl- (n=15) and decane (n=4) containing compounds, which possibly relate to inflammation of the lungs (e.g., 3-Methylhexane: pre $9.1 \times 10^6 \pm 9.7 \times 10^6$ vs post $3.9 \times 10^7 \pm 3.1 \times 10^6$, $P = 0.0005$) or bowels (e.g., Ethyl acetate: pre $9.2 \times 10^5 \pm 6.4 \times 10^5$ vs post $2.1 \times 10^6 \pm 1.2 \times 10^6$, $P = 0.0006$).

CONCLUSIONS: These data suggest exhaled VOCs are affected by ultra-endurance exercise and may serve as biomarkers/indicators of exercise induced inflammation/ stress. Given the exploratory nature of this study and the number of saturated samples, additional studies are needed to determine normal detection limits and the relevance of VOCs in response to ultra-endurance exercise.

1492 Board #86 May 28 10:30 AM - 12:00 PM
Reduced Lung Function And Respiratory Muscle Fatigue After Prolonged Endurance Performance

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 (No relevant relationships reported)

PURPOSE: Exercise-induced bronchoconstriction (EIB) is frequently reported in healthy triathletes immediately after high intensity exercise of prolonged duration, but the recovery time is unknown. The aims of the present study were to investigate 1) changes in lung function from before to 2 hours and 15 hours post a triathlon race, 2) if respiratory muscle fatigue could explain the diminished flow rates observed and 3) its effect on performance. **METHODS:** We recruited 34 healthy athletes (3 female), aged 25-55 years, participating in Norseman Xtreme triathlon (3.8 km open water swim, 180 km cycling and 42 km running). Measurements of lung function, by maximal expiratory flow volume loops, and maximal voluntary ventilation (MVV) were performed before, 2 hours and 15 hours after the race. Associations between lung function, MVV and race time were assessed using linear regression. **RESULTS:** Forced expiratory volume in 1 second (FEV₁) was reduced by >10% from baseline in 10 athletes (29%) 2 hours post race and in 3 athletes (8%) 15 hours post race. Mean MVV was reduced from baseline ($177 \text{ L} \pm 29$) to 2 hours ($161 \text{ L} \pm 35$) post race ($p < 0.01$), and recovered by 15 hours ($174 \text{ L} \pm 34$) post race. Mean race time was 14,3 hours ranging from 10-19 hours. Change in FEV₁ was associated with change in MVV ($\beta .01$ [95%CI .004], $p = .001$), but not race time. **CONCLUSIONS:** Reduced lung function was frequent in healthy triathletes 2 hours post race and associated to respiratory muscle fatigue, but not performance. Both MVV and lung function was normalized in most athletes 15 hours post race.

1493 Board #87 May 28 10:30 AM - 12:00 PM
Abstract Withdrawn

1494 Board #88 May 28 10:30 AM - 12:00 PM
Influence Of Immersion In Water On Respiratory Impedance Measured By Forced Oscillation Technique

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 (No relevant relationships reported)

Immersion in water decreases lung volume and maximal inspiratory muscle pressure. Previous studies have showed that hydrostatic pressure causes increased venous return from lower limbs and cranial displacement of the diaphragm, which leads to a decrease in lung compliance and increased closing volume. However, there is no research to investigate respiratory impedance during immersion in water. **PURPOSE:** Accordingly, the aim of this study was to evaluate respiratory impedance measured by forced oscillation technique during immersion in water in healthy adults. **METHODS:** Eleven healthy males participated in this cross-sectional study. We measured respiratory impedance and respiratory function before and during immersion. To compare the influence of water depths, we carried out one dry land (DL) trial and two water level trials: clavicle level (CL) and xiphoid appendix level (XA). The order of trials between DL, CL and XA was randomized and performed with at least three days rest between trials. **RESULTS:** Respiratory impedance: during immersion, CL (2.8 ± 0.9) and XA (2.5 ± 0.7) showed a significantly higher R5 compared to DL (1.9 ± 0.6) ($p = 0.005$, $p = 0.024$). CL (2.8 ± 0.7) also showed a significantly higher R20 compared to DL (2.1 ± 0.5) ($p = 0.003$). CL (-0.5 ± 0.4) and XA (-0.3 ± 0.2) showed a significantly lower X5 than DL (-0.1 ± 0.2) ($p = 0.015$, $p = 0.021$). CL (9.7 ± 3.6) and XA (8.2 ± 2.4) showed a significantly higher Frequency of resonance compared to DL (5.3 ± 2.9) ($p = 0.007$, $p = 0.001$). Respiratory function: during immersion, Forced vital capacity (FVC) showed significantly lower values at CL (4.1 ± 0.4) compared to DL (4.4 ± 0.4) ($p = 0.029$) and also forced expiratory volume in the first second (FEV_{1,0}) showed a significantly lower value at CL (3.5 ± 0.5) compared to DL (3.8 ± 0.1) ($p = 0.01$). **CONCLUSIONS:** Our results suggested that immersion in water, especially at the clavicle level, influences respiratory impedance and respiratory function.

- 1495** Board #89 May 28 10:30 AM - 12:00 PM
Leptin, Adiponectin And Exercise-Induced Bronchoconstriction In Non-asthmatic Children
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 (No relevant relationships reported)

Purpose: Exercise-induced bronchoconstriction (EIB) has been associated with BMI in asthmatic children, while increased body fat contributes to a reduction in post-exercise pulmonary function in non-asthmatic children. Obesity related-adipocyte hormones such as leptin and adiponectin correlate with EIB severity in asthma however, the role of these hormones on EIB in non-asthmatic children remains unclear. The purpose of this study is to investigate the relationship between leptin and adiponectin and EIB in non-asthmatic children. **Methods:** Twenty-five non-asthmatic prepubescent children (9-10 yr) completed pulmonary function tests (FEV₁, FVC, FEF_{25-75%}) pre- and post-exercise. Each participant completed an incremental, cycle-ergometer exercise test to exhaustion (VO_{2peak}). The maximum percentage fall in FEV₁ and FEF_{25-75%} from pre- to post-exercise was calculated, participants were subsequently classified as EIB positive (EIB+) with drop in FEV₁ ≥ 10%. The change in airway function from pre- to post exercise was assessed as the area under the curve of the percentage fall in post-exercise FEV₁ and FEF_{25-75%} plotted against time for 15 min (AUC₀₋₁₅), using trapezoidal integration. Serum leptin and adiponectin levels were determined from a fingertip capillary blood sample taken before exercise. **Results:** BMI was significantly correlated with leptin (r = 0.473, p < 0.05), but not adiponectin in the overall group (n=25). There was also no significant correlation between leptin or adiponectin and any pulmonary function measure for the overall group. When participants were categorized as EIB+ or EIB-, there was a significant correlation between: leptin and %drop in FEV₁ (r = -0.917, p < 0.05) and FEV₁ AUC₀₋₁₅ (r = -0.780, p < 0.05); and adiponectin and %drop in FEF_{25-75%} (r = 0.780, p < 0.05) and FEF_{25-75%} AUC₀₋₁₅ (r = 0.803, p < 0.05) for the EIB+ group. In the EIB- group, there was no significant correlation between leptin or adiponectin and pulmonary function. **Conclusion:** There was a significant correlation between leptin and adiponectin and decreased airway function in EIB+, but not EIB- non-asthmatic children. The causality of this relationship warrants further investigation, but could provide insight into potential intervention strategies for the management of EIB.

- 1496** Board #90 May 28 10:30 AM - 12:00 PM
Swimming And Respiratory System: Impact Of Exercise On Pro-oxidants Production And Lung Function
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Scientific Abstract (ACSM World Congress 2020)

Swimming and Respiratory System: Impact of Exercise on Pro-oxidants Production and Lung Function.

The respiratory redox state of swimmers can be affected by the increase of minute ventilation (VE) during exercise and/or by chronic exposure to chlorine used to sanitize the water of swimming pools. However, in indoor-pools, the high-humidity and warm-water temperature are recognized as respiratory protecting factors. The exhaled breath condensate (EBC) is a non-invasive method used to assess the pro-oxidants species (EBC) is a non-invasive method used to assess the pH and pro-oxidants species (nitrite [NO₂], hydrogen peroxide [H₂O₂]), while spirometry the lung function (FEV₁, FEV₁/FVC, FEF_{25-75%}).

PURPOSE: To assess the impact of a high-intensity and prolonged-time exercise on the production of [H₂O₂]_{EBC}, [NO₂]_{EBC}, pH_{EBC} and lung function in swimmers.

METHODS: Longitudinal quasi-experimental study. 18 competitive swimmers (8 female) (22±2 years; 53.1±3.5 mL·kg⁻¹·min⁻¹ VO_{2max}) completed 3.500-m of swim in indoor pool treated by chlorine (intensity of 80.2±3.1% of HR_{max}) with no exposure to respiratory irritants by 5-days previous to tests. The spirometry test and EBC collection were done at rest, 20-minutes and 24-hours post-exercise and were analyzed using one-way RM-ANOVA test by the GraphPad-Prism software (v.6.0). The p-value < 0.05 was considered for differences.

RESULTS: The [H₂O₂]_{EBC} (0.35±0.15 vs 0.28±0.12 vs 0.20±0.10 (umol·L⁻¹)) and [NO₂]_{EBC} (1.79±0.21 vs 1.37±0.15 vs 1.03±0.16 (umol·L⁻¹)) decreased significantly at 24-hr post-exercise. The pH_{EBC} (p=0.23 and 0.32) and FEV₁, FEV₁/FVC, FEF_{25-75%} do not changed significantly between stages.

CONCLUSION: A acute high-intensity and prolonged-time swimming session decreased the pro-oxidants production with no changes in lung function in swimmers

exposed chronically to exercise and respiratory irritants. More studies are necessary to identify and isolate the plausible factors involucrated in the formation of respiratory pro-oxidants during exercise in athletes chronically exposed to respiratory irritants.

- 1497** Board #91 May 28 10:30 AM - 12:00 PM
Abstract Withdrawn

- 1498** Board #92 May 28 10:30 AM - 12:00 PM
Inhaled Albuterol Increases Forced Mid-expiratory Flows In Non-asthmatic Children With And Without Obesity

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PURPOSE: The effect of albuterol on β₂-adrenoceptor activation is usually assessed by a significant increase in forced expiratory volume in one second (FEV₁). However, even without a significant increase in FEV₁, an increase in isovolume forced expiratory flow between 25% and 75% (isoFEF₂₅₋₇₅) of forced vital capacity (FVC) would allow for greater exercise tidal flow rates thus increasing ventilatory capacity (V̇_{Ecap}). This could be particularly important in children with obesity, who breathe at low lung volumes and have limited expiratory reserves. We examined if isoFEF₂₅₋₇₅ and V̇_{Ecap} increase with albuterol in non-asthmatic prepubescent children with and without obesity.

METHODS: A total of 46 obese (n=29 boys) and 29 nonobese (n=14 boys) children, ages 8-12yr, performed spirometry according to the American Thoracic Society guidelines before and after 360µg of albuterol. Subjects who displayed ≥12% and ≥200mL increase in FEV₁ after albuterol were excluded. For each individual, V̇_{Ecap} was determined using an estimated tidal volume at maximal exercise (V̇_{Tmax} = FVC/2) and forced expiratory time between 25% and 75% of FVC (FET₂₅₋₇₅) to estimate an individualized maximum breathing frequency (f_{bmax}), where V̇_{Ecap} = V_{Tmax} * f_{bmax}. A two-way ANOVA with repeated measures (obese x nonobese; pre- x post-inhaler) was conducted.

RESULTS: No significant group by treatment interaction was detected. No significant differences were detected in spirometry parameters between children with and those without obesity. From pre- to post-inhaler in the total cohort of children (n=75), FVC significantly decreased (-0.70%, p = 0.04). While there was a statistically significant increase in peak expiratory flow (+3.0%, p = 0.02), FEV₁ (+2.6%, p < 0.01) and FEV₁/FVC (+3.0%, p < 0.01), there were more meaningful increases in isoFEF₂₅₋₇₅ (+17.1%, p < 0.01) and V̇_{Ecap} (+15.5%, p < 0.01). **CONCLUSIONS:** Administration of albuterol can increase isoFEF₂₅₋₇₅ despite a relatively small nonclinical increase in FEV₁. The remarkable increase in flow rates along the effort-independent portion of a forced expiration yields a large increase in V̇_{Ecap}, which could potentially change breathing mechanics and ventilatory output during heavy exercise in non-asthmatic prepubescent children with and without obesity.

- 1499** Board #93 May 28 10:30 AM - 12:00 PM
Influence Of Body Fat On Pulmonary Function And Exercise Capacity In Heart Failure Patients

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Heart failure patients with reduced ejection fraction (HFrEF) often exhibit abnormal pulmonary function and reduced exercise capacity. A common comorbidity in HFrEF is obesity, which is independently associated with altered pulmonary function and reduced exercise capacity. However, it is unknown if body composition is significantly related to pulmonary function and exercise capacity in patients with HFrEF.

PURPOSE: To determine if body composition is related to pulmonary function and exercise capacity in patients with HFrEF. We hypothesized that HFrEF patients, compared to healthy controls (CTL) would exhibit reduced pulmonary function and exercise capacity, which will be negatively related to percent body fat (%BF).

METHODS: Patients with HFrEF (n=19; LV EF: 30±10%) and healthy CTL (n=19) were recruited for this study (Age: HFrEF: 62±8 vs. CTL: 60±14 yrs; Height: HFrEF: 176±9 vs. CTL: 173±9 cm) (both, p>0.05). Participants performed standard pulmonary function testing and an incremental cycling test to volitional fatigue for determination of peak oxygen uptake (VO_{2peak}). Percent body fat (%BF) was measured via dual energy x-ray absorptiometry.

RESULTS: HFrEF patients, compared to CTL had greater % BF (HFrEF: 36±7 vs. CTL: 29±7 %) and body mass index (HFrEF: 31±4 vs. CTL: 26±4 kg/m²) and lower $\dot{V}O_{2peak}$ (HFrEF: 21±6 vs. CTL: 27±6 mL/kg/min) (all, p<0.01). There were no differences between HFrEF and CTL in forced vital capacity (FVC), forced expiratory volume in 1 sec (FEV₁), forced expiratory flow rates between 25 and 75% of FVC (FEF₂₅₋₇₅), residual volume (RV), or total lung capacity (TLC) (all, p>0.05); however, HFrEF had smaller expiratory reserve volume (ERV) than CTL (HFrEF: 0.8±0.4 vs. CTL: 1.1±0.8 L, p<0.05). In HFrEF, % BF was significantly related to FVC (r=-0.60), FEV₁ (r=-0.59), ERV (r=-0.72), and TLC (r=-0.54) (all, p<0.05). In CTL, % BF was significantly related to FEV₁ (r=-0.45) and FEF₂₅₋₇₅ (r=-0.45) (both, p<0.05). Lastly, % BF was significantly related to $\dot{V}O_{2peak}$ in HFrEF (r=-0.78, p<0.05), but not CTL (p>0.05).

CONCLUSIONS: These data demonstrate that static lung volumes (i.e. FVC, ERV, and TLC) and FEV₁ are negatively related to % body fat in patients with HFrEF.

Future studies are necessary to determine the impact of body composition on ventilatory constraints during exercise in HFrEF.

**1500 Board #94 May 28 10:30 AM - 12:00 PM
Target Workload For Exercise Challenge Tests Exceeds Achievable Workload In Children With Mild Asthma**

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PURPOSE: Exercise challenge tests are bronchoprovocation tests used to diagnose exercise induced bronchoconstriction. The American Thoracic Society (ATS) recommends calculating the target workload for exercise challenge tests using predicted forced expiratory volume in 1s (FEV₁). The goal is for patients to achieve a minute ventilation between 40 to 60% of predicted maximum voluntary ventilation (PMVV) during the exercise challenge test. The purpose of this study was to compare predicted workload with actual workload achieved during an exercise challenge test in 8 to 12-year-old children with mild asthma.

METHODS: Eleven children (3 girls, 10.3 ± 0.9 yr, 142.6 ± 8.1 cm, 40.7 ± 9.6 kg) completed pulmonary function testing and also completed maximal exercise tests and exercise challenge tests on a stationary bike. PMVV was calculated as 35 x measured FEV₁. The test was completed at a target workload calculated using measured FEV₁ (53.76 x measured FEV₁ - 11.07). Our goal was to increase workload every minute as follows: 60%, 75%, 90%, and 100% target. However, if the child was unable to maintain cadence or expressed inability to complete 6 minutes of cycling, the workload was maintained or reduced to an achievable workload.

RESULTS: 27% of children were below 40% PMVV, 36% were between 40 - 60% of PMVV, and 36% exceeded 60% of PMVV during the fifth minute of the exercise challenge test. After excluding the 3 children who did not achieve minute ventilation of at least 40% of PMVV, measured workload during the exercise challenge test (64 ± 18W; 66 ± 9%, Range: 49 - 78% of predicted target workload) was significantly lower than predicted target workload (96 ± 18W; P<0.001). Workload during the exercise challenge test was 67 ± 8% (Range: 60 - 80%) of maximum workload from the maximal exercise test. In the current project, we used measured FEV₁ to calculate target workload for exercise challenge tests. However, even when predicted FEV₁ was used to calculate target workload, measured workload during the exercise challenge test was below target and ranged from 43 - 112% (66 ± 22%) of target workload.

CONCLUSIONS: The predicted workload for exercise challenge tests based on ATS guidelines may be difficult to achieve for children with mild asthma. However, target ventilation can be achieved at a workload that is between 60 - 80% of maximum workload.

**1501 Board #95 May 28 10:30 AM - 12:00 PM
Inspiratory Muscle Fatigue Is Not Different In Response To Long Vs. Short-duration High-intensity Exercise**

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(No relevant relationships reported)

Maximal isokinetic power (P_{ISO}) at the limit of short duration (<6 min) high-intensity constant-power exercise (Tlim_{SHORT}) is not different from task power. Conversely, P_{ISO} at the limit of long duration (>7 min) high-intensity constant-power exercise (Tlim_{LONG}) exceeds task power. This suggests that while Tlim_{SHORT} is predominantly limited by locomotor neuromuscular fatigue, other physiological mechanisms contribute to exercise limitation in Tlim_{LONG}. One possibility for this difference in the mechanism of exercise intolerance is that the severity of exercise-induced inspiratory muscle fatigue is greater in Tlim_{LONG} vs. Tlim_{SHORT} due to a larger cumulative work of breathing in the longer-duration task. **PURPOSE:** To determine whether the

magnitude of exercise-induced inspiratory muscle fatigue is greater in Tlim_{LONG} vs. Tlim_{SHORT}. **METHODS:** Ten healthy adults (3 females; 25 ± 3 yr) completed a maximal ramp-sprint test (RIT) to determine critical power (CP), $\dot{V}O_{2peak}$ and peak ramp power (RIT_{peak}). Maximal constant-power exercise was then performed at 1) 50% (Tlim_{SHORT}), and 2) 25 % (Tlim_{LONG}) of the difference between CP and RIT_{peak}. P_{ISO} (6 s effort at 80 r/min) was measured at intolerance. Inspiratory muscle fatigue was assessed as the pre- to post-test reduction in magnetically evoked transdiaphragmatic (Pdi_{tw}) twitch pressure. **RESULTS:** Tlim_{LONG} was longer than Tlim_{SHORT} (10.3 ± 2.6 vs. 5.2 ± 1.1 min; P < 0.001), but $\dot{V}O_{2peak}$ was not different between tests (3.7 ± 0.8 vs. 3.7 ± 0.8 L/min; P > 0.05). P_{ISO} at intolerance was not different from task power in Tlim_{SHORT} (294 ± 101 vs. 241 ± 58 W; P = 0.11). Conversely, P_{ISO} at intolerance was greater than task power in Tlim_{LONG} (341 ± 106 vs. 215 ± 53 W; P = 0.008). Cumulative diaphragm pressure-time product was higher in Tlim_{LONG} vs. Tlim_{SHORT} (5945 ± 1956 vs. 2729 ± 1004 cmH₂O/s; P < 0.001). Both Tlim_{LONG} and Tlim_{SHORT} induced a reduction in Pdi_{tw} (-15 ± 13% vs. -19 ± 13%, respectively; P < 0.05). However, the magnitude of exercise-induced inspiratory muscle fatigue was not different between tests (P > 0.05). **CONCLUSIONS:** Despite P_{ISO} at intolerance being greater than task power in Tlim_{LONG} but not Tlim_{SHORT}, inspiratory muscle fatigue was not different between tests and therefore may not contribute to differences in exercise limitation in Tlim_{LONG} vs. Tlim_{SHORT}.

**1502 Board #96 May 28 10:30 AM - 12:00 PM
Abstract Withdrawn**

**1503 Board #97 May 28 10:30 AM - 12:00 PM
Near-infrared Spectroscopy Measures Of Sternocleidomastoid Blood Flow During Exercise And Hyperpnea**

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Respiratory muscle work exerts an influence on the distribution of blood flow during exercise. Most studies have focused on blood flow to the locomotor musculature rather than respiratory muscle owing to their complex anatomical arrangement. **Purpose:** To examine changes to accessory respiratory muscle blood flow in response to increasing ventilation (\dot{V}_E) during whole-body exercise. **Methods:** Blood-flow index (BFI) of the vastus lateralis (VL), sternocleidomastoid (SCM), and 7th intercostal space (7IC) was measured during five-minute bouts of cycle exercise at 30, 60 and 90% peak-power output (EX). Participants then mimicked the hyperpnea of exercise (HYP) achieved during each exercise bout. BFI was measured using near-infrared spectroscopy optodes and indocyanine green. **Results:** Six healthy males completed this study (age: 26 ± 3 years, $\dot{V}O_{2max}$: 56 ± 9 mL · kg⁻¹ · min⁻¹). \dot{V}_E was matched well between EX and HYP (EX-30%: 53 ± 10 vs. HYP-30%: 56 ± 14; EX-60%: 86 ± 14 vs. HYP-60%: 87 ± 18; EX-90%: 159 ± 31 vs. HYP-90%: 142 ± 40 L · min⁻¹, all p > 0.05). BFI-VL increased from 0.15 ± 0.09 μM · second⁻¹ at rest to 2.57 ± 1.10 μM · second⁻¹ during the EX-30% trial and 0.44 ± 0.23 μM · second⁻¹ during the HYP-30% trial and did not significantly increase thereafter in either condition. No interaction effect was observed between condition and intensity, however, BFI-VL was significantly greater in the EX trials compared to the HYP trials (p < 0.05). BFI-SCM increased slightly from 0.87 ± 0.48 μM · second⁻¹ to 1.01 ± 0.54 and 1.67 ± 1.54 μM · second⁻¹ in the EX-30% and HYP-30% trials respectively. We observed no effects of condition or intensity when measuring BFI-SCM (p > 0.05). At rest BFI-7IC was 0.84 ± 0.59 μM · second⁻¹ and in the EX-30% and HYP-30% trials increased to 1.20 ± 0.75 and 1.26 ± 0.60 μM · second⁻¹, respectively. No differences in BFI-7IC were observed between condition or intensity (p > 0.05). **Conclusion:** Previous studies have shown that during heavy whole-body exercise there exists a competition for blood flow between the locomotor and respiratory muscles during heavy, whole-body exercise. In this study, BFI-SCM was similar between exercise and hyperpnea mimicking trials across a range of ventilations, suggesting blood flow to accessory respiratory muscles is preserved during exercise. Funding: NSERC

THURSDAY, MAY 28, 2020

C-39 Free Communication/Poster - Exercise and Aging

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

- 1504** Board #98 May 28 9:30 AM - 11:00 AM
Potential Mechanisms Of Inflammation-induced Attenuated Muscle Hypertrophy Following 3-d/wk High-intensity Resistance Training Among Aged Individuals
Samia M. O'Bryan, S. Craig Tuggle, Samuel T. Windham, Marcas Bamman, FACSM. *University of Alabama at Birmingham, Birmingham, AL.*
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(No relevant relationships reported)

Purpose: Aging related loss in muscle mass (sarcopenia) is major contributor to functional disability and all-cause mortality. Resistance exercise training (RT) is an established treatment for age-related losses in muscle mass, strength, and power. However, we have previously found that 3 d/wk of heavy RT in older adults may blunt the hypertrophic response to progressive resistance training. We postulate that this effect is mediated by skeletal muscle inflammation, indicated by heightened expression of TNFR1 and TWEAK-R. Typically, acute exercise induced inflammation is beneficial to muscle hypertrophy, and this regimen has been shown to be well tolerated by young adults. However, impaired exercise tolerance and adaptability sometimes demonstrated in older adults may be mediated by increased basal muscle inflammatory burden, coupled with an exaggerated inflammatory response to muscle loading. We hypothesize that this phenomenon in the aging cohort may impair hypertrophic responses to RT if intensive loading occurs too frequently (i.e. 3 d/wk). **Methods:** This study builds on a previous clinical trial conducted by our lab (NCT02442479), analyzing muscle hypertrophy in a four-arm, randomized dose-response trial to determine optimal exercise treatment for aging individuals (60-75 y). For this follow-up molecular analysis, we analyzed two of the groups of interest that underwent either 3 d/wk mixed model consisting of two days high-intensity training days separated by one low-intensity, concentric only day (HLH, n = 18) or 3 d/wk high-intensity training regimen (HHH, n = 18). Skeletal muscle biopsies were collected before and after 35 weeks of training in either HLH or HHH. Muscle and serum-derived miRNA-Seq is underway to identify potentially novel regulators of muscle hypertrophy and inflammation, accompanied by targeted muscle analysis of key inflammatory pathways (e.g., TNF/TWEAK-NFkB, IL-6-STAT3). **Results and Conclusion:** We expect that results from this study will advance our understanding of the role of inflammation in blunting muscle hypertrophy in aging adults, including a better understanding of both dose optimization and inter-individual response heterogeneity. Supported by T32HD071866 and UAB Center for Exercise Medicine.

- 1505** Board #99 May 28 9:30 AM - 11:00 AM
Age-related Differences In Rapid Neuromuscular Parameters Of The Plantar Flexors And Correlations With Physical Function
Phuong L. Ha, Alex A. Olmos, Matthew T. Stratton, Trisha A. VanDusseldorp, Alyssa R. Bailly, Yuri Feito, FACSM, Gerald T. Mangine, Benjamin E. Dalton, Tyler M. Smith, Garrett M. Hester. *Kennesaw State University, Kennesaw, GA.* (Sponsor: Yuri Feito, FACSM)
(No relevant relationships reported)

Few studies have concurrently examined multiple rapid neuromuscular characteristics of the plantar flexors (PFs) in middle-aged (MM) and older (OM) males. Further, it is important to determine the association between these measures and physical function. **PURPOSE:** To compare rapid neuromuscular parameters of the PFs in MM and OM, and examine correlates of physical functioning. **METHODS:** Twenty-nine healthy, MM (n=14; 45.3±2.6 yrs) and OM (n=15; 65.3±3.2 yrs) performed fast, isotonic (IT) contractions with a load of 0.5 Nm and slow, isokinetic (IK; 60°·s⁻¹) concentric contractions of the PFs using a dynamometer. Participants were instructed to push with the ball of their foot "as hard and fast as possible" prior to each contraction. Peak velocity (PV), rate of velocity development (RVD_{IT}), and rate of electromyography rise (RER) were obtained from IT trials. During the IK trials, time to peak torque (TPT) and rate of velocity development (RVD_{IK}) were acquired. RVD was obtained from the linear slope of the velocity-time curve ($\Delta\text{velocity}/\Delta\text{time}$) as the highest rolling 20 ms value. RER of the medial gastrocnemius was derived from the linear slope of the normalized electromyography signal as the highest rolling 50 ms value. Maximal walking velocity (MWV) and time to complete 5 chair rises (5CR) were also recorded. Group comparisons were made with independent samples t-tests, while Pearson correlation coefficients were calculated to examine select relationships. **RESULTS:** RVD_{IT} was lower (MM=5202.83±510.23 vs. OM=4630.29±854.23°·s⁻²;

p=0.037), and 5CR time greater (16%; p=0.022) in OM. RER was only correlated (r=0.431; p=0.026) with RVD_{IT}. Only PV (r=0.396; p=0.033) and RVD_{IT} (r=0.480; p=0.008) were correlated with MWV, while only TPT was correlated with 5CR time (r=0.451; p=0.014). **CONCLUSIONS:** Our findings suggest that rapid neuromuscular measures may be differentially influenced by age, and only particular parameters are associated with physical function.

- 1506** Board #100 May 28 9:30 AM - 11:00 AM
Poor Handgrip Strength And Risk Of Falls In Older Women
Silvia Neri¹, Ricardo Lima¹, André Gadelha², Baruch Vainshelboim³. ¹University of Brasilia, Brasilia, Brazil. ²Federal Institute Goiano, Urutaí, Brazil. ³Stanford University, Palo Alto, CA.
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Falls are the leading cause of fatal and nonfatal injuries among older people, although its association with handgrip strength is less characterized. **PURPOSE:** To prospectively assess the association between poor handgrip strength and incidence of falls in older women. **METHODS:** The cohort included 204 women (68.1 ± 6.2 years) who were assessed for handgrip strength (Jamar Dynamometer) at baseline and followed up for 18 months. FNII Sarcopenia threshold of handgrip strength adjusted for body mass index (BMI) (<0.56) was used for clinical determination of muscle weakness. Multivariable Cox hazard models were analyzed in the total cohort and stratified by postural balance (near tandem stand test cutoff: 10 s) status. **RESULTS:** During the follow-up, 56 (27%) women experienced at least one event of falls. Compared to women with normal handgrip strength, women who had poor handgrip strength adjusted for BMI exhibited significantly higher risk for falls [Hazard Ratio (HR): 2.2, 95% Confidence Interval (CI) (1.1 - 4.6), p=0.031]. The risk was even greater in a stratified analysis among women with impaired balance [HR: 3.2, 95% CI: (1.3 - 7.7), p=0.011] but not significant (p=0.440) in women with normal balance. **CONCLUSIONS:** Poor handgrip strength adjusted for BMI is associated with higher risk of falls in older women and particularly in those with impaired postural balance. These results suggest potential prognostic value of handgrip strength testing in risk stratification for falls.

- 1507** Board #101 May 28 9:30 AM - 11:00 AM
Regular Exercise Training Decreases Circulating Myostatin In Older Overweight Women At Rest And In Response To Acute Exercise
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Myostatin (growth and differentiation factor (GDF) 8) inhibits skeletal muscle growth, whereas follistatin (FST) can inhibit GDF8 to promote skeletal muscle growth. GDF15 may be a biomarker of stress, and also impact skeletal muscle growth. The **PURPOSE** of this project was to determine if an acute bout of exercise in older women could positively influence these three circulating biomarkers. **METHODS:** Overweight, older women (64.0±1.3 years; BMI=32.8±1.0 kg·m⁻²; n=18) participated in an acute bout of cardiorespiratory and resistance exercise before and after a 12-week training intervention. The training intervention consisted of 3 d/wk of progressive supervised treadmill walking and resistance exercise at a moderate to vigorous intensity. Blood was collected before acute exercise (PRE), immediately after (POST), 1 hour recovery (1HR), and 2 hour recovery (2HR). Serum GDF8, FST, and GDF-15 were measured with commercially available ELISA kits. **RESULTS:** BMI did not change (p>0.05). GDF8 was higher (p<0.05) at PRE, 1HR, and 2HR before the exercise training intervention. Both before and after the training intervention, an acute bout of exercise increased (p<0.05) GDF8 at POST, 1HR, 2HR compared to PRE. FST increased (p<0.05) from PRE to 1HR and 2HR both before and after the intervention. GDF15 increased (p<0.05) from PRE to POST before the intervention, but PRE to POST, 1HR, and 2HR after the intervention. **CONCLUSION:** Regular exercise training can reduce the acute exercise effect on circulating GDF8. Further, acute exercise will increase FST before and after an exercise training intervention. These results were independent of a change in BMI. Together, this may be a potential mechanism for exercise to help maintain skeletal muscle mass during aging.

1508 Board #102 May 28 9:30 AM - 11:00 AM
Associations Among Physical Activity, Protein Intake, And Clinical Indicators Of Sarcopenia

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 (No relevant relationships reported)

Sarcopenia is characterized by age-related loss of skeletal muscle mass and function, and is associated with increased risk of falls, fractures, and mortality. Physical inactivity and inadequate protein intake are lifestyle factors that may contribute to the development and progression of sarcopenia. Weight-adjusted skeletal muscle index (wSMI), grip-strength (GRIP) and gait-speed (GAIT) are utilized clinically to diagnose sarcopenia. Phase-angle (PhA), obtained via bioelectrical impedance, is predictive of muscular strength and may also be predictive of sarcopenia. The **PURPOSE** of the study was to evaluate the relationships among indicators of sarcopenia, habitual physical activity, protein intake, and PhA in older adults. **METHODS:** In 96 subjects (68W/28 M, 68±6years) gait speed, grip strength (dynamometer), body composition (bioelectrical impedance), and habitual physical activity (7-day accelerometry) were measured. wSMI [skeletal muscle mass (SMM)÷body mass (BM)] was also calculated. In a subset of 34 subjects, habitual dietary intake was determined (3-day diet recall). Partial correlations (controlling for age and sex) were utilized to examine the relationships among variables of interest. Significance was set to $\alpha < 0.05$. **RESULTS:** Mean values were SMM: 28±6 kg; wSMI: 0.4±0.1; GRIP: 28±9 kg; GAIT: 1.5±0.4 m/s; PhA: 4.9±0.7°; moderate-intensity PA (MOD PA): 58±31 min/day; sedentary time (SED): 707±82 min/day; relative protein intake (RPI): 0.8±0.2 g protein/kg body mass. MOD PA was significantly ($p < 0.05$) correlated with wSMI ($r = 0.28$), PBF ($r = -0.25$), and RPI ($r = 0.42$). RPI was additionally correlated with PhA ($r = 0.37$) and body mass ($r = -0.44$). There was a trend towards a significant correlation between RPI and wSMI ($r = 0.29$, $p = 0.11$). GAIT was significantly correlated with activity counts per minute ($r = 0.23$), PBF ($r = -0.47$), wSMI ($r = 0.45$). GRIP was significantly correlated with SMM ($r = 0.40$). **CONCLUSIONS:** These data show that greater PA and RPI are associated with better scores for some of the clinical indicators of sarcopenia. Thus, increased PA and RPI intake may represent effective strategies for decreasing the risk of sarcopenia.

1509 Board #103 May 28 9:30 AM - 11:00 AM
Skeletal Muscle Fiber Type In Older Patients Receiving Maintenance Hemodialysis Treatment

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PURPOSE: Metabolic abnormalities and increased sedentary time in maintenance hemodialysis (MHD) patients lead to unfavorable skeletal muscle adaptations and reduced exercise tolerance. Muscle function is affected by the proportion of "pure" myosin heavy chain (MyHC) fiber type isoforms (Type I, IIa, and IIx) and prevalence of co-expressing "hybrid" fibers (Type I/IIa, IIa/IIx, I/IIa/IIx, and I/IIx) which display unique functional/metabolic properties associated with disease and inactivity. Previous investigations have utilized ATPase fiber typing methods in MHD patients, but this technique lacks fidelity to identify hybrid fibers. The purpose of this study was to 1) more accurately measure MyHC fiber type distribution in older men undergoing MHD and 2) compare the MyHC fiber type profile of these MHD patients to the literature. **METHODS:** Seven subjects (6 males and 1 female) receiving MHD treatment (age: 63.6 ± 4.4y; MHD duration range: 0.8 - 10y) underwent resting vastus lateralis muscle biopsies. Individual muscle fibers were mechanically isolated (696 total fibers) for MyHC fiber typing via SDS-PAGE. **RESULTS:** MyHC fiber type distribution was 31% I, 4% I/IIa, 23% IIa, 27% IIa/IIx, 3% I/IIa/IIx, 2% I/IIx, and 11% IIx. Rarely identified MyHC I/IIx fibers were found in two MHD patients. **CONCLUSIONS:** MyHC fiber type distribution was 31% I, 4% I/IIa, 23% IIa, 27% IIa/IIx, 3% I/IIa/IIx, 2% I/IIx, and 11% IIx. Rarely identified MyHC I/IIx fibers were found in two MHD patients.

1510 Board #104 May 28 9:30 AM - 11:00 AM
Muscle Power Mediates The Relationship Between Physical Activity And Functional Fitness In Older Women

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Muscle power is critical for older people to independently and safely perform the activities of daily living. Physical activity in general and resistance training, in particular, are essential for the prevention of muscle power loss with ageing. **PURPOSE:** To analyze the associations between moderate-vigorous intensity physical activity (MVPA) and functional fitness in older women, including the role of muscle power in mediating these associations. **METHODS:** Participants were 54 older women with a mean age 73.5±6.8yrs. MVPA (min day⁻¹) was measured by accelerometry. Lower limb peak muscle power (W/kg) was assessed using a mechanography ground reaction force platform. Functional fitness (lower body strength, agility/dynamic balance, and aerobic endurance) was objectively assessed through physical fitness tests from the Senior Fitness Battery, respectively: 30s chair stand (repetitions), 8-foot up-and-go (s), and 6-minute walk test (m). Functional fitness was also subjectively evaluated via the 12-item Composite Physical Function Scale Questionnaire which gives a global score of physical function (points). Direct and indirect mediation model effects were estimated using the PROCESS macro developed by Preacher and Hayes, and 95% bootstrap confidence intervals were constructed to test the hypothesis that muscle power mediated associations. Age was examined as a covariate. **RESULTS:** A significant portion (40-78%) of the total effect of MVPA on functional fitness in older women was explained by muscle power. The indirect effects were observed on physical function global score ($\beta = 0.040$ 95% CI [0.010, 0.099]) and in each of the functional fitness parameters: lower body strength ($\beta = 0.048$, 95% CI [0.013, 0.117]), agility/dynamic ($\beta = -0.009$, 95% CI [-0.024, -0.002]) and aerobic endurance ($\beta = 0.656$, 95% CI [0.146, 1.694]). There were no direct effects of MVPA on functional fitness. **CONCLUSION:** To improve functional fitness in older women, physical activity interventions should consider the mediating role of muscle power and include activities that require force to be rapidly generated.

1511 Board #105 May 28 9:30 AM - 11:00 AM
Early Life Muscle Disuse Causes Premature Dynapenia In Adulthood

Paul T. Reidy¹, Emory Perlman¹, Ryan Schmidt¹, Abbas Doctor¹, Jackie Monnig¹, Ziad Mahmassani², Dennis Fix², Alec McKenzie², Jonathan Petrocelli², Naomi de Hart², Micah Drummond². ¹Miami University, Oxford, OH. ²University of Utah, Salt Lake City, UT. (Sponsor: Kyle Timmerman, FACSM)
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Physical activity (PA) is a vital behavior to maximize health and wellness. Less is understood regarding the impact of muscle disuse on children, specifically during key stages of skeletal muscle development. **PURPOSE:** We propose that, similar to malnutrition, exposure to muscle disuse early in life will impact function in adulthood. **METHODS:** We exposed postnatal mice (1 month old) to physical inactivity in the form of muscle disuse (hindlimb unloading, HU) shortly after weaning, and then let them age to adulthood (5 months of age). They were then tested for physical function (grip strength) and muscle size. **RESULTS:** Compared to similar aged controls, no notable effects of early life physical inactivity (HU) on skeletal muscle size were observed. Pooled muscle mass was 339.4±8.8 mg for Early Control and 332.2±6.2 mg for Early HU. However, a clear and robust reduction in grip strength was experienced in those exposed to HU early in life. Max Grip Strength was 0.398±0.008 kg for Early Control and 0.362±0.007 kg for Early HU ($P < 0.05$). Additional analyses will be presented at the meeting. **CONCLUSIONS:** Since grip strength is a strong predictor of health status, reduced functionality, and early mortality these findings of premature dynapenia (muscle weakness) as a result of early life muscle disuse are concerning. Supported by NIA R01AG AG050781

1512 Board #106 May 28 9:30 AM - 11:00 AM
Statin Therapy Does Not Limit Improvements In Mitochondrial Function And Cardiorespiratory Fitness Following Moderate Exercise

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INTRODUCTION: Statin medications are widely used to reduce major cardiovascular risk factors and events, but have also been reported to reduce cardiorespiratory and mitochondrial adaptations expected with aerobic exercise training. The current study evaluated the influence of statin therapy on aerobic exercise training adaptations in older adults. **METHODS:** Twenty-eight healthy, sedentary older adults (67±5 yrs old, BMI=30±5, mean±SD, 5 males) participated in a 12-week randomized graded treadmill walking intervention (EX) with roughly half the group on statin therapy (+statin). ³¹P MRS was used to quantify oxidative capacity of the plantar flexor muscles (3T MRI, 51.7MHz, TR=3s); a monoexponential model was used to fit the time constant of phosphocreatine recovery following acute plantar flexion. Peak oxygen consumption (VO₂ peak) was measured during a modified Balke exercise stress test. Repeated measures ANOVA was used to assess changes in muscle oxidative capacity and VO₂ peak between groups with significance at p<0.05. **RESULTS:** Prior to the exercise intervention, PCr time constant (tau, s) was significantly prolonged in statin users (+statin 42.2±10.5s; -statin =34.1±9.9s; p=0.039). Following exercise training, the time constant was reduced by 27% (Pre: 40.3±29.6s; Post: 29.6±10.4s) for EX compared to CON (Pre: 35.5±6.3s to 36.4±9.0s), p=0.001, n=27. There was no significant effect of statin therapy with a 28.0% improvement for EX+statin compared to a 25.3% for EX-statin. VO₂ peak increased 11% following EX (Pre: 18.8±2.8 ml/kg/min, Post: 20.1±3.5 ml/kg/min) compared to CON (Pre: 21.8±3.7, Post: 20.8±3.6 ml/kg/min), p=0.001, n=21 with no effect of statin therapy. **CONCLUSION:** Moderate exercise training in older adults on a low dose statin resulted in typical increases in aerobic fitness. These results are encouraging for the majority of older adults as 50% or more are likely to be prescribed a statin for reduction in cardiovascular event risk or prevention of metabolic syndrome. Supported by NIH AG042041.

1513 Board #107 May 28 9:30 AM - 11:00 AM
Sex, But Not Age, Associates With Whole Muscle Carnosine Content Of Trained Men And Women

Eimear Dolan¹, Paul A. Swinton², Luana Farias de Oliveira¹, Nathalia Saffioti Rezende¹, Bruna Caruso Mazzolani¹, Giulia Cazetta Bestetti¹, Fabiana Infante Smaira¹, Alina Dumas¹, Pedro Perim¹, Luiz Riani¹, Bruno Gualano¹, Bryan Saunders¹.
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Carnosine is a dipeptide formed from the amino acids β-alanine and L-histidine, which contributes toward a number of essential processes in skeletal muscle metabolism. A number of modifiable (e.g., sex and age) and non-modifiable factors (e.g., training status) purportedly influence muscle carnosine content (MCarn), but little is known about the relative contribution of these factors. **PURPOSE:** To investigate the influence of modifiable and non-modifiable determinants of MCarn in a group of cycling-trained men and women. **METHODS:** 73 trained cyclists (54 men and 19 women, age 18 - 60) participated. Whole muscle MCarn was determined using high-performance liquid tomography, from a biopsy taken from *m. vastus lateralis*. All participants completed a self-report questionnaire of their current and previous training habits, and an exercise test battery (aerobic capacity testing, wingate test and a 4km time-trial). Body composition was assessed using the sum of 7 skinfolds. To describe relationships between MCarn and a range of demographic, performance and training-related factors, penalized regression in the form of LASSO (least absolute shrinkage and selection operator) analysis was completed. Models were generated using the glmnet package in R with associations described by regression coefficients and percentage inclusion in 10000 bootstrap samples. **RESULTS:** Sex (91% of models) and sum of skinfolds (69% of models), but not age (52% of models), training habits (13-30% of models), nor exercise test performance (4-45% of models), predicted MCarn. The LASSO model estimated women to have a median reduction of ~two units compared to men (-1.8, 95%CrI: -5.2 - 0), while each 2SD increase in the sum of skinfolds resulted in an MCarn decrease of approximately 1 unit (-0.8; 95%CrI: -5.6 - 0). Repeating the model with men only identified no relevant associations (≤37% of models) on MCarn. **CONCLUSION:** Sex and body composition, but not age nor performance outcomes, had very small associations with whole muscle MCarn in a group of trained cyclists. These results imply that habitual training may reduce previously reported impacts of age on MCarn content (at least across the 4 decades investigated in this study). In contrast, women had lower MCarn content than men, even though their type and volume of training was similar.

C-40 Free Communication/Poster - Assessment of Physical Activity and Sedentary Behavior

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

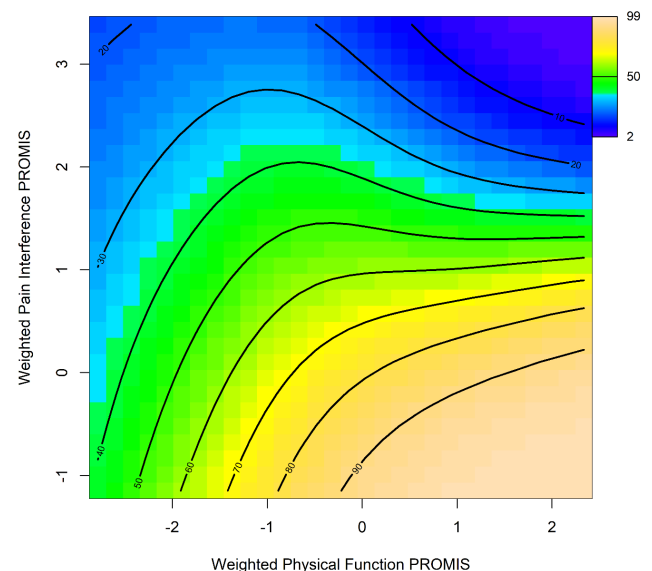
1514 Board #108 May 28 10:30 AM - 12:00 PM
Nonlinear Models And Computer Adaptive Testing Can Decrease Orthopedic Patient Survey Burden

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 (No relevant relationships reported)

The National Institutes of Health Patient Reported Outcomes Measurement Information System (PROMIS) computer adaptive tests (CATs) assess patient symptom level in fewer questions than legacy patient reported outcomes (PRO). While there are benefits to CATs, clinicians commonly desire legacy PROs where they have an existing knowledge base. The American Shoulder & Elbow Surgeons score (ASES) is commonly used to assess shoulder function; it is unknown if PROMIS measures can predict ASES scores.

PURPOSE: Design a nonlinear model using PROMIS CATs to predict ASES scores. **METHODS:** Military Health System beneficiaries who underwent a shoulder surgery and consented to allow their clinical data be used for research (n=897) completed the ASES, PROMIS Physical Function, and PROMIS Pain Interference at varying time points, providing 1,471 complete observations. PROMIS Physical Function and Pain Interference surveys were modeled as these are the theoretical constructs the ASES evaluates. For the prediction models, PROMIS CAT scores were re-weighted based on the standard error of the score, reflecting the confidence in the score, via inverse-variance reweighting. A beta distribution Generalized Additive Mixed Model (GAMM) accounted for multiple observations while incorporating nonlinear interactions into the model. The model's predictive quality was assessed via four-fold cross-validations evaluating the following metrics between predicted vs true data: 1) Pearson correlation coefficients, 2) linear regression R² values, and 3) root mean square error (RMSE). **RESULTS:** The GAMM predictive model (Figure 1) had the following characteristics: Pearson coefficient = 0.74-0.76, R² = 0.55-0.58, and RMSE = 13.4-14.2. **CONCLUSIONS:** PROMIS CATs, in conjunction with nonlinear predictive modeling, can reliably predict legacy PRO scores. PROMIS CATs reduce patient question burden and can provide clinicians the information they are accustomed to receiving from legacy PROs.

Beta GAMM ASES Scores



1515 Board #109 May 28 10:30 AM - 12:00 PM
Comparison Of Parent Self-reported Physical Activity And Accelerometry Among Racially/ethnically Diverse Young Children

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PURPOSE: To compare parent-reported child physical activity (PA) with accelerometer-measured in a sample of racially/ethnically diverse families and examine whether self-reported and objective measures differed by sex. **METHODS:** 146 parent-child dyads, with children (5-7 years old; 47% girls) represented by six racial/ethnic groups (n=23 African American, n=25 American Indian, n=25 Hispanic/Latino, n=25 Hmong, n=24 Somali, and n=24 White) were included in this analytic sample. Parents reported average weekly hours of child light (LPA), moderate (MPA), and vigorous PA (VPA) using a validated self-report measure. Child LPA, MPA, and VPA were objectively measured by accelerometry (ActiGraph GT1M) for 8 days. Correlation analyses were used to compare self-reported and accelerometer-measured PA variables. Multiple linear regression assessed the association between parent self-reported child LPA, MPA and VPA and accelerometry, and whether child sex moderated these associations. All models were adjusted for child age, sex, BMI, race/ethnicity, and household income. **RESULTS:** The average weekly hours of LPA, MPA, and VPA measured by parent self-report and accelerometry were 3, 2.8, 2.3, and 30±6.6, 3.9±1.5, 1.6±1.1 hours per week, respectively. Pearson correlations between self-reported and accelerometer-measured LPA, MPA, and VPA were 0.03, 0.25, and 0.22, respectively. The relationship between self-reported and objective PA were similar between girls and boys (all *P*-interaction > 0.1). Accelerometer-measured MVPA revealed 23.8% of children met the U.S. PA guidelines. **CONCLUSION:** Overall, self-reported and objective measures of PA were poorly correlated in this racially/ethnically diverse sample of parent-child dyads. Misunderstanding of what constitutes different levels of child PA by parents, the survey tool, and the sporadic nature of PA behaviors in young children might explain these findings. When accelerometry is not available, future studies should incorporate descriptive measures of different types of PA and choose a different survey tool, such as Ecological Momentary Assessment to have better estimates of parent-reported child PA throughout the day. Interventions for PA promotion among racially/ethnically diverse children are needed given the low levels of MVPA in this sample.

1516 Board #110 May 28 10:30 AM - 12:00 PM
Activity Monitor Step And Heart Rate Accuracy During Overground Walking And Stair Climbing

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 (No relevant relationships reported)

Wrist-worn activity monitors incorporate various inputs, most notably movement counts and heart rate, to provide an aggregate of daily physical activity. **PURPOSE:** To assess the accuracy of wrist-worn activity monitors during over-ground walking, and ascending and descending stairs. **METHODS:** Forty-seven participants (age = 26.7±5.9 yrs, ht = 169.9±10.4 cm, wt = 77.0±17.8 kg) wore a chest-strap heart rate (HR) monitor (CS), five wrist activity monitors (GV, AL, and PL on the right wrist, FH and MF on the left wrist), and a pedometer (HJ) on the right waist. Participants were filmed as they walked for 200m across a level surface, up four flights of stairs, and down four flights, with full recovery between each. After each of the three trials, HR from CS, GV, FH, and MF were recorded. Video was later reviewed for actual counts (AC) to be compared with the monitors. Repeated measures ANOVA was used to determine significant differences between the counts (Alpha set at .05). Pedometer error was calculated as [(monitor counts-AC)/AC] * 100. **RESULTS:** 200m walk counts: MF (282.8±27.1 counts), PL (265.1±41.4 counts), and AL (254.7±52.4 counts) were significantly lower than AC (294.0±22.4), p<0.05, with error greatest in the PL (13.7%) and AL (14.5%), and least in GV (5.5%) and HJ (6.9%). Ascending counts: PL (73.2±32.4 counts) and AL (92.1±18.8 counts) were significantly lower than AC (106.2±5.0 counts), p<0.05, with error greatest in the PL (34%) and AL (13%) and least in GV (7.5%) and MF (7.8%). Descending counts: MF (97±5.0 counts) and PL (67.9±33.9 counts) were significantly lower than AC (101.8±2.9 counts), p<0.05, with error greatest in the PL (39.5%) and GV (7.7%), and least in MF (3.5%) and HJ (5.0%). Heart Rate: GV (116.1±13.4 b/min) was significantly greater than CS (107.0±19.8 b/min) while walking (p<0.05), GV (130.5±18.5 b/min) and FH (137.1±18.6 b/min) was significantly lower than CS (143.7±18.7 b/min) while ascending (p<0.05), and GV (117.9±15.6 b/min) was significantly greater than CS (110.8±19.7 b/min) while descending (p<0.05). **CONCLUSION:** The HJ and GV provides the most accurate step count across conditions, and MF provides the most accurate HR across conditions. One should account for type and intensity of activity when considering use of wrist-worn activity monitors.

1517 Board #111 May 28 10:30 AM - 12:00 PM
Analysis Of Runners With Medial Tibial Stress Syndrome

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Nowadays, running as a hobby and component of exercise routines has become increasingly popular due to its proven health effects. Therefore, the number of injuries caused by this exercise method has increased substantially amongst recreational and professional runners. Medial tibial stress syndrome (MTSS) is among the most commonly noted injuries, after excluding pains of ischemic origin and stress fractures as a source of posteromedial tibial pain. **PURPOSE:** To describe the kinematics and strength analysis of running athletes diagnosed with MTSS and to evaluate its effect on the athletes' performances. **METHODS:** Twenty-seven runners with MTSS and 29 runners without MTSS (control group) were evaluated. The participants answered the sociodemographic, Baecke's Usual Physical activity and International Physical Activity questionnaires. Videos of the participants while running were recorded from the rear and the side. Kinovea® software was used to analyse the videos. An FPX25 digital algometer (Greenwich, USA) was used to measure the pre- and post-race pain areas. The data gathered were structured into a statistical mixed prediction model of runner speed alteration based on multiple fixed variables. **RESULTS:** Runners with MTSS had an average running speed 0.55 km/h ±0.27 (p<0.01) lesser than that of runners with MTSS. Moreover, the strength of the quadriceps femoris (average less 61,7 Kgf; p<0.01) and hip external rotators (average less 61,6 Kgf; p<0.03) muscular groups was lower among the runners with MTSS. **CONCLUSION:** The average speed of the runners with MTSS is lesser than that of the healthy runners. The strength of the quadriceps femoris and hip external rotators is reduced in runners with this syndrome, suggesting that focused treatment of the weakened muscles could be one way of accelerating recovery.

TABLE: Prediction model of runner speed alteration based on multiple fixed variables.

	Speed	Std. Error	t	p-Value	95% conf. interval
V2*	+2.94 Km/h	±0.14	21.41	0.00	2.67 to 3.22
V3*	+5.91 Km/h	±0.25	23.78	0.00	5.42 to 6.41
MTSS group [†]	-0.55 Km/h	±0.27	-2.07	0.005	-1.09 to -0.1
Baecke's scores [†]	+0.24 Km/h	±0.08	2.90	0.005	0.07 to 0.41
Age [‡]	+0.02 Km/h	±0.01	1.42	0.16	-0.01 to 0.04
Male [‡]	+0.33 Km/h	±0.27	1.24	0.22	-0.20 to 0.87

* reference: V1; † reference: Control Group; ‡ Reference: Female.

1518 Board #112 May 28 10:30 AM - 12:00 PM
Factors Associated With Daily Physical Activity In Children

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 (No relevant relationships reported)

Purpose: The purpose of this study was to examine which factors were related the number of days per week of physical activity in children. **Methods:** Patients presenting to sports medicine clinics between the ages of 5-18 were asked "On average, how many days per week did you participate in MVPA" and "On average, how many minutes per day did you participate in MVPA". Age, sex, BMI percentile, as well as the history of asthma, attention deficit hyperactivity disorder, depression and diabetes were recorded. A linear regression was utilized to determine which factors were associated with increased days of physical activity. **Results:** Data were recorded on 14,440 subjects. Average age of was 13.91±2.49 years, average BMI percentile was 65.50±27.74, and 54.1% were female. A total of 2340 (16.2%) reported asthma, 818 (5.7%) reported ADHD, 308 (2.1%) reported depression, and 92 (.6%) reported diabetes. Average days per week of MVPA was 4.31±1.68. Approximately 5% of patients reported 0 days of MVPA/week, whereas only 6% of patients reported daily MVPA. Females reported .48 less days of MVPA per week (p<.001). Those with a history of depression reported .59 less days of MVPA than those without a history of depression (p<.001). Those with a history of ADHD reported .23 days less of MVPA when compared to those without ADHD (p<.001). Older children completed more days of MVPA (p<.001). **Discussion:** The current MVPA recommendations require 60 minutes of daily MVPA for all school aged children. The vast majority of children in our study were not participating in MVPA 7 days per week. All children should be screened for MVPA to identify and counsel those who are not active daily

to ensure that they gain all the benefits from physical activity. Assessment of total weekly activity should be compared to daily activity to evaluate which factor is more important for reaping the benefits of children's physical activity.

annotated with the novel schema can differentiate sitting and upright postures. Future work is warranted to both improve posture classification and examine IMG accuracy and precision in assessing activity behavior. Supported by NIH 1R01CA215318

1519 Board #113 May 28 10:30 AM - 12:00 PM
Validity Of Optical Heart Rate Measurement In Commercially Available Wearable Fitness Devices

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Wearable fitness devices have risen in popularity for athletes and the general population, and are increasingly integrated into smartwatch technology. Optical heart rate measurement by photoplethysmography provides data to monitor and track training intensities and progress. **PURPOSE:** To determine the validity of optical HR measurement in 3 fitness devices while resting, walking, and running. **METHODS:** Ten subjects (5 male, 5 female) completed 4 testing protocols based on the ANSI/CTI standards for sedentary (Sed), and treadmill walking (Wlk), running (Run), and dynamic running/walking (Dyn). Subjects wore 3 optical heart rate devices: Polar OH1 on the right forearm (OH1), Garmin Forerunner 945 (FR945) on the left wrist and Apple Watch 4 (AW4) on the right wrist. The Polar H10 (H10), a chest strap device, was the criterion HR measurement device. Sed, Wlk, and Run were all 7-minute protocols with 1 minute of standing, 5 minutes of prescribed intensity, and 1 final minute of standing. The Dyn protocol was a 12-minute protocol with 1 minute of standing, 10 minutes of variable intensity walking and running, and 1 minute of standing. Raw HR data was extracted from each device and temporally aligned with the H10 for data analysis. **RESULTS:** Mean descriptive statistics for the subjects were: age = 26.8 ± 7.6 years, height = 1.70 ± .12 m, weight = 73.0 ± 14.3kg, BMI = 25.1 ± 2.8 kg/m² and body fat 22.6 ± 11.2%. Mean Absolute Deviation (MAD), and Mean Average Percentage Error (MAPE) were calculated for each device for each protocol (Table 1). **CONCLUSIONS:** At rest and during both steady-state and variable-speed treadmill walking and running, the Polar OH1, Garmin Forerunner 945, and Apple Watch 4 optical HR monitors demonstrated a level of accuracy well within that required by the ANSI/CTA Standard (2018) for physical activity monitoring devices for heart rate measurement (<10% Mean Absolute Percent Error). Supported by the David E. Martin Sport Science Research Fund and The Atlanta Track Club.

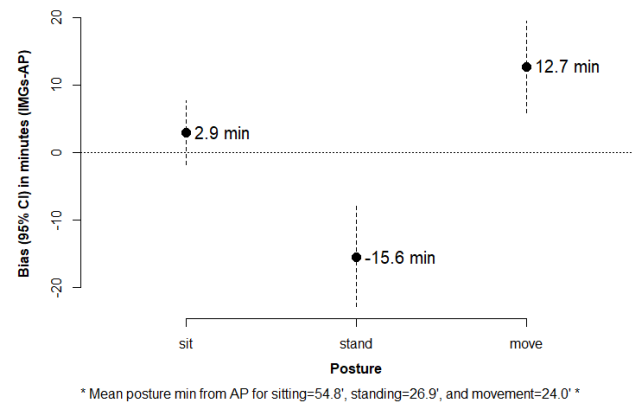
Table 1.	Mean Absolute Deviation (Beats Per Minute)			Mean Absolute Percentage Error (%)		
	OH1	FR945	AW4	OH1	FR945	AW4
Sedentary	1.56	2.29	1.48	2.00	3.02	2.02
Walk	2.95	4.74	2.00	3.15	4.96	2.24
Run	4.41	7.48	5.64	3.31	5.19	3.99
Dynamic	2.58	7.59	3.15	1.92	5.17	2.39

1520 Board #114 May 28 10:30 AM - 12:00 PM
Comparing Posture Classifications From Wearable Camera Still-images To Accelerometry

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Purpose: To assess the convergent validity of a novel image annotation schema for determining posture from wearable camera still-images (IMGs) and activPAL (AP) posture classifications. **Methods:** Participants (n=5, mean age 45y, range 21-81y, 3F) wore an AP monitor at the right anterior-mid-thigh and an Autographer wearable camera (WC) above the xiphoid process during two or three, 2hr visits. WC was set to capture IMGs every 5-60 sec. IMGs were annotated with the Oxford Image Browser software for 3 postures that matched AP classifications: sitting, standing and movement. A sequence of 3 IMGs denoted a postural "event". Sequences of fewer than 3 IMGs and when IMGs could not be accurately classified were annotated as "transitions". For analyses, IMGs and AP output were converted to one-sec epochs and matched sec-by-sec. Total visit time and event time is reported in min. Overall and event percent agreement between AP and IMGs were calculated. Within events, statistical bias and CIs for posture times from IMGs to AP posture times were calculated to determine accuracy and precision with mean posture times from AP stated as reference. Confusion matrices were computed to determine misclassification. **Results:** 13 visits were analyzed with a total visit time of 1546 min and total event time of 1375 min. Mean overall percent agreement including events and transitions was 72%, while mean event percent agreement was 80%. Fig.1 shows bias and mean event posture min from AP, where bias was low for sitting but IMGs tended to underestimate standing and overestimate movement. From confusion matrices, IMGs misclassify standing as movement 46% of the time. **Conclusion:** Within events, IMGs

Fig.1. IMGs bias compared to AP mean posture times within events



1521 Board #115 May 28 10:30 AM - 12:00 PM
A Comparison Of Two Qualitative MVPA Scoring Protocols: Youth Met_y Cut-points Require Further Exploration

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Qualitative measures of activity have been traditionally described utilizing MET values. Notably, activity intensity is categorized as moderate if MET values range from 3.0-5.9; activities with 6.0+ METs are categorized as vigorous-intensity. Recently, the Youth Compendium of Physical Activities was released by an NCCOR workgroup in response to concerns that adult MET energy expenditure values may not accurately account for age differences in basal metabolic rates. However, the Youth Compendium does not currently provide adjusted MET_y moderate-vigorous activity (MVPA) cut-points for youth, resulting in potential research errors such as over-reporting of a child's MVPA. **PURPOSE:** To determine if average MVPA energy expenditure values would significantly differ when two youth scoring protocols (the traditional Three-Day Physical Activity Recall (3DPAR) vs. new NCCOR Youth Compendium) were compared across repeated measures in a sample of pre-adolescent girls. **METHODS:** Study participants completed detailed 7-day PA logs at study baseline (BL), 1-week follow-up (FU1), and 3-month follow-up (FU2). All self-reported activities were coded with MET (3DPAR) or MET_y (NCCOR Youth Compendium) energy expenditure (EE) values from each protocol's respective activity repository. Conservatively, if multiple EE values were available per activity, the lowest value was selected. Activities were considered MVPA if MET/MET_y metrics exceeded 3.0. **RESULTS:** At all data collection times, mean volume of MVPA was greatest when utilizing the NCCOR protocol. Group differences between the scoring protocols were significant when examining both weekday (BL/FU1/FU2; p < .001) and weekend activity (BL/FU1/FU2; p < .001). **CONCLUSION:** To our knowledge, this is the first study which provides comparisons of two qualitative MVPA scoring protocols utilizing repeated measures analyses of EE values in youth. Thus, findings may be important to future research using self-report activity data. In the current study, adult cut-points for MVPA were applied to the Youth Compendium scoring protocol, although literature suggests that EE of similar activities is higher for children than adults. Consequently, we urge that higher MVPA cut-points for the Youth Compendium be explored to more accurately capture measures of PA epidemiology in youth.

THURSDAY, MAY 28, 2020

1522 Board #116 May 28 10:30 AM - 12:00 PM

Paffenbarger Physical Activity Questionnaire (ppaq) For Chinese College Students: A Cross-validation StudyPanpan Chen¹, Hongjun Yu¹, Weimo Zhu, FACSM². ¹Tsinghua University, Beijing, China. ²University of Illinois, Urbana-Champaign, IL.

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(No relevant relationships reported)

Purpose: To cross-validate PPAQ, a validated physical activity (PA) recall questionnaire, for the Chinese college students.**Methods:** 166 (99 males & 67 females; Age = 18.6 ± 1.1 yr., Height = 170.6 ± 8.4 cm, Weight = 63.3 ± 12.4 kg, BMI = 21.6 ± 3.1) Chinese college students' 7-day energy expenditure (EE) data were estimated using ActiGraph wGT3X-BT accelerometers. They were also asked to recall their PA using PPAQ before and after the accelerometer data collection. Total EE, walking steps, light, moderate, vigorous, very vigorous and moderate-to-vigorous PA (MVPA) time, estimated by ActiGraph were compared with EE derived from PPAQ and test-retest reliability was computed also for PPAQ.**Results:** All subjects wore the accelerometer for at least 10 hr. a day and over 4 days in one week. The correlation between the accelerometer total EE and that reported by PPAQ is 0.308 ($p < 0.001$), accelerometer walking and that reported by PPAQ is 0.361 ($p < 0.001$), which were low, but consistent with the validity reported for the questionnaire method. The test-retest reliability coefficient of PPAQ is 0.761. In average, the Chinese college student' PA are: Weekly Total EE = 1778.41 ± 1003.76 (kcal), Daily EE = 142.93 ± 85.85 (kcal), Weekly walking Steps = 38730.02 ± 15506.72 (steps), Weekly total MVPA = 347.2 ± 144.4 (minutes), Daily MVPA 28.06 ± 14.71 (minutes), Weekly Average PA intensity METs = 1.14 ± 0.07 (METs), according to the ActiGraph.**Conclusion:** Similar validity and reliability of PPAQ were confirmed for the Chinese college student sample and they met the PA guideline.

1523 Board #117 May 28 10:30 AM - 12:00 PM

Accelerometer-derived Physical Activity Estimates And Daily Wear Time In ChildrenWendy Y. Huang¹, Ruirui Xing¹, Stephen H.S. Wong, FACSM². ¹Hong Kong Baptist University, Hong Kong, China. ²The Chinese University of Hong Kong, Hong Kong, China.

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Most of the studies applying the accelerometers to quantify physical activity (PA) and sedentary time (ST) require participants to wear the devices during waking hours only. There is no consensus on how many wearing hours are enough to reflect daily activity behavior in free-living conditions. Whether wear time has substantial impact on accelerometer-based estimates remains unclear. **PURPOSE:** To examine whether accelerometer-derived metrics were dependent on daily wear time. **METHODS:** Baseline data from 120 children (24.2% boys) aged 8 to 11 years who participated in the longitudinal study on active travel were analyzed. They were instructed to wear an ActiGraph wGT3x accelerometer on the waist for 7 to 10 consecutive days, only removing it while swimming and bathing. Accelerometer-derived metrics included daily wear time, total activity counts (TAC), ST, light-intensity PA (LPA), moderate-intensity PA (MPA), vigorous-intensity PA (VPA), moderate-to-vigorous PA (MVPA), moderate-to-vigorous PA (MVPA) bouts ≥ 10 minutes (MVPA-10), and proportion of VPA within MVPA (%VPA). Linear mixed models were performed to examine the relationships of these metrics with daily wear time which was categorized into quarters. **RESULTS:** Majority of the children (96%) provided at least 3 valid accelerometer wear days (defined as ≥ 480 minutes of valid wear time per day), with a total of 797 valid wear days included in analyses. After adjustment for age, sex, and body mass index, none of the PA metrics was completely independent on wear time. A linear relationship was found between wear time and four PA metrics including TAC, MPA, LPA, and ST. However, MVPA estimates were comparable between the first (8 to 11 hours per day) and second quarters (11 to 13 hours per day) of wear time (mean ± standard error: 31.4 ± 1.8 vs 35.7 ± 1.8 minutes, NS). Similar results were found for MVPA-10, VPA, and %VPA. **CONCLUSIONS:** Accelerometer-derived PA metrics were largely dependent on wear time. MVPA minutes seem to be comparable across wear time of 13 hours per day or less. Comparisons of accelerometer-derived PA estimates between studies need to be cautious and taken into account of differences in wear duration.

1524 Board #118 May 28 10:30 AM - 12:00 PM

Attitudes And Perceptions Concerning Physical Activity Vary According To FITNESSGRAM BMI Classification In YouthAnthony J. Clapp¹, John L. Walker, FACSM², Kevin W. McCurdy². ¹Augsburg University, Minneapolis, MN. ²Texas State University, San Marcos, TX.

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(No relevant relationships reported)

FITNESSGRAM has established criterion standards for body composition and body mass index (BMI) according to gender and age in children. Aerobic fitness has been shown to differ based on these classifications. **PURPOSE:** The purpose of this study was to determine the variation in attitudes, motivation, and barriers toward physical activity according to FITNESSGRAM BMI classification in youth. **METHODS:** Subjects were 1,643 boys and girls, ages 11-17 years, participated in the 2014 FLASHE Study, a national epidemiological survey of various health behaviors. BMI was calculated based on reported weight and height, and FITNESSGRAM classification was determined according to gender and age. Participants' responses regarding attitudes, motivation, and barriers toward activity were compared across FITNESSGRAM BMI classifications, categorized as either Very Lean or within Health Fitness Zone (HFZ) versus those participants in the Needs Improvement (NI) category. **RESULTS:** Participants classified as NI for BMI reported significantly less support from friends in being physically active ($p = .04$), greater dislike for sweating ($p = .002$), greater dislike for exercise ($p = .008$), greater dislike among family members regarding exercise ($p < .001$), lower self-perception of being athletic ($p < .001$), lower perception that physical activity would make them more attractive ($p = .004$), lower confidence in ability to exercise regularly ($p < .001$), lower perception that they were a healthy weight ($p < .001$), higher perception that they were being teased about their weight ($p < .001$), higher feelings of being left out ($p < .001$), and higher feelings of being isolated ($p < .001$) than participants classified as either Very Lean or within HFZ. **CONCLUSIONS:** Previous research has not investigated variations across FITNESSGRAM BMI classifications. These data suggest that youth classified as NI according to FITNESSGRAM BMI standards are less motivated, have less family support, and perceive copious barriers for being physically active than those classified as Very Lean or within HFZ. These findings are consistent with FITNESSGRAM classifications for aerobic capacity. Addressing the psychosocial aspects related to being physically active may be important for preventing and reversing the trending overweight and obesity among youth.

1525 Board #119 May 28 10:30 AM - 12:00 PM

Years Spent In Secondary Physical Education And Levels Of Physical Activity In College Students And Adults

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(No relevant relationships reported)

Physical education requirements in the United States vary and are often left to local districts in each state to decide. Considering the relationship between physical activity and obesity and physical fitness with mortality, requirements relating to national recommendations appear important. Long term implications of participation in physical education are contradictory at best with the limited studies performed concluding conflicting results. **Purpose:** To examine the relationship between years of participation in physical education at a high school level and levels of physical activity and fitness in college students and adults. **Methods:** Forty-one participants ranging in age from 18-65 (mean age 33.6) were recruited utilizing an inter-collegiate mailing system. Participants completed a self-administered IPAQ long-form questionnaire as well as additional physical education related questions. Participants also completed a YMCA Step Test. **Results:** When comparing participant results to national recommendations for physical activity 6 of 41 met vigorous physical activity guidelines (14.6%), and 0 met guidelines for moderate physical activity. When adding in vigorous outdoor housework those meeting vigorous guidelines went up to 11 of 41 participants (26.8%), and when adding in moderate outdoor and indoor housework those meeting moderate guidelines went up to 4 of 41 (9.7%). Mean score of 4.5 on the YMCA Step Test for all participants was between below average and poor with a standard deviation of nearly two scoring levels. No significant relationships were found when comparing time spent in physical education classes (required or total) to recalled moderate physical activity and fitness levels in college students and adults, while a significant relationship was seen when comparing the time spent in physical education classes (required and total) to recalled vigorous physical activity and fitness levels in college students and adults ($p = 0.02$). **Conclusion:** Further study to examine the relationship between physical education and long-term physical activity is needed with particular attention being paid to physical education requirements and their variances.

1526 Board #120 May 28 10:30 AM - 12:00 PM

Impact Of Online Time And Physical Activity Participation On Waist-to-hip Ratio Of College Students

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Purpose: Internet has become an important part of college students' life, through which they learn, chat, read, write, and shop etc. As a result, they spent little time doing physical activity (PA), but lots of sitting in front of their laptops or smartphones. Yet, the relationship among their online time, PA time and waist-to-hip ratio (WHR), a commonly used health risk measure, has not been determined. The purpose of this study was to examine these relationships.

Methods: A total of 1,144 college students (M±SD of Age: 20.57±3.42 yr.; Males = 53.8%) from a major Chinese university were recruited for the study and their waist circumference (WC) and hip circumference (HC) were measured. In addition, daily online time (DOT), weekly online time (WOT), weekly PA frequency (WPAF), daily PA time (DPAT), weekly PA time (WPAT) were measured by a self-report survey. WHR was computed and its relationship with online and physical activity time was analyzed using the Spearman's correlation analyses.

Results: The relationships among WC, HC, WHR, DOT, WOT, WPAF, DPAT, and WPAT were summarized below:

	DOT	WOT	WPAF	DPAT	WPAT	WC	HC
DOT							
WOT	1.000**						
WPAF	-.646**	-.646**					
DPAT	-.403**	-.403**	.538**				
WPAT	-.609**	-.609**	.902**	.829**			
WC	.618**	.618**	-.677**	-.454**	-.641**		
HC	.013	.013	-.173**	-.042	-.115**	.578**	
WHR	.754**	.754**	-.696**	-.511**	-.686**	.825**	.048

**= Correlation is statistically significant at $p < 0.01$; WOT=DOT×7,

WPAT=DPAT×WPAF

Conclusion: College students' WC and WHR were positively related to WOT and DOT and negatively related to their DPAT, WPAF and WPAT. Their WOT and DOT were negatively related to WPAF, DPAT and WPAT. Thus, it is very important and urgent to develop interventions to reduce their online time and increase their PA time.

1527 Board #121 May 28 10:30 AM - 12:00 PM

Comparing Sleep Pattern Estimates Of Different Monitor Methods

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PURPOSE: Sleep quality and quantity are associated with an increased risk for chronic diseases, but many studies rely on self-report logs to assess sleep. Wearable devices estimate sleep quantity and quality, but it is not clear how these device estimates of sleep compare to self-report logs. The purpose of this study was to 1) compare sleep estimates collected by the devices and the self-report logs and 2) determine if estimates of sleep duration are different between individuals classified as "good" and "poor" sleepers. **METHODS:** In this cross-sectional observational study, participants (n=26, average age=30, 16 females) simultaneously wore devices on the wrist and thigh for seven consecutive days and tracked their wake and sleep times using a daily sleep log (SL). At the end of the 7-days, they completed the Pittsburgh Sleep Quality Index (PSQI) questionnaire, which classified their sleep quality as "good" or "poor." Repeated measures ANOVA and Pearson correlations were used to compare average sleep duration across monitors and an independent t-test was used to compare the sleep duration estimates between "good" and "poor" sleepers. **RESULTS:** There was a significant difference between the sleep duration estimates collected by the sensors (THIGH=557.8±78.5 min; WRIST=564.4±53.2 min) and the self-report logs (SL=492.2±43 min; PSQI=472±55.2 min) ($p < 0.0001$). There was a strong significant positive correlation of 0.6 between the sleep duration estimates collected by the PSQI and the sleep log. Between "good" and "poor" sleepers, there was no significant difference in sleep pattern estimates. **CONCLUSIONS:** Sleep duration estimates collected by the sensors tended to be higher than self-report estimates. This difference may be due to bias in self-reporting sleep, or misclassification of lying time (e.g., watching TV) that is classified as sleep time by devices. Sleep duration estimates did

not differ between those with "good" or "poor" sleep quality, highlighting that sleep is a multidimensional physiological construct. To ensure coherent translation in sleep studies, there is a need to develop standardized methods that will produce comparable estimates of sleep across device and self-report data.

1528 Board #122 May 28 10:30 AM - 12:00 PM

Energy Cost Of Selected Supine, Sitting, And Standing Sedentary Behaviors In Adults

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Sedentary behaviors are pervasive in all societies. According to the 2018 American Time Use Survey, nearly 96% of adults spend 4-5 hours/day in sedentary behaviors that include watching TV, reading, computer use, relaxing and thinking. Since sedentary behaviors increase chronic disease risks, interest is high in knowing the energy costs of sedentary behaviors to help populations to reduce time spent in sedentary behaviors. **PURPOSE:** To update the energy costs of sedentary behaviors in the 2011 Adult Compendium of Physical Activities. **METHODS:** Energy cost in $\text{mlkg}^{-1}\text{min}^{-1}$ and heart rate in bmin^{-1} were measured by Cosmed K4b2 portable indirect calorimetry system in 10 males and 9 females (20-59y), mean age (31.6 ± 7.5 y), weight (63.4 ± 8.9 kg), and height (167.1 ± 5.8 cm). The subjects completed 17 randomly assigned behaviors in lying, reclining, sitting, and standing positions (doing nothing, watching TV, reading, writing, texting, typing, fidgeting) for 5 min with a 2 min rest between behaviors. Mean \pm SD were computed with data presented as mean METs computed as $\text{VO}_2 \text{ mlkg}^{-1}\text{min}^{-1} / 3.5 \text{ mlkg}^{-1}\text{min}^{-1}$. Terminal digits for MET values were rounded to 0, 3, 5, or 8 to comply with format of the Compendium. **RESULTS:** Mean MET values are presented by behaviors and postures performed. Doing nothing (lie: 1.3, sit: 1.3, stand: 1.0); Watching TV (lie: 1.3, sit: 1.3); Reading (recline: 1.5, sit: 1.0); Writing (recline: 1.5, sit: 1.3, stand: 1.3); Texting (recline: 1.3, sit: 1.0, stand: 1.0); Fidgeting (sit hands only: 1.5, sit feet only: 1.8, stand hands & feet: 2.0); Typing (stand: 1.3). Of the measured MET values, seven were the same as the Compendium, four were lower (on the order of 0.3 to 0.8 METs), and one was higher by 0.3 METs (Recline: read). Heart rates during the behaviors ranged from 62 to 80 $\text{beats}\cdot\text{min}^{-1}$. **CONCLUSIONS:** The measured mean MET values ranged from 1.0 to 2.0 METs, classified as inactive (1.0-1.49 METs) and light activity (1.5-2.9 METs). Duplication of measured MET values to those in the Compendium confirm the energy cost of common sedentary behaviors. Of the four behaviors with lower measured MET values, three had been estimated in the Compendium (Sit: read, text; Stand: text). Four behaviors not in the 2011 Compendium were measured (Recline: write, text; Stand: write, text). Supported by the Shanghai University of Sport

1529 Board #123 May 28 10:30 AM - 12:00 PM

Classification Accuracy Of Wrist-worn Physical Activity Monitors Relative To Free-living Heart Rate

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Wrist-worn accelerometers have replaced hip-worn devices as the wear-site of choice when measuring physical activity (PA) in many large-scale studies. Data suggesting superior compliance with study protocols has largely driven this transition due to the potential for a more accurate view of habitual PA. Similarly, activity classification utilizing raw acceleration data has gained popularity relative to epoch-based activity count methods, owing to open source analytical packages, higher classification accuracy, and the potential for greater comparability among devices. As activity classification methods for wrist-worn accelerometer data are derived from PA performed in controlled settings, their accuracy in quantifying free-living PA is unknown. **PURPOSE:** The purpose of this study was to examine the classification accuracy of common PA quantification methods against a free-living, participant-specific intensity classification, heart rate reserve (HRR). **Methods:** Healthy young adults (n=33; 18.6 \pm 0.7 years, 69.6% female) wore a triaxial accelerometer on their non-dominant wrist and a heart rate monitor around their chest for 24 hours. Free-living intensity was quantified using traditional HRR ranges (e.g. MVPA $\geq 40\%$), calculated using resting heart rate during sleep and age-predicted maximum heart rate. Two commonly used data classification methods were applied, 1) Euclidean norm minus one (ENMO) values calculated from raw triaxial data using milligravitational (mg) cut points of light <100.6, moderate 100.6 - <428.8, vigorous ≥ 428.8 , and MVPA ≥ 100.6 , and 2) activity counts across 1-, 15-, and 60-second epochs with count per minute (cpm) cut points of light 1514 - <2199, moderate 2199 - <4712, vigorous ≥ 4721 , and MVPA ≥ 2199 . **Results:** ENMO-based classification underestimated average MVPA by 31.9 \pm 106.6% (19.4 \pm 105.3 mins). In contrast, activity count-based classification overestimated average MVPA by 368.4 \pm 396.2% (178.3 \pm 105.1

mins), 708.9 ± 914.7% (271.0 ± 113.9 mins), and 798.9 ± 1170.7% (280.3 ± 131.7 mins), for 1-, 15-, and 60-second epochs, respectively. **Conclusions:** Data processing utilizing raw triaxial data and ENMO appears to offer the most accurate PA intensity classification. However, all methods substantially misclassify activity relative to free-living HRR.

1530 Board #124 May 28 10:30 AM - 12:00 PM
Energy Cost Of Selected Household Physical Activities In Adults

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According to the 2018 American Time Use Survey, nearly 78% of US adults spend from 2.0-2.5 hours/day in housework activities that include cleaning, laundry, straightening up, cooking, washing dishes and other activities. Another 11% of adults spend nearly 1.0 hour/day caring for older household adults. As many adults do household activities, there is interest in knowing the energy costs of such activities. **PURPOSE:** To update the MET values in the 2011 Adult Compendium of Physical Activities (Compendium) with measured oxygen uptake MET values for selected household physical activities (PAs) in adults. **METHODS:** The energy costs of six meal-related, five household cleaning, and two other care PAs were measured in 20 adults ages 20-59 (10 males, 10 females). Each simulated PA was performed in a laboratory setting for 8-min with a 4-min rest between PAs. Submaximal VO_2 (ml/kg/min) and heart rate (beats/min) were measured with a Cosmed K4b² portable indirect calorimetry system. METs were computed as VO_2 in ml/kg/min divided by 3.5 ml/kg/min. Subjects self-rated their PA and physical fitness level as low, middle or high. **RESULTS:** Subject characteristics were averaged for age (33.7 ± 11.2 yrs.), weight (67.9 ± 12.0 kg), and height (166.1 ± 7.4 cm). MET values were averaged up or down to reflect terminal digit values as presented in the 2011 Compendium (0, 3, 5, 8). MET values: carrying groceries on level surface (3.5), putting away groceries (2.5), food prep and cooking while standing (1.8), food prep and cooking while sitting (1.8), setting the table (2.3), clearing the table and washing dishes (2.0), folding and putting away laundry (2.0), putting away household items (3.0), major cleaning (3.0), sweeping sidewalk (3.0), watering plants (1.8), other care feeding/grooming (1.8), other care bathing/dressing (2.8). Heart rates ranged from 74 to 92 beats/min across all PAs. PA and fitness levels were rated as middle. **CONCLUSIONS:** Measured MET values were generally lower (on the order of 0.3 to 1.2 METs) than estimated MET values presented in the 2011 Compendium. Measured MET values were the same as the 2011 Compendium for putting away groceries and putting away household items. Overall, measured MET values for frequently performed household activities are rated as low- to moderate intensity. Supported by the Shanghai University of Sport

1531 Board #125 May 28 10:30 AM - 12:00 PM
Validity And Reliability Of Two Brief Physical Activity Questionnaires In Adults With Obstructive Sleep Apnea

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Efforts to encourage the medical community to prescribe exercise for disease prevention and management have increased significantly in recent years. In patients with obstructive sleep apnea (OSA), it is encouraging that exercise has been shown to improve sleep efficiency, daytime sleepiness, and disease severity. However, in order to better understand the dose-response relationship between exercise and OSA-related outcomes, accurate and reliable methods for assessing physical activity habits are needed. **PURPOSE:** To determine the validity and reliability of two self-report physical activity questionnaires [Physical Activity Vital Sign (PAVS); International Physical Activity Questionnaire-Short Form (IPAQ-SF)] in an OSA population. **METHODS:** 39 adults diagnosed with moderate-to-severe OSA [64% female; mean age (SD)=51.5 (9.5) yr; body mass index (BMI)=39.1 (8.8) kg/m²; apnea hypopnea index (AHI)=40.4 (29.4)] wore an accelerometer for 7 consecutive days and completed the PAVS and IPAQ-SF twice within 10 days. Criterion validity was evaluated using Pearson (*r*) correlation coefficients comparing the total number of min/wk of moderate-vigorous physical activity (MVPA) from PAVS and IPAQ-SF to accelerometry. Spearman rank correlation coefficients (*p*) were calculated to determine construct validity against self-reported measures (quality of life, daytime sleepiness, and treatment adherence) and BMI. **RESULTS:** PAVS and IPAQ-SF scores were reported as total min/wk of moderate-vigorous physical activity (MVPA). Test-retest reliability for MVPA was excellent for PAVS (ICC=0.98, *p*<0.01) and good for IPAQ-SF (ICC=0.77, *p*<0.01). Levels of MVPA from accelerometry strongly correlated with PAVS (*r* = 0.80; *p*<0.001) and moderately with IPAQ-SF (*r* = 0.57; *p*<0.001). Both PAVS (*p* = -0.273; *p*=0.05) and IPAQ-SF (*p* = -0.268; *p*=0.05) were significantly

related to BMI, but no other variables. **CONCLUSIONS:** This study provides preliminary evidence that the PAVS and IPAQ-SF questionnaires have acceptable reliability and validity to assess physical activity levels in adults with OSA.

1532 Board #126 May 28 10:30 AM - 12:00 PM
Validity Of Accelerometry In Ambulatory Children And Young Adults With Cerebral Palsy

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PURPOSE: This study aimed to validate five published ActiGraph (AG) cut-off points for the measurements of physical activity (PA) and sedentary time (ST) in ambulatory children and young adults with cerebral palsy (CP). Additionally, four energy expenditure (EE) prediction equations based on AG counts and activPAL (AP) steps were examined in this population, using oxygen uptake (VO_2) as the criterion. **METHODS:** Four male and six female participants with CP (GMFCS levels I-III, ages 9-21 years) completed seven activities while simultaneously wearing an AG, AP monitor and indirect calorimetry unit. VO_2 was measured on a breath-by-breath basis using the indirect calorimetry and was converted into EE using metabolic equivalents. AG counts were classified as sedentary, light PA (LPA) or moderate-to-vigorous PA (MVPA) using five cut-off points: Puyau, Evenson, Romanzini, Clanchy and Baque. The predicted EE was computed using three AG-based equations (Freedson, Trost and Treuth) and an AP step-based equation. The classification accuracies of the five AG cut-off points were assessed using Spearman correlation (*r*) and kappa (κ) coefficients. Agreements between measured and predicted EE values were assessed using paired-*t* tests, mean differences (95% confidence interval) and Bland-Altman plots. **RESULTS:** Of the five AG cut-off points, Baque (*r* = 0.896, κ = 0.773) and Clanchy (*r* = 0.935, κ = 0.721) classified PA and ST most accurately. All the equations overestimated EE during sitting activities and underestimated EE during rapid walking. Across all activities, the mean bias and 95% limits of agreement for the Freedson, Trost, Treuth and AP prediction equations were -0.05 METs (-2.15, 2.05), -0.28 kcal·min⁻¹ (-2.18, 2.74), -0.54 METs (-2.37, 1.29) and 0.04 METs (-2.60, 2.68), respectively. The Freedson, Treuth and AP equations exhibited systematic bias during rapid walking, as their differences from the criterion measure increased progressively with increasing activity intensity. **CONCLUSION:** The AG accurately classified PA and ST when the Baque and Clanchy cut-off points were used. However, none of the available AG or AP equations accurately predicted the EE during PA and ST in children and young adults with CP. Further development is needed to ensure that both devices can estimate EE accurately in this population.

1533 Board #127 May 28 10:30 AM - 12:00 PM
Posture And Metabolic Syndrome Among Law Enforcement Officers

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Law enforcement officers job duties require high physical demands but also place them at greater metabolic syndrome risk due to frequent bouts of on-duty sedentary behavior. **PURPOSE:** To examine posture and metabolic syndrome risk among law enforcement officers. **METHODS:** Thirty-one participants aged 33.10 ± 9.78 years participated in the study. Law enforcement officers were asked to wear activity monitoring devices for 7-consecutive days during on-duty and off-duty times while also maintaining an activity log. At the end of monitoring period, participants had their metabolic risk factors measured using a finger-prick test after fasting for at least 10 hours prior. Metabolic syndrome was determined if participants had 3 of the 5 following criteria: waist circumference measurement > 89 centimeters for women or > 102 centimeters for men; serum triglycerides > 150mg/dL; high-density lipoprotein < 50mg/dL for women and 40mg/dL for men; blood pressure $\geq 130/85$ mmHg; and fasting glucose ≥ 100 mg/dL. The ActivPal device measured posture for 18 participants who adhered to wearing the device for at least four days of the seven consecutive-day monitoring period. Descriptive statistics were used to determine means for all metabolic risk factors and to determine time spent in postural positions (sitting, standing, and stepping). **RESULTS:** 16.1% (n = 5) had three or more metabolic risk factors and 35.5% (n = 11) had two or more metabolic risk factors. Average on-duty sitting time was 6.77 ± 1.29 hours compared to off-duty sitting time of 5.20 ± 2.64 hours. Average on-duty standing time was 2.02 ± 0.70 hours compared to off-duty standing time of 1.65 ± 0.76 hours. **CONCLUSIONS:** Law enforcement officers may be at risk of developing metabolic syndrome and have unfavorable posture during a typical day.

1534 Board #128 May 28 10:30 AM - 12:00 PM
Predicting Oxygen Uptake From Accelerometer Output In Adults With Down Syndrome: Vector Magnitude Vs. Vertical Axis

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Adults with Down syndrome (DS) have altered movement patterns. Especially during walking, their altered mediolateral and anteroposterior body motion predicts their elevated energy cost. Triaxial accelerometers provide a metric of three-dimensional acceleration—Vector Magnitude (VM) counts—which may better estimate the rate of oxygen uptake (VO_2) during physical activities and sedentary behaviors than the traditionally used Vertical Axis (VA) counts. **PURPOSE:** To examine if VM counts are more accurate than VA counts in estimating VO_2 across different physical activities and sedentary behaviors in adults with DS. **METHODS:** Sixteen adults with DS (10 men; age 31 ± 15 years) performed 12 tasks: sitting; playing app; drawing; folding clothes; sweeping; fitness circuit; moving box; basketball; standing; and walking at the preferred speed and at 0.8 and 1.4 m s^{-1} . We measured VO_2 with a spirometer (K4b², Cosmed) and VA and VM with an accelerometer (wGT3X-BT, Actigraph) on the non-dominant hip. We used two separate multi-level regression models to predict VO_2 from VA or VM. We evaluated the fit of models with the R^2 , and accuracy with Bland-Altman plots and absolute percent error which was compared between models across tasks using within-subject (method-by-task) ANOVA and follow-up paired-samples t-tests. **RESULTS:** Both VM and VA significantly predicted VO_2 in separate models ($p < 0.001$; $R^2 = 0.74$ and 0.65 , respectively). Across all tasks combined, absolute percent error was lower for the VM than the VA model (23.7 ± 26.2 and 33.6 ± 35.9 , respectively). A significant method-by-task interaction in within-subject ANOVA and follow-up t-tests indicated that absolute error was lower for the VM than the VA model for sitting, playing an app, drawing, and standing ($p \leq 0.004$), but did not differ for other tasks. Bland-Altman plots indicated zero mean error for both models; however, the limits of agreement were narrower for the VM than the VA model (-6.44 to 6.44 and -5.57 to $5.57 \text{ ml kg}^{-1} \text{ min}^{-1}$, respectively). **CONCLUSION:** Both VA and VM counts predict VO_2 in adults with DS; however, prediction is more accurate for a VM than a VA model during sedentary behaviors. VM counts should be used in developing accelerometer-based prediction of physical activity and sedentary behavior in adults with DS. Supported by NIH Grant R15HD098660

1535 Board #129 May 28 10:30 AM - 12:00 PM
Comparison Of Total MVPA Versus MVPA In Bout Of At Least 10 Minutes In Adults With Obesity.

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Introduction: The 2008 Physical Activity Guidelines for Americans recommended adults engage in ≥ 150 min/week of moderate-to-vigorous intensity physical activity (MVPA) in bouts of ≥ 10 minutes to elicit numerous health benefits. However, the 2018 Physical Activity Guidelines recommends that all MVPA, regardless of bout length, contribute to the desired MVPA goal as this also elicits health benefits.

Purpose: This study examined whether the number of adults meeting the public health recommendation of 150 min/week of MVPA differed based on the criteria that considered all minutes or minutes that were only accumulated in bouts of ≥ 10 minutes.

Methods: Baseline data from 377 adults with obesity (age= 45.5 ± 8.0 years; BMI= $32.2 \pm 3.8 \text{ kg/m}^2$) who enrolled in a behavioral weight loss program were analyzed. Participants reported not engaging in regular structured exercise that exceeded 60 min/week. Participants were instructed to wear an activity monitor (SenseWear Armband) for 7 days while maintaining their regular activity prior to initiating the intervention. Data were considered valid if the activity monitor was worn for ≥ 10 hours per day on at least 4 days. These data from the activity monitor were used to identify total minutes of MVPA that met the criteria of ≥ 3 METs regardless of bout length and total minutes of MVPA that was accumulated in bouts ≥ 10 minutes.

Results: Median minutes of total MVPA was 244 (25th, 75th percentiles: 118.0, 458.0) min/week. Median minutes of MVPA in bouts ≥ 10 minutes was 103 (25th, 75th percentiles: 27.5, 232.5) min/week. Both total MVPA (-0.327 , $p < 0.001$) and MVPA in bouts ≥ 10 minutes (-0.275 $p < 0.001$) were correlated with BMI using the Spearman Rank Order procedure. The proportion of adults engaging in ≥ 150 min/week meeting was 67.4% when total minutes of MVPA was considered and 39.8% when minutes of MVPA in bouts ≥ 10 minutes was considered.

Conclusion: The proportion of adults with overweight or obesity meeting the recommended 150 minutes per week of MVPA will vary based on whether total MVPA or MVPA in bouts ≥ 10 minutes is used to determine engagement. However, both total

MVPA and MVPA resulting from bout ≥ 10 minutes may contribute to a lower BMI. These findings may have implications for evaluation of and recommendations for MVPA that may impact body weight regulation.

1536 Board #130 May 28 10:30 AM - 12:00 PM
Comparison Of Physical Activity Scale For Individuals With Physical Disabilities And Accelerometry In Arthritic Individuals

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Purpose: To compare physical activity (PA) estimates from the PA Scale for Individuals with Physical Disabilities (PASIPD) to accelerometer data in individuals with arthritis. **Methods:** Adults aged 64-88y, a sub-sample recruited for a larger protocol, and self-reported with arthritis were included in this analysis. Subjects completed a seven-day monitoring period that included wearing a thigh worn activPAL (AP) accelerometer during all waking hours and completing a wear-time log. At the end of the monitoring phase individuals completed the PASIPD. Accelerometer data was processed with PALstudio (v8.9.1.24) and raw data was manipulated using the activPAL processing package in RStudio (1.2.1335) to calculate hours in stepping, light (1.5-2.99 METs) PA (LPA), and moderate-vigorous (>3.0 METs) PA (MVPA). Items were taken from the PASIPD to calculate hours of LPA and MVPA, and to derive a total activity score. Spearman correlations comparing AP stepping and total PASIPD, AP LPA and PASIPD LPA, and AP MVPA and PASIPD MVPA were computed. Wilcoxon Signed Rank tests were computed for differences between AP and PASIPD LPA and AP and PASIPD MVPA. **Results:** Twenty-seven subjects (16 male, 7 female) [mean \pm SD] age 75.8 ± 6.2 yrs; height 168.4 ± 9.5 cm; mass 83.8 ± 17.6 kg) were analyzed. AP Stepping was significantly correlated with total PASIPD score with a Spearman's rho of .425; $p = .014$. AP LPA and PASIPD LPA, and AP MVPA and PASIPD MVPA were significantly correlated, Spearman's rho of .436; $p = .012$, and .435; $p = .012$, respectively. On average, PASIPD underestimated AP LPA by 1.38 hours ($p = .024$) and overestimated AP MVPA by 1.34 hours ($p < .0001$). **Conclusion:** Differences between PASIPD and AP measures of LPA and MVPA were apparent, but the PASIPD was moderately correlated to PA levels in this sample of arthritis individuals. Future work on examining the precision and accuracy of PA surveys in heterogeneous populations with varying disease and disability is warranted. This work was partially supported by NIH 1R21HD080828 and NIH 1R01CA215318

1537 Board #131 May 28 10:30 AM - 12:00 PM
Objectively Measured Association Between Air Pollution And Physical Activity In College Students In Beijing

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PURPOSE: To examine the association between hourly air pollution on hourly physical activity (PA) among college students in Beijing, China.

METHODS: A total of 340 participants (70.58% male) were recruited from the Tsinghua University, in Beijing, China. Accelerometers provided PA measures, including moderate-to-vigorous physical activity (MVPA), walking steps, energy expenditure for 7 consecutive days. Corresponding air pollution data by the Beijing Municipal Ecological Environment Bureau in the closed site (Wan Liu site) in Tsinghua University were collected including average hourly air quality index (AQI) and PM_{2.5} ($\mu\text{g}/\text{m}^3$). Associations were estimated using linear individual fixed-effect regressions.

RESULTS: A one level increase in hourly air quality index (AQI) was associated with an reduction in one-hour PA by 0.083 (95% confidence interval [CI] = -0.137, -0.029) minutes of MVPA, 8.822 (95% CI = -15.028, -2.617) walking steps, 0.653 (95% CI = -1.033, -0.273) kcal of energy expenditure. A $10 \mu\text{g}/\text{m}^3$ increase in air pollution concentration in hourly PM_{2.5} was associated with a reduction in one-hour PA by 0.021 (95% confidence interval [CI] = -0.033, -0.010) minutes of MVPA, 2.232 (95% CI = -3.548, -0.916) walking steps, 0.170 (95% CI = -0.250, -0.089) kcal of energy expenditure.

CONCLUSIONS: Although there is a negative trend between air pollution and PA, their impact on college students in Beijing seems limited.

1538 Board #132 May 28 10:30 AM - 12:00 PM
Lower Physical Activity Following Days Of Supervised Training Sessions In Both Obese And Post-bariatric Participants

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Physical activity compensation (PAC) has been studied in a populations ranging from children to older adults participating across a range of mixed exercise interventions yielding equivocal results. Although physical activity is the highest predictor of weight loss success in post-bariatric (PB) individuals, it has not been reported if compensatory physical activity is also exhibited in PB individuals during exercise intervention.

PURPOSE: To determine if PAC occurs on days following different types supervised exercise sessions in obese and post-bariatric individuals as measured by step count. **METHODS:** Ten obese individual [7 female, 3 male; BMI = 38.99 ± 6.5] and 8 PB individuals [7 female, 1 male; Body Mass Index (BMI) = 34.95 ± 7.6] participated in a supervised 12 week three days per week treadmill exercise training program. The obese continuous moderate intensity group exercised for 20 minutes at 60% HRR for weeks 3 through 6 and 20 minutes at 65% HRR for weeks 7 through 12. The PB high intensity interval group exercised at 80% of their age adjusted heart rate reserve (HRR) for 4 one minute intervals interspersed with 4 minute recovery bouts at 50% of the HRR for weeks 3 through 6. Exercise was increased to 6 one minute bouts at the same HRR intensity and recovery time for weeks 7 through 12. . Both exercise interventions included a 2-week run-in to avoid injuries. Total weekly and daily steps were measured using micro activPALs for the pre-exercise week and weeks 3, 9 and 12.

RESULTS: Paired post hoc t tests ($P > .05$) found both obese and PB groups average daily steps were lower on days following supervised sessions. Average steps on days for exercise in week 3 for the Obese and PB groups were 9,840 and 10,797 respectively. For week 9, the average step count on days following supervised exercise was 7,567 for the obese group and 7,731 for the PB group. In both groups regardless of exercise mode, daily step counts increased and plateaued for weeks 3 through 9 and approached pre-study levels in week 12.

CONCLUSIONS: Despite different types of exercise intervention methods and near matching step volume, both obese and PB groups demonstrated lower levels of physical activity on the following day. The step count on those days was closely aligned with counts measured prior to exercise training and reflects a habitual and familiar activity pattern.

1539 Board #133 May 28 10:30 AM - 12:00 PM
Does Reactivity To Accelerometry Occur In A Single Swimming Trial? A Randomized, Crossover Study

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PURPOSE: Recent research has suggested that awareness of being monitored can influence the habitual physical activity behaviour of participants. This reactivity effect appears to also occur in single bouts of physical activity. However, it is presently unknown whether this acute reactivity effect exists in aquatic environments. The purpose of this study was, therefore, to test the hypothesis that reactivity would also occur in water-based studies. **METHODS:** Fifty-six healthy, recreational swimmers (31 men, age 22 ± 2 yr; 25 women, age 22 ± 1 yr) volunteered to participate in this ethically approved study. On two separate occasions, the participants randomly completed a 20-min swimming bout at a self-selected pace wearing (A) or not wearing (NA) a head-mounted accelerometer. Evidence of reactivity was defined as a statistically significant change in swimming distance covered (in m) in the A condition compared with the NA condition. Situational motivation, perceived performance, and perceived exertion were also assessed in both A and NA conditions. **RESULTS:** Swimming distance covered was longer (829 ± 202 vs. 811 ± 204 m) and perceived exertion was more strenuous (13.0 ± 2.4 vs. 12.2 ± 2.1) during the A condition compared with the NA condition ($P < 0.05$). Perceived performance and situational motivation were not significantly different between conditions ($P > 0.05$). **CONCLUSIONS:** These results indicate that the acute reactivity effect is likely to be present in aquatic environments and may threaten the internal validity of physical activity assessments in water-based studies.

1540 Board #134 May 28 10:30 AM - 12:00 PM
A Tailored Multiple Imputation Approach To Handle Arbitrarily-Missing Accelerometer Data In A Randomized Controlled Trial

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(No relevant relationships reported)

Common applications of Multiple Imputation (MI) are too generic, yielding highly variable and nonreplicable results. **PURPOSE:** Evaluate a tailored MI approach for handling missing physical behavior (PB) outcome summaries (e.g., sitting time) due to accelerometer non-wear in an RCT and its impact in estimating time spent in PBs. **METHODS:** A missing data simulation was conducted from a complete subsample (N=39) of accelerometer data collected for 7-days at the start and end of a yearlong RCT. Data from 3 PB variables (sitting, standing and stepping time) were randomly deleted for 3 study groups at each timepoint to generate 10 datasets per group × timepoint with arbitrarily missing data (8-77%) in increments of 8%. A tailored MI approach was used for missing data where: i) each variable was imputed separately using unique correlated auxiliary variables, and ii) the number of imputations necessary to produce replicable and stable parameter estimates and standard errors were computed for each imputation model. Statistical differences in parameter estimates from univariate timepoint and repeated measures mixed model analyses between imputed and complete datasets were tested with paired sample T-tests and two-tailed Z scores, respectively. Errors (%) in parameter estimates relative to the complete dataset were calculated to quantify the magnitude and variability of the bias. **RESULTS:** The tailored MI approach produced unbiased parameter estimates and standard errors in both univariate timepoint and change analyses in sample sizes as small as N=13 with up to 54% missing data. Error and variability in parameter estimates increased exponentially above the 54% threshold in both univariate (mean % error ± SD: *above threshold* = 31 ± 10%, *below threshold* = 11 ± 4%) and change analyses (mean % error ± SD: *above threshold* = 465 ± 98%, *below threshold* = 175 ± 55%). **CONCLUSIONS:** To our knowledge, this tailored approach is the most robust MI methodology to date for imputing incrementally missing accelerometer-based summary PB data in an RCT. Prior PB MI simulations yielded lower acceptable missing data thresholds (≤ 30%) in larger sample sizes (N ≥ 20), and did not test the impact on analyzing change between repeated measures. Tailoring MI to restore lost statistical power may prevent conservative estimates of the treatment effects in PB RCTs.

1541 Board #135 May 28 10:30 AM - 12:00 PM
Validity Of Physical Activity Measured By Proxy-response Questionnaire In Adults With Intellectual Disability

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Proxy-response questionnaires are widely used to measure physical activity (PA) and sedentary behaviors in adults with intellectual disability (ID). However, there are limited studies documenting the validity of this measurement approach in adults with ID.

PURPOSE: This study examined the validity of physical activity and sedentary behavior measured by a proxy-response questionnaire against accelerometry in adults with ID.

METHODS: Sixty adults with ID (30 men and 30 women; age 44 ± 14 years) wore an accelerometer (ActiGraph, wGTX-BT) for 7 consecutive days. Caregivers or family members of participants completed the International Physical Activity Questionnaire-Short Form (IPAQ-SF) regarding PA and sedentary behavior for the last 7 days. Spearman's correlation coefficient estimated the degree of association between IPAQ-SF and accelerometer measurements. The level of agreement between measurements was compared with absolute error and using Bland-Altman plots.

RESULTS: There was no significant correlation for moderate PA, vigorous PA and sedentary time between two methods ($r = 0.01 - 0.23, p > .05$). The Bland-Altman plots indicated that caregivers and family members reported less sedentary time (-107 min day⁻¹) and more moderate (+36 min day⁻¹) and vigorous PA time (+26 min day⁻¹) compared with the accelerometer measurement. Caregivers and family members underestimated moderate PA days (-1 days week⁻¹) and overestimated vigorous PA days (+0.75 days week⁻¹). The absolute error estimates for moderate PA, vigorous PA, and sedentary time were 48.2 ± 75.1%; 26.5 ± 32.6%; and 237.5 ± 127.2%, respectively. The 95% limits of agreement for moderate PA were -124.2 to 197 min day⁻¹ and for vigorous PA - 46.6 to 81.3 min day⁻¹. The 95% limits of agreement for sedentary time were - 599 min day⁻¹ to 378.3 min day⁻¹.

CONCLUSION: There was limited evidence for the validity and accuracy of proxy-measured PA and sedentary time using the IPAQ-SF in adults with ID. This suggests that device-based measurement may be a preferred method in studies of PA in adults with ID.

1542 Board #136 May 28 10:30 AM - 12:00 PM
Physical Activity And Sedentary Time In Adults With Down Syndrome Estimated By Different Cut Points

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Physical activity (PA) and sedentary time in persons with Down syndrome (DS) have been previously examined with accelerometry using intensity cut points developed for the general population. These cut-points may not be valid for persons with DS due to altered biomechanical and physiological responses to PA. **PURPOSE:** To examine if DS-specific cut-points and cut-points developed for the general population differ in estimating sedentary time and PA levels in persons with DS. **METHODS:** Eleven adults with DS (4 women & 7 men; age 37 ± 14 years) wore for 7 days an accelerometer (wGT3X-BT, Actigraph) on their right hip. Times sedentary and in light, moderate, and vigorous PA were assessed with three cut-point sets: (a) Troiano; (b) Freedson; and (c) DS-specific. The first two sets of cut-points were developed for the general population based on vertical axis counts. The third was developed by our group based on vector magnitude counts in 16 adults with DS. We compared sedentary time and PA variables between methods using 3×4 (method-by-intensity) within-group ANOVA. A significant interaction was analyzed with follow-up within-group ANOVA at each intensity level and post-hoc tests between methods if needed. **RESULTS:** A significant method-by-intensity interaction ($p = 0.002$) indicated that the estimates of times in sedentary and light, moderate, and vigorous PA generally differed between methods. Follow-up analysis showed that: (a) sedentary time was lower by our DS-specific cut points than the Troiano and Freedson (457 ± 131 , 505 ± 149 , and 517 ± 111 min·day⁻¹, respectively; $p \leq 0.04$); (b) light PA did not differ between methods (345 ± 37 , 336 ± 85 , and 346 ± 73 min·day⁻¹, respectively; $p = 0.782$); moderate PA was higher by our cut points than the Troiano and Freedson (85 ± 44 , 28 ± 24 , and 25 ± 23 min·day⁻¹, respectively; $p < 0.001$); and (d) vigorous PA was higher by our cut points than the Troiano and Freedson (9.9 ± 9.2 , 0.3 ± 0.8 , and 0.1 ± 0.2 min·day⁻¹, respectively; $p \leq 0.007$). There were no differences between the Troiano and Freedson. **CONCLUSIONS:** Compared to cut-points for the general population, DS-specific cut-points estimate lower levels of sedentary time and higher levels of moderate and vigorous PA. Supported by NIH Grant R15HD098660

1543 Board #137 May 28 10:30 AM - 12:00 PM
Accelerometer Cut Points For Adults With Down Syndrome

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Past research has indicated that the relationship between energy expenditure and accelerometer output is different between adults with and without Down syndrome (DS). This suggests a need for DS-specific cut points for determining levels of sedentary behavior and physical activity from accelerometer output for adults with DS. **PURPOSE:** To develop accelerometer output cut points for sedentary behavior and moderate and vigorous intensity physical activity for adults with DS. **METHODS:** Sixteen adults with DS (10 men & 6 women; age 31 ± 15 years) performed 12 tasks each lasting 6 min: sitting; playing app on tablet; drawing; folding clothes; sweeping; fitness circuit; moving a box; basketball; standing; and walking at the preferred speed and at 0.8 and 1.4 m·s⁻¹. We measured the rate of oxygen uptake with portable indirect calorimetry (K4b², Cosmed) and expressed it in Metabolic Equivalents (METs). Output from a triaxial accelerometer (wGT3X-BT, Actigraph) worn on the non-dominant hip was determined as Vector Magnitude. Receiver Operating Characteristic (ROC) curves were used to identify Vector Magnitude cut points for sedentary behavior and moderate (3.0 - 5.99 METs) and vigorous (≥ 6 METs) intensity physical activity. Overall performance of classification models was assessed with the area under the ROC curve. Optimal cut points maximizing sensitivity and specificity were selected based on Youden's index. **RESULTS:** Area under the ROC curve was high for all models: (a) sedentary behavior (0.96; 95% CI: 0.93 - 0.98); (b) moderate intensity physical activity (0.92; 95% CI: 0.88 - 0.96); and (c) vigorous intensity physical activity (0.92; 95% CI: 0.85 - 0.99). The optimal Vector Magnitude cut points were: (a) sedentary behavior ≤ 236 counts·min⁻¹ (sensitivity 0.98; specificity 0.90; Youden's index 0.88); (b)

moderate-intensity physical activity ≤ 2167 counts·min⁻¹ (sensitivity 0.99; specificity 0.82; Youden's index 0.81); and (c) vigorous-intensity physical activity ≥ 4200 counts·min⁻¹ (sensitivity 1.00; specificity 0.84; Youden's index 0.84). **CONCLUSION:** This study offers the first DS-specific accelerometer output cut-points for classifying sedentary behavior and intensity of physical activity in adults with DS. Overall classification accuracy was excellent. Supported by NIH Grant R15HD098660

1544 Board #138 May 28 10:30 AM - 12:00 PM
Sedentary Behavior Levels And Patterns In Men And Women With Intellectual Disability

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Adults with Intellectual Disability (ID) experience health disparities that may be attributable to high levels of sedentary behavior. The levels and weekly patterns of sedentary behavior among U.S. adults with ID have received little attention. **PURPOSE:** To examine levels and patterns of sedentary behavior and how these differ between sexes and weekdays and weekend days in adults with ID. **METHODS:** The sample included 52 adults with ID (25 men; age 45 ± 14 years) who wore an accelerometer (wGT3X-BT; Actigraph) on the hip for 7 days. Using valid days, we determined total sedentary time, percent of wear time spent sedentary, number and duration of sedentary bouts, and breaks in sedentary time. We examined sedentary bouts with thresholds of ≥ 1 , ≥ 10 , ≥ 30 , ≥ 60 and ≥ 90 min and breaks for bouts ≥ 10 min. We used t-tests and 2×2 (sex by day) ANOVA to evaluate the effects of sex and day of the week. **RESULTS:** Total sedentary time did not differ between men and women (533 ± 139 and 496 ± 140 min·day⁻¹, respectively; $p = 0.35$; for both sexes combined, 514 ± 139 min·day⁻¹). Men and women with ID accumulated sedentary time mostly in short bouts < 10 min in duration. There were no significant differences between men and women, except for duration of sedentary bouts ≥ 1 min which was longer for men than women for weekdays (6.45 ± 2.58 and 5.18 ± 1.09 min, respectively; $p = 0.027$) and for all days of the week combined (6.71 ± 2.62 and 5.29 ± 1.11 min, respectively; $p = 0.017$). Most variables did not differ between week and weekend days, except for: duration of sedentary bouts ≥ 1 min was longer during weekend than weekdays in women (5.5 ± 1.8 and 5.18 ± 1.07 min, respectively; $p = 0.048$); duration of sedentary bouts ≥ 60 min was longer during week than weekend days in men (56 ± 42 and 47 ± 44 min, respectively; $p = 0.037$); number of sedentary bouts ≥ 1 min was greater during weekdays than weekend days in men (87 ± 21 and 83 ± 25 bouts·day⁻¹, respectively; $p = 0.045$); and duration of breaks was greater during the weekdays than weekend days in men (138 ± 126 and 81 ± 67 min, respectively; $p < 0.001$). **CONCLUSION:** U.S. adults with ID spend a large portion of the day in sedentary behavior primarily of short bouts. There are small differences between sexes and between days of the week, suggesting near-uniform sedentary behavior levels and patterns for men and women with ID throughout the week.

1545 Board #139 May 28 10:30 AM - 12:00 PM
Validation Of Previous-day Recalls Of Screen-based Sedentary Behavior In Young Male Adults

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PURPOSE: Previous-day recall (PDR) has been suggested as a valid measurement of type, purpose and amount of sedentary behaviors in youth and adults. However, no studies have explored the feasibility and validity of using PDR to estimate sedentary behaviors in various bouts. This study examined the validity of a self-administered PDR in evaluating the total screen-based sedentary behaviors (SSB) and SSB by types and bouts using the activPAL as a criterion measure. **METHODS:** One hundred young male adults aged 18-35 years volunteered to participate in the validation study. They completed a web-based PDR over 7 consecutive days, in which three categories of SSB (computer work & surf internet, watching TV/video, and play computer games) were recorded to the nearest 15 minutes. Participants wore an activPAL over the 7 days to determine the daily sedentary time and the sedentary time during each 15-min segment. The activPAL-based SSB were calculated based on the start point and endpoint of sedentary behavior from PDR. Total SSB, SSB by type of activities and by duration of bouts were drawn from PDR. Bivariate correlations between PDR- and activPAL-assessed outcomes were conducted. Bland-Altman Plots were performed to determine the agreement between two methods by type of activities and by the duration of bouts. **RESULTS:** Total SSB assessed by PDR was associated with activPAL-determined sedentary time ($r = 0.37$). The absolute mean difference between PDR and activPAL

was -1.38 h/day (95% confidence interval [CI]: -3.64, 0.88) for total SSB, -1.07 h/day (95% CI: -3.11, 0.96) for computer work & surf internet, -0.20 h/day (95% CI: -1.17, 0.76) for watching TV/video, and -0.15 h/day (95% CI: -0.95, 0.65) for playing computer games. The mean difference between two methods was smaller for sedentary bouts of ≥ 4 h (-0.20 h/day, 95% CI: -0.69, 0.29) than for the sedentary bout shorter than 1 h (-0.42 h/day, 95% CI: -1.42, 0.57).

CONCLUSIONS: The online PDR could be used as an easy and valid tool to identify SSB, in particular the type and bouts of SSB in young male adults.

1546 Board #140 May 28 10:30 AM - 12:00 PM
Identification Of Actigraph Wgt3x-bt Device Non-wear In Infants

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Traditionally, device non-wear time is determined by examining periods of consecutive zero counts, however, zero counts may also indicate periods of non-movement or sleep. In infants, evaluating non-wear is challenging due to their sporadic nature of movement and sleep frequency. These unique behavior characteristics make a zero counts approach prone to misclassification of non-movement and sleep as non-wear. Thus, an infant-specific method to identify device non-wear time is necessary. **PURPOSE:** To compare a novel method for identifying device non-wear to consecutive zero counts in infants. **METHODS:** Fifteen infants (mean \pm SD; age, 8.7 \pm 1.7 wk; 5.1 \pm 0.8 kg, 56.2 \pm 2.1 cm) wore an ActiGraph wGT3X-BT on the hip and ankle. Criterion data (minutes of wear and non-wear) were collected during two, 2-hour periods of direct observation during which infants spent time in an infant bouncer including sleeping and waking time. A vector magnitude and the inclination angle of each individual axis were calculated from raw 30 Hz acceleration data before being averaged into 1-min epochs. Using the 1-min data, a 4-min rolling coefficient of variation (CV) of each axis was calculated for each minute. Three decision tree models were developed using data from the 1) hip, 2) ankle, and 3) hip and ankle combined. For the consecutive zero counts method, two or more minutes of consecutive zero counts were considered non-wear; this was examined for the hip, ankle, and hip and ankle combined (i.e. if one site indicated "wear" the combined label was "wear"). **RESULTS:** There were 3,506 total min of observation with 1,987 min of sleep and 1,519 min of waking time with zero criterion non-wear minutes during the observation period. The decision tree approach resulted in lower misclassification of wear as non-wear (5.1-6.0%; 178-212 min) compared to the zero counts method (43.8-51.7%; 1,534-1,813 min). Of the misclassified minutes for the decision tree, 5.3-8.8% (106-175 min) was sleep time compared to 66.8-77.3% (1,328-1,535 min) for the consecutive zero counts method. **CONCLUSIONS:** Overall, using movement variability (i.e. CV) and device position (i.e. inclination angle), device non-wear can be more robustly identified when worn during periods of non-movement and sleep compared to a consecutive zero counts approach. Supported by NIH P30DK072476-10.

1547 Board #141 May 28 10:30 AM - 12:00 PM
Examination Of Consumer Level Activity Monitors When Compared To Gold Standard Assessments Of Steps, Energy Expenditure And Heart Rate

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(No relevant relationships reported)

Consumer level activity monitors offer individuals the ability to self-monitor their physical activity throughout the day. However, examination of the accuracy between brands and comparison to gold standard measures is needed. **PURPOSE:** To compare two consumer-level activity trackers in assessing steps, energy expenditure and heart rate to gold standard assessments. **METHODS:** A total of 19 individuals who met ACSM guidelines for physical activity volunteered for the study (11 males, 8 females, age: 23 \pm 7.6y). Subjects completed 2 sessions performing the Rockport 1-mile Walk test while wearing a Garmin Vivospot (GV) or Polar A370 (A370) activity monitor. Subjects were also connected to a metabolic cart and ECG. Kilocalories (kcal), steps and heart rate (HR) was recorded from the watch, metabolic cart, and ECG every 3 minutes for the duration of the walk. Video recording was used to determine steps taken. HR data was averaged over the 1-mile walk. Total steps and kcal for the 1-mile walk were used for analyses. A Pearson Product-Moment correlation examined the relationship between the activity monitor and gold standard measure for HR, kcal, and step count. A paired samples t-test was used to determine differences between the watches for the 3 variables ($p = .05$). **RESULTS:** A strong positive correlation was found for ECG and both monitors (GV: $r = .83$; A370: $r = .95$; $p < .05$), with a percent difference of 6.6% (GV) and 2.9% (A370). The GV and A370 kcal were moderately correlated with the metabolic cart (GV: $r = .59$, A370: $r = .52$; $p < .05$),

with a percent difference of 11.7% (GV) and 19.2% (A370). Watch step counts were strongly correlated with manual step counts (GV: $r = .74$, A370: $r = .77$; $p < .05$). Percent differences for step counts were 11.6% (GV) and 3.9% (A370). There were no significant differences between the GV and A370 for HR. The two monitors were significantly different for steps. GV measured a higher step count. The two monitors were significantly different for kcal. A370 estimated higher energy expenditure than the GV. **CONCLUSION:** This study presents preliminary findings on the accuracy of two popular consumer level physical activity monitors, showing a strong relationship for step counts and HR compared to gold standard measures. Differences exist between these two brands in their estimation of kcal and steps.

1548 Board #142 May 28 10:30 AM - 12:00 PM
Comparison Between Fitbit Flex And Flex 2: Measures Of Sedentary And Physical Activity In Free-living

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In recent years, Fitbit has been increasingly used as a measurement or intervention tool in physical activity research. However, Fitbit's shorter lifespan of model generation than research-based accelerometers may limit its utilization in the longitudinal study if measurement properties vary across model generations. To date, no information is available whether the estimates of sedentary behavior (SED) and physical activity (PA) differ between predecessor and newer models of Fitbit. **Purpose:** To determine the inter-model comparability between FF and FF2 in assessing SED and PA during free-living conditions. **Methods:** 38 healthy adults (Female: 65.8%, Age: 23.8 \pm 0.8 yrs, BMI: 25.0 \pm 24.6 kg/m²) wore the FF and FF2 on non-dominant wrist for seven consecutive days. Raw data of FF and FF2 were converted to activity counts summarized into minutes of SED and moderate-to-vigorous PA (MVPA) using a proprietary algorithm. Spearman's correlation was used to assess the relationship between the estimates from FF and FF2. Paired t-test and mean absolute percent error (MAPE) were used to examine differences between FF and FF2. Bland-Altman (BA) plots were used to examine bias for agreement and variance between two devices. **Results:** The correlation showed a strong relationship ($r = 0.81$, $P < 0.01$) between FF and FF2 for estimating in total daily activities. FF2 yielded almost identical MVPA estimate (mean difference = 0.04 min/day, $p = 0.94$), but 8.8 min/day higher SED estimate ($p < 0.01$) when compared with FF. MAPEs were relatively lower for both SED (0.8 \pm 0.8%) and MVPA (9.1 \pm 9.9%). BA plots showed no apparent bias for the agreement and variance between the estimates from two devices; SED (limits of agreement: -9.9 ~ 27.1 min/day, Pitman's test: $r = -0.14$, $P = 1.51$) and MVPA (-5.7 ~ 5.8 min/day, $r = -0.36$, $P = 1.94$) estimates. **Conclusion:** Findings from this study showed that the estimates of SED and MVPA were similar between FF and FF2. Therefore, Fitbit Flex models can provide comparable estimates in SED and PA between models. Further, we suggest that researchers can choose FF2 as a measurement of PA when FF is not available in the market during the longitudinal PA research.

1549 Board #143 May 28 10:30 AM - 12:00 PM
The Play Study: Perception Is Everything. Physical Literacy And Reported MVPA In Children.

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(No relevant relationships reported)

PURPOSE: To investigate the association between self-reported 60 minutes of moderate-to-vigorous physical activity (MVPA)/day and motor skill competence in children.

METHODS: Children 6-11 years participating in an after school or summer local YMCA program were enrolled. Study participants completed the PLAY study questionnaire, a two part questionnaire, with the first section completed by parents, and the second section by the child along with parents. Each child attested yes or no to participating in the current recommendation of 60 minutes of MVPA/day. The questionnaire targets elements of physical literacy including family and child knowledge/understanding, daily behavior, confidence and motivation, surrounding physical activity. Correlation analysis was performed between questionnaire answers and six tests of physical literacy; sit-and-reach, grip strength, y-balance, vertical jump, obstacle course time and points. To quantify physical literacy, principal components analysis was used to generate a linear combination of six physical assessment scores. The first weighted component was divided at the median, with scores \geq to the median deemed physically literate, and scores less than this value deemed not physically literate. Fischer analysis was used for comparison statistics. **RESULTS:** Eighty-nine children participated in the study; mean age 7.2 \pm 2.3 years, 53% (N=47) female. Seventy percent (N=62) answered yes to the question "Do you get 60 minutes of

MVPA/day?" while 29% (N=26) answered no. Only 51% (N=45) of study participants were deemed *physically literate*. Correlation analysis revealed no statistical difference in physical literacy scores between children who report 60 minutes of MVPA/day and children who report otherwise ($P=0.816$). More importantly, of children who *perceived* they spent 60 minutes/day in MVPA/day, only 52% could be considered physically literate. Of children who *perceived* they did not get 60 minutes of MVPA/day, 54% were considered not physically literate.

CONCLUSIONS: Simply asking about daily MVPA will not suffice as a screening tool for childhood physical inactivity and motor skill competency. These results emphasize the need for a clinically useful sensitive and specific screening tool that predicts motor skill competence in children required for sustained PA.

1550 Board #144 May 28 10:30 AM - 12:00 PM
Accuracy Of MotionSense Hrv For Assessing Sedentary Behavior And Physical Activity
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 (No relevant relationships reported)

MotionSense HRV (MS-HRV) is a wrist-worn accelerometry-based sensor that is paired with a smartphone to examine health behaviors such as stress response, heart rate, and physical activity (PA). However, little information is available on the validity of MS-HRV in estimating PA.

PURPOSE: To evaluate the accuracy of MS-HRV for assessing PA and sedentary behavior (SED) in adults, using the most widely utilized accelerometer-based activity monitor, ActiGraph GT9X (GT9X), as a criterion measure, during free-living conditions.

METHODS: 19 adults (Female: 58%, Age: 30.9 ± 13.7 yrs, BMI: 30.3 ± 4.1 kg·m²) wore the MS-HRV on non-dominant wrist and AG on dominant hip simultaneously for seven consecutive days. The MS-HRV is composed of a smartphone and wristband that is accelerometer and LED biometric sensor to measure PA unobtrusively. Raw acceleration data from both MS-HRV and GT9X were processed using GGIR package that summarizes multiday raw acceleration data to the amount of time (min/day) spent in SED and moderate-to-vigorous PA (MVPA) using Euclidean Norm Minus One (aka. ENMO). Pearson correlations and Bland-Altman (BA) plots were used to examine the relationship and agreement between MS-HRV and GT9X. Equivalence test was used to compare the 90% confidence intervals (CI) of the estimates from the MS-HRV with the respective equivalence zone (EZ; ± 10% of the mean estimates) from the GT9X.

RESULTS: The correlations between MS-HRV and AG were high for both SED ($r = 0.95, P < .01$) and MVPA ($r = 0.89, P < .01$). BA plots illustrated no variance difference in SED estimates (Pitman's test: $r = -0.16, P = 0.95$), but significantly different variance in MVPA ($r = -0.91, P = .02$) from two devices. The estimates of SED and MVPA from the MS-HRV (SED Mean (90% CI): 237.6 min/day (198.5 - 276.8)); MVPA: 21.5 min/day (16.4 - 26.6) were not significantly equivalent to those from the GT9X (SED Mean (EZ)): 257.6 min/day (231.8 - 283.4); MVPA: 8.7 min/day (7.8 - 9.5)).

CONCLUSIONS: The MS-HRV accelerometer yielded comparable estimates of SED, but significantly higher estimate of MVPA when compared with the GT9X accelerometer. The observed difference in MVPA estimate could be due to the difference in device placement location (wrist vs. hip). Therefore, subsequent research that compares the estimates from two devices worn at the same location is warranted.

1551 Board #145 May 28 10:30 AM - 12:00 PM
Validity Of Step Counting By Commercially Available Wearable Fitness Devices
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Wearable fitness devices have become widely accessible for athletes and the general population and are increasingly integrated into smartwatch technology. They are used to track daily physical activity and exercise behavior such as steps and provide data to training and health applications to track and evaluate health and fitness. **PURPOSE:** To determine the validity of step counting in two wearable fitness devices during steady-state walking and running and during dynamic changes in walking and running speed. **METHODS:** Ten subjects (5 females, 5 males) completed 3 treadmill test protocols based upon the ANSI/CTA standards for walking (Wlk), running (Run), and dynamic walking and running (Dyn) activities. Subjects wore a Garmin Forerunner 945 (FR945) on the left wrist and an Apple Watch Series 4 (AW4) on the right wrist during the Wlk, Run, and Dyn protocols, which involved 5 minutes of steady-state walking, 5 minutes of steady-state running, and 10 minutes of walking and 3 different running speeds, respectively. Each protocol began and ended with 1 minute of standing. Footsteps were video recorded and counted by 2 observers to determine criterion step counts for each trial. Step counts from the FR945 and the AW4 were determined for each trial for comparison to the criterion step counts. **RESULTS:** Mean

(± SD) subject characteristics: age = 26.8 ± 7.6 y, height = 1.70 ± 0.12 m, weight = 73.0 ± 14.3 kg, BMI = 25.1 ± 2.8 kg/m², bodyfat = 22.6 ± 11.2 %. Mean Absolute Deviation (MAD) for Wlk, Run, and Dyn for the FR945 was 3.5, 4.8, and 6.6 steps, respectively. MAD for Wlk, Run, and Dyn for the AP4 was 4.6, 4.4, and 14.0 steps, respectively. The Mean Absolute Percent Error (MAPE) for Wlk, Run, and Dyn for the FR945 was 0.66 %, 0.59 %, and 0.45 %, respectively. MAPE for Wlk, Run, and Dyn for the AP4 was 0.86 %, 0.56 %, and 0.98 %, respectively. **CONCLUSIONS:** During both steady-state and variable-speed treadmill walking and running, the Garmin Forerunner 945 and the Apple Watch Series 4 demonstrated less than 1% Mean Absolute Percent Error in step counting, a level of accuracy well within that required by the ANSI/CTA Standard (2016) for physical activity monitoring devices. Supported by the Dr. David E. Martin Sport Science Research Fund and the Atlanta Track Club.

1552 Board #146 May 28 10:30 AM - 12:00 PM
DIFFERENCES IN BODY COMPOSITION AND PHYSICAL ACTIVITY LEVEL ACCORDING TO SELF-PERCEPTION HEALTH IN CHILDREN SCHOOL
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Purpose: Comparison of body composition and physical activity level according to self-perception health in schoolchildren. The balance between health and well-being in children and adolescents can be understood through the physical, social, mental and spiritual environment. **Methods:** The sample consisted of 90 schoolchildren, 40 boys and 50 girls aged 9 to 11 years old, who are part of the Ilhabela Mixed-Longitudinal Growth, Development and Physical Fitness Project coordinated by Center of studies physical fitness research laboratory from São Caetano do Sul (CELAFISCS) in São Paulo. Body composition measurements were analyzed according to the CELAFISCS standard, physical activity level and sedentary time objectively determined by accelerometer (actiGraph GT3X analyzed with Freedson 1998). For the perception of health, the Likert scale Diet and Lifestyle questionnaire was used. **Statistical analysis:** ANOVA One Way, Post-hoc Bonferroni, the significance level adopted was $p < .05$. **Results:** There were significant differences in body composition in body weight, BMI, waist circumference and X3DC according to self-perception health. This phenomenon was not found in regards to physical activity and sedentary behavior. **Conclusion:** According to students self-perception health, differences in body composition were found when compared to self-rated health, and body composition values were lower in students who reported a positive score.

1553 Board #147 May 28 10:30 AM - 12:00 PM
Physiological Demands Of Snowboarding: A Field Study
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 (No relevant relationships reported)

PURPOSE: Snowboarding is a recreational activity with large popularity and is also a sport in the Winter Olympics. Despite its popularity and inclusion in the Olympic program, relatively little remains known about the physiological characteristics of a snowboard session, particularly in field settings. The purpose of this study was to classify physiological responses to recreational snowboarding relative to ACSM daily activity guidelines. **METHODS:** To date, twenty-one men and women who were experienced snowboarders were recruited from a university community and while snowboarding wore a heart-rate monitor and GPS device. Data were collected at 1-second intervals and analyzed for time spent in moderate and vigorous intensities based on percentage of heart rate maximum (HR_{MAX}) (light ≤ 64% HR_{MAX} ; moderate 64–76% HR_{MAX} ; vigorous ≥ 76% HR_{MAX}). Based on this information, the amount of time in each HR_{ZONE} was calculated. Data were processed and analyzed using R and SPSS. **RESULTS:** Participants snowboarded an average duration of ~6 hours, covering ~38 kilometers. Average heart rate over the entire session was 63.3±9.5% of HR_{MAX} (122±19 BPM); during actual snowboarding, average heart rates were ~72% of HR_{MAX} (140±10 BPM). Participants spent a significantly greater amount of time in light and moderate intensity activity during non-snowboarding activity (NS) compared to snowboarding (SN) ($p < 0.001$ for both), but amount of time in vigorous intensity was not different between conditions (NS: 31.05 ± 35.78 vs SN: 39.36 ± 33.67 minutes, $p = 0.478$). Total MVPA during SN was 62.33 ± 32.90 minutes compared to 82.86 ± 68.41 minutes for NS, which was not significantly different ($p = 0.262$). **CONCLUSION:** The present data suggest that snowboarding can meet ACSM guidelines for moderate-vigorous intensity exercise of at least 30 minutes a day.

1554 Board #148 May 28 10:30 AM - 12:00 PM
Interrater Reliability Of Movement And Activity In Physical Space (maps) Scores
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The Movement and Activity in Physical Space (MAPS) System is a unique assessment combining data from accelerometers and the global positioning system (GPS) to provide patient-centered data from 13 activity-environment-related variables. Processing MAPS data is time-consuming and requires the use of multiple raters to ensure data are analyzed in a timely process and reduce potential risk of bias; however, it is unknown if the scores obtained from multiple raters are consistent which could significantly influence results. **PURPOSE:** Evaluate the interrater reliability of MAPS system variables obtained from 2 independent raters. **METHODS:** Twenty days of data from 3 participants were processed by 2 independent raters. Participants were instructed to wear an Actigraph GT9X Link accelerometer on their dominant hip and a LandAirSea Flashback 2 GPS for 7-days during waking hours. Outcome variables included: physical activity counts (PAC), physical activity counts at home (PAH), physical activity counts at locations other than home (PAL), step counts (SC), step counts at home (SH), step counts at locations other than home (SL), time at home (TH), time at locations other than home (TL), travel time (TT), number of locations visited (NL), number of instrumental trips (NIT), number of discretionary trips (NDT), MAPS intensity (MAPSi), and MAPS volume (MAPSv). To determine the interrater reliability of MAPS system variables obtained from separate raters intraclass correlation coefficients (ICC_{3,1}) were calculated for each MAPS system outcome. An ICC of .7 was considered acceptable and an ICC of .8 or greater considered good. **RESULTS:** The ICCs for most of the MAPS variables were considered good with PAC=.92; PAH=.75; PAL=.25; SC=.99; SH=.80; SL=.26; TH=.96; TL=.97; TT=.94; NL=.92; NIT=.78; NDT=.72; MAPSi=.49; MAPSv=.61. **CONCLUSIONS:** Overall, interrater reliability between raters was good for 7 MAPS variables with acceptable ICCs for 3 variables. Evaluation of GPS data can be challenging particularly when trying to determine departure and arrival times which are necessary for calculation of MAPS scores and activity counts at locations. Using a team of raters, rather than a single rater, would help to reduce potential bias from evaluation of GPS data; which is consistent with the currently recommended MAPS protocols.

C-41 Free Communication/Poster - Intervention Strategies

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

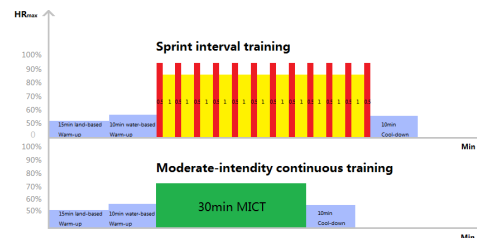
1555 Board #149 May 28 10:30 AM - 12:00 PM
Participation In A Seven-Day Health Education Camp Improved Health Parameters In Overweight Children
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Childhood obesity affects millions of children worldwide. Multidisciplinary interventions are more effective in treating and controlling obesity since it has a multifactorial origin. Health education camps have shown positive contributions to both obesity prevention and treatment. **PURPOSE:** To investigate the effects of participating in the camp how fun can be healthy (KIDS) on health parameters in overweight children. **METHODS:** Twenty children of both genders (7-11 years olds; BMI >85th) attended the KIDS for seven days. Educational, social and recreational activities were carried out at KIDS by a multidisciplinary team (physical education, nutrition, psychology, and pedagogy). Anthropometric parameters (Body weight - BW; Body mass index - BMI), skinfold thickness (tricipital + subscapular - ΣST), % body fat (%BF), resting metabolic rate (RMR), triglycerides (TG), LDL, basal insulin (BI), HOMA IR, HOMA B, and VO₂max were measured before and after KIDS. Parental control of children's eating habits and sleep patterns was also assessed before KIDS. The paired Student's t-test was used to compare the effect of intervention. **RESULTS:** Children improved all health parameters after KIDS respectively (52.52±10.28 vs 51.85±9.76kg; 25.23±2.35 vs 24.93±2.24kg/m²; 64.85±14.97 vs 58.53±12.28mm; 45.11±8.18 vs 41.66±6.71%BF; 1,579.22±347.23 vs 1,805.11±312.23kcal; 130.31±96.01 vs 50.05±19.86mg/dL; 93.22±26.36 vs 68.94±22.23mg/dL; 14.56±7.26 vs 8.59±2.18μU/mL; 2.81±1.36 vs 1.55±0.58μU/mL; 327.09±197.84 vs 211.47±83.22; p<0.05). However, no change was observed in VO₂max when compared pre and post KIDS respectively (38.74±2.56 vs 38.72±2.61mL.kg⁻¹.min⁻¹). Maternal

concern for the child's overweight and modulation were the items of greatest concern while the perception of maternal overweight and the pressure to children's eat were the least concern of the parents. It was also observed a high incidence of excessive daytime sleepiness, sleep breathing disorders and sleep onset and maintenance disorder in these children. **CONCLUSIONS:** Participation in KIDS for seven days induced significant improvement in health parameters, but not in aerobic fitness in overweight children. Supported by CNPq, CAPES, and Sabin.

1556 Board #150 May 28 10:30 AM - 12:00 PM
A Better Approach To Improve Cardiovascular Function In Middle-aged, Inactive Human
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 (No relevant relationships reported)

PURPOSE: Investigate whether different aquatic aerobic exercise intensity modalities yield differential effects on vascular and endothelial function in middle-aged, inactive human **METHODS:** A randomized, controlled trial of middle-aged with inactive recipients 6 weeks of sprint interval training (SIT) or 6 weeks of moderate-intensity continued training (MICT). Outcomes included arterial stiffness, endothelial function, lipid metabolism, body composition and aerobic capacity. **RESULTS:** Twenty-six middle-aged with inactive human (mean age 41 years, 73% male) completed the study. The decrease (P<0.05) of AIX@75 (augmentation index at HR of 75 beat/min) in SIT group was greater than MICT group. On the contrary, subendocardial viability ratio (SEVR) was elevated in the MICT (P<0.01) groups but not after SIT. Brachial artery BP decreased (P<0.01) by -8.1±1.5 mmHg after MICT exercise with no change in SIT. Both groups could significantly reduce fasting blood glucose (P<0.001), but only the decrease of total cholesterol was found in SIT (P<0.01). Brachial artery Flow-mediated vasodilation (FMD) was improved in both group, MICT only showed marginal significance(P=0.07)compared with SIT (P<0.05). SIT's relative VO₂max and O₂ pulse increased (P<0.05) by 8.4% and 8.6%, respectively, with no change in MICT. Both groups of interventions could reduce BMI (P<0.05), but SIT was mainly by increasing lean body mass (P<0.01) and decreasing fat mass (P<0.001), while the lean body mass of MICT did not change. **CONCLUSIONS:** The results of the present study demonstrate that short-term low-volume aquatic SIT is a time-efficient strategy to induce changes in arterial vascular stiffness, endothelial function, lipid metabolism and body composition during exercise that are comparable to changes induced by water-based traditional high-volume MICT.



1557 Board #151 May 28 10:30 AM - 12:00 PM
Intrinsic Facilitators And Barriers, And Recurrent Negative Thoughts Of Physical Activity In Uk Children.
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An increasing number of physical activity (PA) interventions have been implemented to tackle the child obesity epidemic, yet many have shown limited effectiveness. This is possibly due to a lack of in-depth understanding of the intrinsic motivators and demotivators to PA for children. **PURPOSE:** A main aim of this study was to explore the intrinsic facilitators and barriers to PA participation through the lived experience of UK children (Study 1). Utilising the latter findings, our second aim was to develop and validate the PA-specific Rumination Scale for Children (PARSC) to assess children's tendencies to engage in repeated negative thoughts about PA, which may hinder participation (Study 2). **METHODS:** For Study 1, 21 focus groups were formed based on participants' year group (aged 6-10 years), sex and pedometer-assessed PA. Focus group discussions were thematically analysed. For Study 2, the themes identified for the intrinsic barriers were used to develop PARSC, which were completed twice by

382 children (aged 6-11 years). **RESULTS:** For Study 1, four overarching themes were identified for the intrinsic facilitators - sense of competence/accomplishments, cognitive motivator, sensations and socialisation/social facilitation. Four main themes for the intrinsic barriers were lack of competence, fear of negative experiences, external constraints and lacking a sense of purpose. For Study 2, results from Rasch analysis demonstrated that PARSC possessed sound internal validity and consistency, and test-retest reliability. Self-perceived PA ($p = 0.004$) and avoidant coping ($p = 0.01$) were predictive of PA-specific rumination tendencies with 15% of variance explained. **CONCLUSION:** The themes identified from the current study can inform future PA interventions and PE curriculum for UK children. Also, PARSC can be a useful tool to assess children's PA-specific rumination tendencies and to advance our understanding of the role of rumination in PA behaviour.

1558 Board #152 May 28 10:30 AM - 12:00 PM
An IT-based Health Behaviour Change Program To Increase Physical Activity: Evaluation Of Successes And Challenges

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IT interventions initially used to promote health used static platforms, often only as a repository of health-based educational material. Such Web 1.0 technologies failed to promote longer-term user engagement, and rarely allowed the interactivity required for more effective health promotion impact. With more interactive Web 2.0 technologies, greater engagement and retention is often evident, with the participation architecture encouraging interactive user-focused tools and interfaces that allow individuals to determine how information is generated, modified, and shared collaboratively.

PURPOSE: To identify successes and challenges of an RCT and real-world trial of an IT-based physical activity (PA) promotion intervention.

METHODS: The WALK 2.0 study used a Web 2.0-based platform to engage and retain participants in health behaviour change to increase PA. The program included 2 trials: (1) an RCT comparing a Web 2.0 intervention with a less interactive Web 1.0 intervention, and (2) a real-world randomised ecological trial (RET) comparing a Web 2.0 and Web 1.0 intervention.

RESULTS: The RCT showed that, compared to the Web 1.0 group, the Web 2.0 group improved PA in the short-term ($p=.02$), but that the effect diminished over time, despite higher engagement of the Web 2.0 group. The RET showed that the Web 2.0 intervention was more effective in improving PA ($p=.005$), and that while the Web 2.0 website was visited significantly more ($p=.002$), both groups displayed high non-usage attrition and low intervention engagement. Whilst the RCT and RET showed that using a more interactive Web 2.0-based approach was more effective in improving PA, several challenges were identified in designing, implementing, and evaluating such interventions. These include IT-based intervention development in a research context, the ability to establish a self-sustaining online community, the rapid pace of change in web-based technology and implications for trial design, the selection of best outcome measures for ecological trials, and managing engagement, non-usage and study attrition in real-world trials.

CONCLUSIONS: Future research must look to broader research designs that allow for the ever changing IT-user landscape and behaviour, and greater reliance on development and testing in real-world settings.

1559 Board #153 May 28 10:30 AM - 12:00 PM
Satisfaction And Participant Adherence In A Family Healthy Lifestyle Intervention For Children With ADHD

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Consistent evidence demonstrates that healthy lifestyle behaviors (i.e., sleep, nutrition, physical activity, and recreational screen time) are related to neurocognitive development and daily functioning of children with Attention-Deficit/Hyperactivity Disorder (ADHD). However, adopting and sustaining healthy home routines can be difficult for families. Interventions that effectively alter healthy home routines

have potential to influence physical and mental health among children with ADHD. **PURPOSE:** To develop and beta-test the Building Unstoppable families through Intergenerational Lifestyle Transformation (BUILT) program; and assess fidelity, adherence, and satisfaction via attendance rates and post-intervention semi-structured interviews. **METHODS:** BUILT was offered at the University of Illinois at Chicago campus for six consecutive Saturdays. Two families from a Comprehensive ADHD Clinic, three children with ADHD, were enrolled and participated in sleep, physical activity, and nutrition activities during Family Fun Days and were also provided weekly home challenges related to cooking, physical activity, sleep, and screen time. Children earned tickets for completing home challenges, and these were redeemable for prizes. Attendance was taken at each session and semi-structured interviews were conducted with parents at post-intervention. Interviews were audio-recorded, transcribed, and coded using a thematic analysis approach. **RESULTS:** Participating families each attended 5 out of the 6 total sessions (83.33%). Thematic analysis of interviews showed positive aspects of the program included: improving routine structure, showing children their ability, keeping kids active, pursuing goals, relating accelerometer measures to activity, and associating nutrition with being strong and sports performance. **CONCLUSION:** Providing equipment, between session goals, and technology-based physical activity between sessions were beneficial to participant adherence. These findings will inform refinement of the intervention in a second iteration.

1560 Board #154 May 28 10:30 AM - 12:00 PM
Impact Of A Dog Walking Course On College Students' Physical Activity

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The increase in sedentary behaviors, poor dietary choices, and academic time demands during college or university is well documented. Physical activity-related service-learning curricula offers a way to circumvent the negative effects of these increases by providing students with physical activity, as well as the opportunity to learn responsibility, life skills, and values associated with larger social issues.

Research identifies the positive effects of dog walking for both dogs and humans. Shelter dogs, in particular, benefit from this physical activity because of their stressful surroundings and need for physical and psychological activity.

PURPOSE: The purpose of this study was to compare physical activity (PA) levels of students enrolled in a standard PA course and students enrolled in a service-learning PA course where shelter dogs were walked by students.

METHODS: College students enrolled in a standard fitness walking course ($N = 46$; 74% females) and a fitness dog walking course ($N = 19$; 68% females) wore NL-1000 pedometers 2 times/week during their 50 minute class session. Data was collected across 30 and 32 course sessions, respectively. Means and standard deviations were calculated and an independent t-test was performed.

RESULTS: Students in the standard fitness walking course acquired approximately 1760.9 steps \pm 640.9, walked an average of .83 miles \pm .3) and acquired approximately 7.6 minutes \pm 4.2) of moderate to vigorous PA. Students enrolled in the fitness dog walking course acquired approximately 4406.0 steps \pm 317.9, walked an average of .21 miles \pm .16 and acquired approximately 26.2 minutes \pm 3.2) of moderate to vigorous PA. There was a significant difference in steps ($t(60) = 20.8$, $p < .000$, $d = 5.2$), distance ($t(60) = 20.9$, $p < .000$, $d = 5.3$), and minutes ($t(60) = 19.7$, $p < .000$, $d = 5.0$) of moderate to vigorous PA between courses.

CONCLUSION: Students enrolled in a service-learning PA course walked significantly more steps, distance, and minutes than students enrolled in a traditional PA course. Notably, students in the dog walking course reached approximately 40% of their recommended step requirements during class time. The local shelter dogs also benefitted from being physically active demonstrating the utility of community engagement when seeking innovative ways to promote PA among college students.

1561 Board #155 May 28 10:30 AM - 12:00 PM
Abstract Withdrawn

1562 Board #156 May 28 10:30 AM - 12:00 PM
Utilizing A Clinical Research Registry As A Recruitment Tool For Exercise Trials

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(No relevant relationships reported)

Utilizing a multi-faceted recruitment approach to enlist potential research volunteers can help overcome financial, staffing and time burdens. Recently, our Duke Health and Exercise Research Trials team created an online registry to connect with individuals interested in clinical research participation.

Purpose To examine our registry's ability to engage a diverse pool of volunteers in the greater Durham, NC area.

Methods We developed our IRB-approved registry in REDCap, a secure tracking database. Our registry allows us to recruit volunteers without cold-calling in one of two ways. First, we can contact individuals who are current or former participants from one of our research studies. Second, we can recruit from the general public by directing individuals to our registry's web link via flyers, social media posts, and word-of-mouth. By volunteers consenting to join the registry, we are able to collect basic contact, demographic, and health-related information. Then, we screen for initial qualification by study-specific inclusion/exclusion criteria. For those who appear to be qualified for a particular study, we contact them to provide study-specific overviews and conduct the full screening process.

Results Since our registry launch in July 2018 to October 2019, 357 volunteers consented to join the registry. Because personal health information entry is optional, our registry includes 289 subjects who provided their birth year (1938 to 2001), 306 reported their gender (62% females), and 312 reported their race/ethnicity (77% Caucasian; 14% Black or African American; 93% not Hispanic/Latino). We have self-reported height/weight on 306 subjects. In addition, 29% reported having a chronic disease diagnosis (n=8 disease categories).

Conclusion To date, as the majority are non-Hispanic Caucasian females, there appears to be a racial and gender disparity amongst our registry sample. However, our registry includes a significant proportion of volunteers who self-reported a chronic disease diagnosis. Based on initial implementation, our registry has successfully linked volunteers with 5 ongoing studies, ranging from healthy to diseased populations. Importantly, our findings highlight the need to improve our recruitment strategies to appeal to a more diverse population of future registry volunteers.

1563 Board #157 May 28 10:30 AM - 12:00 PM
Compliance Rate Of Device-based Intensity Prescriptions And Individual Preference For The Methods

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Compliance with physical activity (PA) prescription is a key component to maximizing desired health outcomes. For instance, health improvement may be diminished or may not even occur without prescription compliance. Due to the practical limitations of prescribing activity intensity in a free-living setting, a precise and practical prescription method is necessary, and using a wearable device could be the gateway to address the issue. Several methods using wearable technologies are already available for this purpose, but few have determined the extent of prescription compliance when using the devices. **PURPOSE:** To determine the compliance rate of the device-based intensity prescriptions and to identify individual preference for the methods. **METHODS:** Forty healthy adults (age 18-65 years; 20 females) participated in this study. The participants were prescribed to perform an aerobic activity (walking and/or running) at moderate- and vigorous-intensity using both (1) heart rate (HR) and (2) real-time cadence (RC) and continued to perform the activity for 2 minutes. For HR and RC prescriptions, a chest heart rate monitor and a cadence sensor that were paired with wrist-based running watches were used, respectively. After completion of the walking trials, preference for the prescriptions was assessed by three domains including: (1) easy-to-understand the prescription, (2) easy-to-perform the prescribed activity, and (3) easy-to-maintain the prescribed intensity for a given duration. Descriptive statistics were conducted to calculate the compliance rate and mean values as well as for the comparison for preferences of the two methods. **RESULTS:** Higher compliance rates were found when utilizing RC compared to HR for both moderate (92.1% v. 76.9%) and vigorous (94.9% v. 69.2%) intensities. For both intensities, a combination of walking and running was mainly used to comply with HR prescription, whereas walking was a dominant type of activity when utilizing RC. Lastly, the prescription

using RC was more preferred over HR in all the three domains (70%, 72%, and 75%, respectively). **CONCLUSION:** The utilization of RC can help researchers and practitioners yield higher compliance rates, but further efforts are still needed on the improvement in compliance rate of the device-based intensity prescriptions.

1564 Board #158 May 28 10:30 AM - 12:00 PM
Sedentary Behavior And Parental Perceptions And Intentions Toward Physical Activity Of Puerto Rican Children

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PURPOSE: To describe parental perceptions of their children physical activity (PA) and intentions to change behaviors related to PA and device-measured of time in sedentary behaviors (SBT) of Puerto Rican children. **METHODS:** Seventy-three children (mean±SD; age, 8.9±1.3 yrs; BMI 33.1±10.4 kg m⁻²) wore an ActiGraph GT3X accelerometer on their right hip for seven consecutive days to estimate SBT. Parents answered a question on their perceptions (PP) of their child's physical activity; "days that my child participate in active physical exercise for at least 20 to 30 minutes". To answer the following categorical variables were used: "6-7 days each week", "3-5 days each week", and "1-2 days each week or less". Parent's intentions (PI) to modify PA and SBT were assessed by answering two questions; "During the next month I intend to get 30 minutes of physical exercise at least 5 days per week, and their answers were categorized into "I will probably will try", "I probably will not try" and "I already do this", and "During the next month, I intend to limit my child's daily TV viewing to 2 hours per day (or less)" answers categorized into "I will probably will try", "I probably will not try", and "I already do this". Frequency distributions and descriptive statistics were performed for ordinal and continuous variables respectively. Due to the non-normality of the data, Mann-Whitney U-tests were used to explore differences in SBT by gender. To calculate minutes in SBT an Actigraph vector two-regression model (VM²RM) that has been validated for use in children was used (Crouter, Horton, & Bassett, 2012).

RESULTS: Significant differences were found between boys and girls for total SBT (239.3±74.6 min/days vs. 296.2±128.4 min/days, respectively, p=0.024). Also, a significant difference in SBT by gender was observed. Boys whose parents expressed that they already limit their child's TV time spend less SBT than girls (241.3±65.3 vs. 291.5±127.4, respectively, p=0.002). No significant differences in daily SBT was reported when considering PP. **CONCLUSIONS:** Boys whose parents already limit their TV time spent significant less time on SBT than girls. Findings support the inclusion of goals related to PI in PA and/or SBT interventions, particularly when minimizing sedentary time among children.

1565 Board #159 May 28 10:30 AM - 12:00 PM
Does The Quality Of Dietary Intake Improve With Regular Exercise?

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(No relevant relationships reported)

Lifestyle-induced reduction in health risk is thought to be the result of improvement in both exercise and eating behaviour. Whether increasing exercise is associated with a corresponding improvement in eating behaviour is unclear. **PURPOSE:** To determine if the adoption of exercise consistent with consensus recommendations influences diet quality in previously sedentary adults. **METHODS:** Participants were 129 obese (BMI: 33.0 ± 4.5 kg/m²), middle-aged (51.5 ± 7.9 years), sedentary adults (81 females [62.8%]) who were randomly assigned to one of the following 4 groups: i) no-exercise control (n=32), ii) low-amount, low-intensity exercise (LALI) (180 and 300 kcal/session for women and men, respectively, at 50% of VO_{2peak}) (n=36), iii) high-amount, low-intensity exercise (HALI) (360 and 600 kcal/session, respectively, at 50% of VO_{2peak}) (n=40), iv) high-amount, high-intensity exercise (HAHI) (360 and 600 kcal/session, respectively, at 75% of VO_{2peak}) (n=21). All exercise sessions were supervised. Self-reported daily diet records were assessed using an automated web-based program. The Canadian Healthy Eating Index (C-HEI) was averaged from 3-day diet records obtained at baseline, 8, 16 and 24 weeks. C-HEI is calculated using 8 adequacy (total vegetables and fruit, whole fruit, dark green and orange vegetables, total grain products, whole grains, milk and alternatives, meat and alternatives) and 3 moderation (saturated fats, sodium, other food) components. The components were summed to produce a single score between 0 and 100, with higher scores reflecting greater adherence to 2007 Canada's Food Guide, and hence better diet quality.

RESULTS: Mean (± standard deviation) C-HEI in all participants at baseline was 58.4 ± 13.4, with no difference between groups (P= 0.40). There was no change in C-HEI at 24 weeks vs baseline in any of the groups assigned to increased amounts of exercise or

intensity ($p=0.5$). Collapsed across all groups, the mean change in C-HEI at 24 weeks was (3.9 ± 16.0). **CONCLUSION:** The diet quality of the participants, as reflected by the C-HEI, was poor at baseline and was not improved consequent to the adoption of exercise consistent with consensus recommendations. Contrary to expectations, engaging in a structured exercise program is not paralleled by favorable changes in dietary behaviour.

1566 Board #160 May 28 10:30 AM - 12:00 PM
<HIIT As An Effective Method To Reduce Visceral Fat Area In Short Term>

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(No relevant relationships reported)

The lack of time for physical activity is a position that prevails in sedentary people. The low level of physical activity, coupled with factors such as poor diet has been related to the development of metabolic syndrome. HIIT is a modality that increases the level of physical activity with positive effects on cardiorespiratory variables, however, there is insufficient evidence of the effect on body composition. **PURPOSE:** to analyze the effect of a HIIT on body composition in sedentary adults. **METHODS:** twelve sedentary adults (50% women) 31.5 \pm 5.4 years old, participated in 16 sessions (three per week) treadmill HIIT. Height (168.3 ± 8.6 cm), body weight (BW) (80.8 ± 18.0 kg), muscle mass (MM) (30.1 ± 6.9 kg), body fat percentage (BFP) (33.2 ± 4.3 %) and visceral fat area (VFA) (126.3 ± 39.5 cm²) were measured. An initial measurement (M1), after session eight (M2) and 16 (M3) were made. HIIT consisted of three minutes warmup at 40% of your maximal aerobic speed (MAS), five one-minute intervals (80% MAS) with one-minute breaks (50% MAS), followed by a five-minute recovery (40% MAS). MAS was estimated with the 30-15 Intermittent Fitness Test. **RESULTS:** a mixed two-way ANOVA without significant variation between sex and measurements ($p = .942$) was applied. In the same way, with a one-way ANOVA of related samples, no differences were found in BW ($\% \Delta = -0.4$; $p = .237$; $\eta^2 = .123$), MM ($\% \Delta = 1.3$; $p = .142$; $\eta^2 = .162$) BFP ($\% \Delta = -1.2$; $p = .444$; $\eta^2 = .071$) among the three measurements. Differences in VFA (126.3 ± 39.5 cm² and 117.0 ± 40.8 cm²; $p = 0.002$; $\eta^2 = .472$) were found between M1 and M3, respectively. **CONCLUSIONS:** these results indicate that 16 sessions of high intensity interval training, lasting 17 minutes per session, decrease the visceral fat of sedentary people.

1567 Board #161 May 28 10:30 AM - 12:00 PM
Validity & Reliability Of A Self-Report Modified Sitting Time And Physical Activity Questionnaire

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Self-report questionnaires are important tools for public health because of their ability to reach large populations at relatively low costs. Given recent scientific findings which highlight the risks of too much sitting time as well as the importance of physical activity throughout the entire day, new self-report instrumentation is needed which can effectively measure both sitting time and physical activity throughout the entire day. **PURPOSE:** To determine the validity and reliability of a modified physical activity (PA) and sitting time (ST) questionnaire during work-time (WT) and leisure-time (LT). **METHODS:** Full-time workers aged at least eighteen years ($n=26$) kept time logs and wore Actical Physical Activity accelerometers during the workweek for 4 days during work-time and leisure-time, while simultaneously completing a modified Occupational Sitting and Physical Activity Questionnaire (OSPAQ) two times 7-10 days apart. **RESULTS:** Using intraclass correlation coefficient calculations, test-retest reliability ranged from 0.661-0.901, with WT Sedentary Time (0.901), WT PA (0.869), and LT Sedentary Time (0.818) showing excellent test-retest reliability. LT PA also showed good test-retest reliability (0.661). For validity, spearman's rho correlation coefficients were calculated, resulting in two categories of the modified OSPAQ with significant p -values, WT Sedentary ($p=0.001$) and LT PA ($p=0.04$). Self-report WT sedentary time showed a moderate correlation ($r=0.583$) to accelerometer data, while self-report LT PA showed a small correlation ($r=0.394$). Neither WT PA nor LT Sedentary showed significance. **CONCLUSIONS:** The modified OSPAQ instrument showed excellent to good test-retest reliability and moderate to small correlation of WT sedentary time and LT PA with accelerometry. The modified OSPAQ instrument could be used as a public health tool to measure both PA and ST behaviors throughout the entire day.

1568 Board #162 May 28 10:30 AM - 12:00 PM

Retention Strategies For Incentive-free Exercise Interventions: Importance Of Enrollment Timing

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(No relevant relationships reported)

Nearly half of all US adults have a chronic disease diagnosis; these individuals are more likely to be sedentary than age-matched controls. When exercise programs incentivize their participation, attrition may be reduced for the duration of the trial, but the results lack applicability outside of the clinic. Thus, there remains a need to identify cost-free predictors of exercise adherence among sufferers of chronic diseases. **PURPOSE:** To determine the effect of enrollment timing on retention in an incentive-free, community exercise program. **METHODS:** 224 previously inactive patients with chronic diseases (cancer, diabetes, pulmonary and cardiovascular disease) were enrolled in an intervention involving 10 weeks of aerobic, resistance, and flexibility training. Independent-samples t -tests and chi-squared tests compared the profiles of patients who did and did not complete the trial. Logistic regression tested the effect of enrollment timing on program completion holding constant potential confounders. **RESULTS:** Across 62 continuous months of admission, 43.3% of patients completed the trial. Retention differed throughout the year with the highest rate occurring in January and February; 55.8% of participants enrolled in those months were retained compared to 39.5% during later months ($p=0.038$). Patients exhibited no differences in health history, cardiometabolic risk factors, anthropometric measurements, functional assessments, or quality of life scores between months of enrollment. Holding constant sex, age, and diagnosis, initiating training during the first 2 months of the year predicted a 2.1-fold increase in program completion ($p=0.023$; 95% CI of OR: 1.107-4.053). **CONCLUSIONS:** Incentive-free exercise interventions for patients with chronic diseases have high attrition. Fewer than half of our patients were retained for 10 weeks. However, those who enrolled at the start of the year were more likely to complete the program, indicating possible value seasonal recruitment.

1569 Board #163 May 28 10:30 AM - 12:00 PM

Qualitative Study On The Perceived Barriers Of A Physical Activity Program In Toddlers: Classroom Teacher Perspective

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(No relevant relationships reported)

Toddler children (18 months-2.8 years) spend a significant portion of their day at childcare settings, where they spend most of their time engaged in sedentary activity. Toddler classroom teachers have a considerable influence on toddlers' physical activity (PA) levels. Due to the toddler classroom environment, teachers may encounter unique age and ability related barriers to the implementation of PA programs. **PURPOSE:** The purpose of this qualitative study was to determine the perceived barriers that toddler classroom teachers may face in implementing PA programs to toddlers. **METHODS:** Toddler classroom teachers from 3 environmentally matched childcare centers from the Springfield MA area participated in this qualitative study. Focus group meetings ($n=3$) were conducted separately at each center. At each meeting, a semi-structured focus group format and questionnaire were used to guide the sessions. All focus groups were audio-recorded and later transcribed by a primary, secondary, and tertiary trained researchers. Researchers used open coding to identify themes. Representative quotes were selected for each theme to demonstrate saturation of ideas. **RESULTS:** A total of 15 teachers participated in this study (age = 38.4 ± 12.5 ; BMI (self-reported) = 26.1 ± 4.3 kg/m²). Teachers had an average of 9.5 ± 8.7 years of experience as toddler classroom teachers (ranging between 1 to 28 years). Teachers perceived barriers to PA were categorized into 3 main themes. The three main themes were 1) essential childcare needs (e.g., regular diaper changes of the toddlers, child supervision), 2) wide variation in cognitive and motor skill abilities of toddlers (e.g., differences in children that just learned to walk versus those that have been walking for an extended period, short attention span) and 3) limited resources and physical space (e.g., limited activity options, small classroom design to hold 9 toddlers). **CONCLUSION:** This qualitative study provides preliminary evidence that classroom teachers face unique perceived barriers in implementing PA to toddlers. Future research should examine how these perceived barriers can be incorporated into the design and implementation of PA programs designed for toddlers within the childcare center.

1570 Board #164 May 28 10:30 AM - 12:00 PM
Physical Fitness, Neurocognitive Performance, And Apolipoprotein E Genotype In Familial Alzheimer's Disease

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(No relevant relationships reported)

Cognitively normal older carriers of the Apolipoprotein E-ε4 (ApoE-4) allele have a greater rate of memory decline over time than do noncarriers of this allele. However, the potential neurophysiological mechanisms and the role of physical fitness have not been examined in the elderly with a family history of Alzheimer's disease (ADFH) and ApoE-4 genotype. **PURPOSE:** To investigate the brain event-related potential (ERP) performance and the interactive effects on physical fitness in the ADFH individuals with the ApoE-4 heterozygotes. **METHODS:** Forty-four older adults with ADFH were recruited and divided into an ApoE-4 group (n=22; 71.68±5.84 yrs) and a non-ApoE-4 group (n=22; 72.09±7.50 yrs) according to the ApoE genotype. They performed a senior functional physical fitness (SFPF) test and completed a visuospatial working memory task with low and high cognitive load while simultaneously recording electroencephalographic signals. **RESULTS:** Although there were no significant between-group differences with regard to reaction time and ERP P3 latency across two conditions, the ApoE-4 relative to non-ApoE-4 group showed significantly lower accuracy rates (ARs) (72.15±11.39% vs. 78.72±6.60%, p=.011) and smaller ERP P3 amplitudes (4.02±1.50μV vs. 6.41±2.70μV, p<.001) only in the high working-memory load condition. Cardiorespiratory fitness was significantly correlated with the neuropsychological performance (i.e., ARs) in the ApoE-4 group (r=0.52, p=.014). **CONCLUSION:** ADFH individuals with the ApoE-4 genotype only showed poorer neurocognitive performance (i.e., ARs & ERP P3 amplitudes) when performing a cognitive task with high working memory load. The potential neurophysiological mechanism could be attributed to poorer cognitive processes associated with the updating of the contents of working memory. Regular physical exercise aimed at enhancing cardiorespiratory endurance may ameliorate the negative impact of visuospatial working memory declines and further delay the onset of Alzheimer's disease in ADFH individuals with the ApoE-4 genotype. Supported by the Minister of Science and Technology in Taiwan under grant numbers MOST 105-2410-H-006-050-MY3.

1571 Board #165 May 28 10:30 AM - 12:00 PM
Feasibility Of Self-paced Intermittent Hypoxic Exercise As An Exercise Intervention In Obese Populations

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(No relevant relationships reported)

Background. We have previously shown for a healthy population, that in hypoxic conditions equivalent to 3500 m, self-paced intermittent best effort walking results in ~32% greater oxygen cost (VO₂) compared to matched work steady state walking. By combining a self-paced intermittent protocol with recumbent cycling, suggested to be a more comfortable exercise mode for obese populations, some perceived barriers to exercise (e.g. lack of time, discomfort) could be mitigated against, whilst increasing the exercise stimulus. **Purpose.** To determine if self-paced intermittent recumbent cycling performed in normobaric hypoxia increases oxygen cost and energy expenditure (EE) compared to matched work and duration steady-state exercise, and is a tolerable exercise mode for obese populations. **Method.** Fourteen tier 2 obese participants (4 men; 39 ± 13 yr; 165.1 ± 8.1 cm; 95.2 ± 16.1 kg; BMI: 34.9 ± 5.0 kg/m²) completed 3 exercise trials separated by 7 days. Trials were performed on a recumbent cycle ergometer and in a normobaric hypoxic chamber (F_O 0.135). After determination of hypoxic ventilatory threshold (VT) and maximal power output (W_{max}), participants completed one 20 min steady state (SS) cycle at 90% VT, and one self-paced intermittent (INT) cycle. During INT, participants performed periods of maximal work at W_{max} and could stop and rest as many times as necessary before completing the distance covered during SS. Breath-by-breath data were collected by a metabolic cart, and heart rate and arterial oxygen saturation were monitored throughout. Time to complete SS and INT were compared by Wilcoxon signed-rank test, and physiological data were compared by paired t-test. **Results.** Time to complete the exercise bouts was similar (SS: 1200 ± 00 s vs INT: 1421 ± 441 s, p = 0.14). INT elicited a 30% higher VO₂ (SS: 1779.46 ± 320.19 L; INT: 2553.77 ± 1097.65 L) and EE than SS [0.89 ± 0.38 MJ (212.81 ± 91.47 kcal) vs. 0.62 ± 0.11 MJ (148.29 ± 26.68 kcal)], p = 0.03). **Conclusion.** The self-paced INT protocol was completed by all obese participants without incident or complaint, and induced a 30% increase in EE compared to a comparable duration of work performed at 90% VT. Further work is required to compare long-term adherence and weight loss/metabolic responses to this mode of exercise completed in both normoxic and hypoxic conditions.

1572 Board #166 May 28 10:30 AM - 12:00 PM
Evaluation Of The Painless Stretching Program On Range Of Motion And Pain

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(No relevant relationships reported)

PURPOSE: About 80% of Americans develop a lower back problem in their lifetime. This varies from a relatively mild, but persistent back ache to herniated, or ruptured discs between vertebrae of the lower back. This can be alleviated by restoring mobility, particularly in the lower back area. The Painless Flexibility™ system is an effective treatment for the typical lower back pain and other related symptoms such as sciatica. The Painless Flexibility™ system utilizes exercises and techniques that are focused on the fascia rather than the muscles, bones or joints. The purpose was to determine if the Painless Flexibility™ system group program increases the range of mobility and decreases reported pain level. The study duration was six months to collect data for evaluation of an impact study. **METHODS:** Nine participants underwent a series of questionnaires & physical evaluation of ability to stretch and level of back pain felt. Flexibility and pain were measured twice (pre-intervention and post-intervention) and a paired t-test was used to test for change and Cohen's d reported as an effect size. **RESULTS:** There was a statistically significant improvement in scalpular retraction (d=1.25, p=.005), sit and reach (d=1.26, p=.005), spine rotation (d=1.39, p=.003), and modified Thompson test (d=1.58, p=.001). Reported pain decreased (d=0.74, p=.015). **CONCLUSIONS:** The Painless Flexibility is an effective program to increase flexibility and reduce lower back pain.

1573 Board #167 May 28 10:30 AM - 12:00 PM
Barriers, Facilitators, Needs And Goals Of Exercise For People With Osteoporosis

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Although the literature clearly demonstrates that exercise benefits people with osteoporosis, it is a challenge to initiate and adhere to an exercise program for most individuals. Currently there is little evidence on exercise preferences of people with osteoporosis yet these factors may contribute to reduced exercise adherence. **Purpose:** Therefore, this project surveyed patients with osteoporosis in a physician's clinic to understand their exercise preferences, barriers, needs, and goals. **Methods:** The Personalized Exercise Questionnaire (PEQ) was used to gain insight into the barriers, facilitators, and goals related to exercise. Participants were recruited from a subspecialty metabolic bone disorder clinic with a large population of osteoporotic patients. **Results:** Data on a total of 287 surveys were collected. The sample was 90% female with a mean age of 67 (SD: 10.7) years. Most participants preferred to exercise in the morning (n=208, 75%), on their own time (n=180, 65%), with exercise that were easy to perform (n=151, 55%), slow paced (n=133, 48%), and easy to remember (n=117, 43%). Home (n=171, 62%) was the most preferred location to exercise. Related to feedback, participants wanted to receive feedback by email (n=106, 60%) about proper exercise technique (n=138, 78%), exercise progress (n=124, 70%), and receive that feedback monthly (n=96, 54%). The most important goal for the participants was to improve strength (n=241, 84%) and the least important goal was to reduce falls (n=129, 45%). A higher proportion of men (64%) said that they had barriers that stopped them from exercising compared to 54% of women. Time was the most common barrier reported in 30% of participants and pain was the second most common barrier in 23% of the participants. **Conclusion:** This study provides insight into participant preferences for exercise. Future studies should take these results into account when designing an exercise program for people with osteoporosis.

1574 Board #168 May 28 10:30 AM - 12:00 PM
Randomized Face-to-face Vs. Remote Exercise Interventions In Overweight And Obese Subjects
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PURPOSE: To compare the effect of face-to-face exercise intervention and wearable activity tracker-based remote intervention on anthropometry and metabolism in overweight and obese subjects. **METHODS:** All 50 overweight and obese subjects were selected [age: (43.81±9.75) yrs; body mass index: (27.29±2.61) kg/cm²; 30 males]. CRF was measured with a graded exercise test by cycle ergometer. Body composition was measured by bioelectrical impedance analysis (BIA). Other indicators include anthropometric and biochemical characteristics (FBG, TC, TG, LDL-C, HDL-C). Exercise intervention program: 3 times/week, 60 min per session at 45%-65%VO_{2max}, 12 weeks. Two supervision modes: a traditional face-to-face group intervention, and a wearable activity tracker-based remote intervention with social networking platform (WeChat). **RESULTS:** After 12 weeks exercise training, BMI, fat%, neck circumference, waist circumference, FBG and TG were significantly improved in both face-to-face and remote groups. However, LDL-C and TC changed significantly only in the face-to-face group (decreased by 32.32±19.38%, 4.47±19.48%, respectively). The changes of neck circumference (-1.77±2.92 vs. -0.87±5.09 cm) and waist circumference (-3.76±5.52 vs. -0.39±4.37 cm) were more significant in the face-to-face intervention group than in the remote intervention group. **CONCLUSIONS:** 12 weeks of face-to-face and wearable activity tracker-based remote intervention can improve the body composition and glycolipid metabolism of overweight and obese subjects, but face-to-face intervention may have more significant effect on improving the circumference, LDL-C and TC. Supported by Social Science Foundation of Jiangsu Province (BE2018752), Science and Technology Support Plan (Social Development) of Changzhou (CE20195046).

1575 Board #169 May 28 10:30 AM - 12:00 PM
Act-Belong-Commit Framework For A Mentally Healthy College Campus: Campus Recreation And Exercise Science Partnership
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A growing concern for universities is the state of mental health with a clear need for positive mental health campaigns and strategies to shift the culture surrounding mental well-being. Our campus has adopted a holistic framework, Act-Belong-Commit, to improve mental health through positive intentional engagement in activities.

PURPOSE: The purpose of this study was to examine the mental health climate and well-being of current students on a primarily residential collegiate campus before the implementation of Act-Belong-Commit campaign. **METHODS:** 176 students (21.2±2.5 yrs; 162 female, 19 male, 2 gender non-binary) participated in the campus-wide survey. There was equal representation of the students across years in school with little ethnic/racial diversity: (Caucasian=93%; African American=2%; Hispanic/Latinx=3%; Asian=2%) and some diversity in sexual orientation (heterosexual=87%; homosexual=2%; bisexual=8%, or other=2%). Measures included: Satisfaction With Life (SWL), Multidimensional Scale of Perceived Social Support (MSPSS), Self-Stigma of Seeking Help Scale (SSSHS), Depression Anxiety Stress Scale (DASS), Resilience and the Meaning of Life Questionnaire (MLQ). A small subset (n=55) completed an ABC self-assessment. **RESULTS:** Social Support was significantly correlated ($p<0.05$) with many positive mental health outcomes: SWL ($r=.62$); Resilience ($r=.39$); Meaning of Life ($r=.34$); Depression Subscale ($r=-.56$); Anxiety Subscale ($r=-.34$); Stress ($r=-0.35$). High perceived social support and positive mental health were also seen in people high on ACT (Social Support $r=.32$; resilience $r=.37$, depression $r=-.32$, anxiety $r=-.26$, and stress $r=-.36$) and BELONG (SWL $r=.35$, resilience $r=.39$, depression $r=-.29$, stress $r=-.28$). **CONCLUSION:** Social support and a sense of belonging was integrally tied to measures of positive mental health and improved satisfaction with life measures. Belonging comes from being engaged in an active life with people and activities that bring meaning and purpose. Campus recreation and exercise science programs will lead the implementation of the ABC campaign, promoting physical activity, mindfulness/meditation, and play as activities to engage in a various levels as part of this positive mental health campaign.

1576 Board #170 May 28 10:30 AM - 12:00 PM
Autonomy Increases Children'S Enjoyment Of High-intensity Interval Training During Physical Education.
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PURPOSE: This study explored enjoyment of HIIT within a self-determination framework (autonomy and competence) in elementary school physical education (PE) classes. The use of this framework may make school-based, HIIT interventions more accepted by children.

METHODS: Participants were 2nd, 5th grade children ($n=382$) from central Texas (48.7% female, 53.8% white). HIIT was a 7 min warm-up structured as high-intensity body weight exercises for 30 seconds with 10 seconds rest completed twice weekly. Each PE class completed both a teacher-led (non-autonomy) and a student-led (autonomy) condition. Student enjoyment, competency, and perceived effort of HIIT was assessed with one item for each variable on a 5-point likert scale (5 = "I enjoyed it a lot," 5 = "I did really well," "5 = very hard") paired with images to illustrate each level of the scale. In addition, enjoyment, competency, and perceived effort were assessed for each of the specific activities performed during the HIIT warm-up. **RESULTS:** Enjoyment was significantly higher for the autonomous, ($M=4.5$, $SD=0.88$), than the non-autonomous, ($M=4.1$, $SD=1.1$) condition, $F(1,374) = 64.21$, $p<0.001$. Within each condition, enjoyment was significantly correlated with competence across the HIIT conditions: autonomous, $r=.45$, $p<0.001$; non-autonomous, $r=.48$, $p<0.001$. Perceived effort was only significantly correlated with competency for the autonomous condition, $r=0.11$, $p<0.05$. With regard to specific activities, children enjoyed full-body aerobic activities more than strength activities. Specifically, with the exception of high knees ($M=3.74$, $SD=1.19$), enjoyment for aerobic-focused activities were all over 4 on the 5 point scale: jumping jacks ($M=4.48$, $SD=0.83$), star jacks ($M=4.0$, $SD=1.14$) and jogging in place ($M=4.30$, $SD=0.96$). In contrast, activities that emphasized strength were all rated under 4 on the same, 5 point scale: push-ups ($M=3.68$, $SD=1.26$), sit-ups ($M=3.88$, $SD=1.30$), mountain climbers ($M=3.74$, $SD=1.19$).

CONCLUSION: Children across grades tended to enjoy more aerobic-focused HIIT activities. In addition, the inclusion of choice to provide a sense of autonomy increased enjoyment, which was associated with perceived competence. These data can be used to inform the design of school-based, HIIT interventions.

1577 Board #171 May 28 10:30 AM - 12:00 PM
Using Fruits And Vegetables To Motivate Adherence To Walk With Ease, An Arthritis Focused Walking Program, In Low-income African American Women
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 (No relevant relationships reported)

PURPOSE: To explore whether fruits and vegetables prescriptions were associated with increasing physical activity engagement in low income African American populations. Arthritis can be an obstacle to physical activity, and inactivity is often associated with chronic conditions such as cardiovascular disease, diabetes, and obesity. African American women are less likely to engage in recommended amounts of physical activity, and experience higher levels of chronic disease than other ethnicities.

METHODS: Individuals from low income areas, and who are African American, are less likely to engage in physical activity, and often lack access to fresh fruits & vegetables (F&V). To motivate adherence to Walk with Ease (WWE), an Arthritis Foundation evidence-based walking program, we paired weekly walks with a F&V prescription called "veggie scripts". A total of 277 adults (mean age 64 years, 86% female, and 75% African-American) participated in WWE. Currently, the program is implemented in 17 sites in the Dallas area, 7 sites have completed WWE (N = 152) and 10 sites are currently active. Participants from two sites received \$15 veggie script vouchers redeemable at community farm stands. WWE consisted of a weekly walking group and self-directed learning module for 6 weeks. A community health worker (CHW) leads the weekly walking groups at each site. Participants complete a pre and post-survey that collects demographics, comorbid conditions, and walking habits. Weekly minutes of walking are self-reported each week.

RESULTS: On average, participants reported a total of 112.7 minutes of walking per week. The majority of the participants (54%) attended three or more weekly group walks and 22.3% attended all six walks. Participants who received veggie prescriptions ($n = 25$) were slightly more active than those who did not (122.2 minutes vs. 110.8 minutes per week). Additionally, veggie script recipients were more likely to attend three or more weekly walking sessions than their counterparts (64% vs. 52%). **CONCLUSIONS:** The data offers a novel approach to community health: that possibly offering fruits and vegetables incentives may increase physical activity

participation. This approach may improve dose of WWE delivered in low-income, African American communities, while simultaneously encouraging better dietary habits.

1578 Board #172 May 28 10:30 AM - 12:00 PM
Differences Between Predicted And Measured VO_2 During Level And Uphill Walking

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Walking is a popular choice of exercise in many populations. It is especially utilized in older populations and those recovering from cardiovascular injuries. The ACSM equations are a resource for clinicians to use as a way to estimate intensity levels using VO_2 or MET as the outcome measure. The accuracy of these calculations are important to ensure those individuals are working at the prescribed intensity level. The equations allow for a more rapid and cost effective way to measure intensity level than expensive and cumbersome equipment. **Purpose:** The purpose of this study was to compare the predicted and measured $\text{VO}_{2\max}$ a population of untrained college age individuals. **Methods:** 21 healthy untrained college age individuals with an average BMI of 29.1 kg/m², completed 3 x 3 minute treadmill walking tasks. These consisted of walking at 1.5 m/s at both level and a 5% incline and then an incline of 5% at an iso efficient pace compared to the level 1.5 m/s. Iso efficient pace was calculated using the ACSM equations and individual correction factors. **Results:** During level walking, the measured VO_2 (14.4±1.1 mlO₂/kg/min) was 14.5% greater (p<0.001) than predicted (12.5 mlO₂/kg/min) from the ACSM walking equation. All 21 of the participants measured values were greater than predicted by the equation. During the 5% incline at iso efficient pace, participants walked at an average velocity of 1.1±0.025 m/s, and the measured VO_2 (15.3±1.2 mlO₂/kg/min) was 7% different (p=0.001) than predicted (16.1±0.3 mlO₂/kg/min) from the ACSM equation. Of the 21 participants, 16 of them had measured VO_2 values that were smaller than predicted. During the 5% incline at the pace of 1.5 m/s, measured VO_2 (19.9±1.2 mlO₂/kg/min) was 5.7% different (p=0.01) than predicted (20.6 mlO₂/kg/min). Seventeen of the participants had measured values that were less than the predicted value. **Conclusion:** For a group of untrained college age individuals with BMI on the edge of the overweight/obese range, the ACSM equations fail to capture the measured values of oxygen consumption. Clinicians and researchers who are using this equation as a prescription for exercise should be cautious when using these equations to calculate exercise intensity.

C-42 Free Communication/Poster - Physical Activity and Health

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

1579 Board #173 May 28 10:30 AM - 12:00 PM
CONTINUOUS METABOLIC SYNDROME SCORE AND PHYSICAL ACTIVITY AMONG METABOLIC SYNDROME POSITIVE INDIVIDUALS

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(No relevant relationships reported)

Metabolic syndrome (MetS) is a clustering of cardiometabolic factors increasing risk of morbidity and mortality. Traditionally, MetS is assessed dichotomously; however, new techniques allow for consideration of the severity of MetS using gender- and race-specific, continuous z-scores. **Purpose:** This study aimed to identify how self-reported daily minutes of physical activity (PA) by intensity (sedentary, moderate, and vigorous) predicted degree of severity of MetS among MetS positive individuals (12 to 80-years-old). **Methods:** Using 2015-2016 National Health and Nutritional Examination Surveys data, individuals with no missing cardiometabolic data were classified as MetS positive using ATP III criteria (obesity, dyslipidemia, dysglycemia, and hypertension). Subsequently, MetS z-scores were derived for each individual (n=708). Due to limited variability of the MetS z-score, tertiles (Lower: -1.95 to 0.76, Middle: 0.77 to 1.38, and Upper: 1.39 to 7.32) were created to increase predictive ability of PA. Differences in daily minutes of PA between MetS tertiles were determined with an ANOVA and linear regression was utilized to predict the severity of MetS with PA. **Results:** The middle tertile (n=234) reported the most sedentary time (381.41±212.18 minutes; p=0.287) and vigorous PA (11.04±35.03 minutes; p=0.374). The lower tertile (n=237) reported the greatest amounts of moderate PA (26.71±52.69 minutes; p=0.128). However, no significant differences between tertiles

were observed. The linear regression revealed PA intensity was not a significant predictor of MetS z-score tertile. **CONCLUSIONS:** Overall, PA, as reported in total daily minutes, did not differ between MetS z-score tertiles nor did it predict severity of MetS. This may be due to PA being self-reported and/or the exclusion of non-MetS individuals. Future research may be able to elucidate a relation using a more sensitive, objective measure of PA to better understand its relation with MetS.

1580 Board #174 May 28 10:30 AM - 12:00 PM
Abstract Withdrawn

1581 Board #175 May 28 10:30 AM - 12:00 PM
UNDERSTANDING PHYSICAL ACTIVITY BEHAVIOUR IN CANADIANS LIVING WITH CHRONIC DISEASE: A RETROSPECTIVE COHORT STUDY

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(No relevant relationships reported)

Regular physical activity (PA) can reduce the incidence of many chronic diseases. Rural-dwelling Canadians are at a higher risk of developing chronic diseases than their urban counterparts – potentially due to higher rates of inactivity. There is a scarcity of literature describing PA in these high-risk groups. Smartphones and mHealth apps such as Carrot Rewards (reward-based app downloaded by 1.3+ million Canadians) provide a unique opportunity to measure free-living PA amongst Canadians living with chronic disease. **Purpose:** To determine (1) daily step count averages (data collected by Carrot Rewards) for participants who self-report at least one chronic disease vs. those self-reporting none, and (2) whether these averages vary with living environment. **Methods:** In this retrospective cohort study, 12,327 Ontarians (age: M=34.72, SD=13.63, gender: female 62.9%, male 35.3%, other 1.8%), completed a 'chronic disease' Carrot Rewards survey adapted from the Canadian Community Health Survey. In this survey, participants could self-report chronic disease diagnoses including: diabetes, cardiovascular disease, chronic obstructive pulmonary disease, cancer and mood/anxiety disorders. Smartphone accelerometers, (HealthKit (iOS), Google Fit (Android) or FitBit) collected step count data which was retrieved by the Carrot Rewards app. Self-reported demographic information indicated participant rural/urban status. **Results:** 37.7% of survey respondents reported being diagnosed with at least one chronic disease and 33% identified as rural-dwelling. Participants with at least one chronic disease had a significantly lower (p<.001) daily step count average (M=5136.29, SD=3732.83) than those with no diagnosis (M=5724.24, SD=3960.47). Rural-dwelling persons (M=5422.40, SD=3943.49) had lower mean daily step count averages than their urban counterparts (M=5542.61, SD=3858.32), though not statistically significant (p=.123). **Conclusions:** This study provides an objective lens into the PA behaviours of understudied Canadian populations. Individuals living with chronic disease had significantly lower daily step counts when compared to their 'healthy' counterparts. A fundamental understanding of PA behaviours for at-risk Canadians may help inform the design of targeted PA interventions in the future.

1582 Board #176 May 28 10:30 AM - 12:00 PM
The Independent And Joint Associations Of Fitness And Fatness With Incident Prediabetes In Women: A Cohort Study

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(No relevant relationships reported)

Purpose: The purpose of this study was to examine the associations of cardiorespiratory fitness (CRF), general adiposity (i.e., body mass index; BMI) and central adiposity (i.e., waist-to-height ratio, WHtR) with risks of incident prediabetes in women. **Methods:** A prospective cohort of 1534 women aged 20-79 years old who had an annual health check-up with no history of major chronic diseases at baseline between 1979 and 2005 were observed in the Cooper Clinic, TX, USA. Cox proportional hazards models were established to assess the association between fitness and fatness and incident prediabetes defined as fasting glucose 100-125 mg/dL. Independent and joint analyses were conducted for CRF (fit - upper 75% vs. unfit - lower 25%), BMI (<25 kg/m² vs. ≥25 kg/m²), and WHtR (<0.50 vs. ≥0.50), while adjusting for confounding variables. **Results:** Overall, 18.1% of the women developed prediabetes during an average follow-up of 5.06 years. CRF, BMI, and WHtR were significantly associated with incident prediabetes in age-adjusted Cox proportional hazard models. When explanatory and confounding variables were considered simultaneously in fully adjusted multivariable models, only those who were unfit remained at risk (HR = 1.39, 95% CI = 1.02, 1.90). Joint analysis revealed a

higher risk for those in the unfit/BMI < 25 (HR = 1.54 CI = 1.07, 2.20) and unfit/WHtR < .50 (HR = 1.48, 95% CI 0.6, 2.08) categories. Being unfit did not further increase the risk of incident prediabetes in those with higher levels of general or central adiposity.

CONCLUSIONS: Fitness not fatness was associated with incident prediabetes in women. Public health efforts should especially emphasize promoting exercise and physical activity to improve CRF for the prevention of prediabetes in women.

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1583 Board #177 May 28 10:30 AM - 12:00 PM
Accuracy Of Classifying Prediabetes Predicted By Grip Strength In Obese Adults Utilizing Machine Learning

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PURPOSE: To compare the accuracy of classifying prediabetes, include type 2 diabetes, predicted by hand-grip strength employing machine learning (ML) techniques in Korean obese adults.

METHODS: The data of 1230 Korean obese adults (51.5% males, 19-65yrs) was retrieved from the Korean National Health and Nutrition Examination Survey (KNHANES) 2014-2015. Obesity was identified by the Korean standard BMI (BMI \geq 25kg/m²) and waist circumference (WC; Male: WC \geq 90cm, Female: WC \geq 85cm). A total of 591 individuals with prediabetes and type 2 diabetes was diagnosed by the criteria 1) diagnosed as type 2 diabetes, 2) using diabetes medication, 3) abnormal fasting glucose level (fasting glucose \geq 100mg/dL). Three grip strength models were employed, which were 1) normal grip strength (GS), 2) divided by weight (GSW), and 3) divided by BMI (GSB), respectively, to examine the effect of different relative grip strengths on prediabetes. Multilayer perceptron (MLP) and traditional logistic regression (LR) algorithms employing RSNNS package in R, were applied to classify the prediabetes predicted by hand-grip strength by age, income, education, occupation, marital status, binge drinking, smoking, daily calories intake, sedentary time, strengthening exercise adherence, aerobic exercise adherence variables, separated by gender. To evaluate the accuracy (ACC), sensitivity (SEN), and specificity (SPE) of the confusion matrix of ML, the participants were separated into a train for deriving equations and a test group for holdout cross-validation.

RESULTS: To classify prediabetes in obese males, GSB adjusted by co-variables was revealed the highest ACC for both ML classifiers (train group: MLP=71.5%, LR=67.6%; test group: MLP=63.9%, LR=66.1%), and GSW showed the lowest ACC (MLP: train=67.6%, test=61.6%). Moreover, GSW and GSB of MLP showed higher SEN than SPE in test group (SEN, SPE: GSW=78.6%, 44.1%; GSB=74.4%, 52.5%, respectively). In obese females, however, both ML classifiers did not show any consistent accuracy levels.

CONCLUSIONS: It was revealed that GSB showed a strong relationship with prediabetes in obese male adults in Korea. Moreover, MLP and LR classifiers present fair accuracy in the cross-validation to classify prediabetes predicted by GSB.

1584 Board #178 May 28 10:30 AM - 12:00 PM
Daily Step Count And Prevalence Of Perceived Occupational Stress: A Cross-sectional Study Among Japanese Workers

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 (No relevant relationships reported)

PURPOSE: We conducted a cross-sectional study to investigate the relationship between daily step counts and the prevalence of perceived occupational stress among Japanese workers.

METHODS: Participants were 4,768 Japanese men [median (inter quartile range) age 45 (36–56) years] and 1,137 women [median (inter quartile range) age 42 (33–50) years] who completed a self-administered questionnaire on their health habits, including daily step counts (<6,000 steps/day, 6,000–7,999 steps/day, 8,000–9,999 steps/day, and \geq 10,000 steps/day) in 2017. Participants were classified into 4 groups based on their daily step counts. The prevalence of perceived occupational stress was obtained using the Brief Job Stress Questionnaire. Multivariable-adjusted odds ratios and 95% confidence intervals for the prevalence of occupational stress were obtained using logistic regression models while adjusting for age (continuous variable), sex (men, women), smoking (current-smoker, former-smoker, and never-smoker), drinking (never, < 3 times/week, 3–5 times/week, and \geq 6 times/week), sleep time (\geq 6 hour and < 6 hour), and some non-communicable diseases (yes, no).

RESULTS: 999 participants had perceived occupational stress. Using the lowest daily step count group (<6,000 steps/day) as reference the multivariable-odds ratios and 95% confidence intervals were 0.77 (0.63–0.94) for 6,000–7,999 steps/day group, 0.91 (0.70–1.18) for 8,000–9,999 steps/day group, and 0.94 (0.69–1.29) for \geq 10,000 steps/day group, respectively.

CONCLUSIONS: In this cross-sectional analysis, the results suggest that there is a J-curve relationship between daily step counts and the prevalence of perceived occupational stress among Japanese workers.

1585 Board #179 May 28 10:30 AM - 12:00 PM
A Prospective Cohort Study Of Physical Fitness And Incident Hearing Loss: The Niigata Wellness Study

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 (No relevant relationships reported)

There is limited evidence examining the association between physical fitness and hearing loss. Although the precise mechanisms are not fully understood, it may include beneficial changes to cochlear blood circulation, central nervous system, and oxidative stress.

PURPOSE: To investigate the association between muscular and performance fitness (MPF) and the incidence of hearing loss among Japanese people in the Niigata Wellness Study.

METHODS: Participants included 21,907 people (13,992 men [median (interquartile range) age 49 (43-54) years] free of hearing loss who underwent physical fitness tests in 2001. MPF index was calculated using a summed z-score by sex and age from grip strength, vertical jump, single-leg balance with eyes closed, forward bending, and whole-body reaction time. The participants were divided into quartiles according to the MPF index and each physical fitness test. During 2002-2007, participants were followed for development of hearing loss, which was defined as > 30 dB at 1 kHz and/or > 40 dB at 4 kHz in the worse ear on pure-tone audiometry. Hazard ratios (HRs) and 95% confidence intervals (95% CIs) for the incidence of hearing loss were estimated using Cox proportional hazards models after adjusting for age, age², sex, body mass index, cigarette smoking, alcohol intake, hypertension, dyslipidemia, and diabetes.

RESULTS: During the follow-up, 2,765 participants developed hearing loss. The HRs (95% CIs) for developing hearing loss across quartiles of MPF index (lowest to highest) were 1.00 (reference), 0.88 (0.79-0.97), 0.83 (0.75-0.93), and 0.79 (0.71-0.88) (*P* for trend < 0.001). Vertical jump, single-leg balance, and whole-body reaction time were significantly inversely associated with incident hearing loss (*P* for trend < 0.001, < 0.001, and 0.043, respectively).

CONCLUSIONS: MPF may be associated with lower risk of incident hearing loss. Further studies are required to consider other confounding factors such as noise exposure.

1586 Board #180 May 28 10:30 AM - 12:00 PM
Association Among Length Of Residence, Physical Activity, And Obesity In Us Immigrants

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 (No relevant relationships reported)

PURPOSE: The proportion of immigrants in the US population continues to grow. The failure of adaptation to a new culture has negative effects on lifestyle behaviors, thereby leading to increased risk of obesity. Physical activity (PA), particularly, may function as a mediator of the relationship between length of residence and obesity. The purpose of this study was to examine whether objectively measured PA mediated the length of residence-obesity association among US immigrants. **METHODS:** Data from the 2003 to 2006 National Health and Nutrition Examination Survey (NHANES) was used for this study. Participants (\geq 18 years) who were born outside the US were included in this analysis (n = 989). The participants were categorized into two groups (e.g., living in US more than 10 years vs. less than 10 years). PA time was measured by Actigraph accelerometer. Valid days in PA were defined as the device being worn for at least 10 hours and a minimum of 4 days, which included at least one weekend day. Obesity was defined as body fat percentage measured by dual-energy X-ray absorptiometry. Mediation analysis was used to test whether PA mediated the

relationship between the length of residence and obesity based on Baron and Kenny's (1986) approach. All statistical analyses were conducted using SURVEY procedures in SAS version 9.4 to account for the complex-sampling design of the NHANES.

RESULTS: Participants with living in the US for more than 10 years were significantly more likely to be at high risk of obesity ($\beta = 3.01, p < .001$), and less likely to spend time participating in PA ($\beta = -6.6, p < .05$), compared to those who living in the US for less than 10 years. Also, the relationship between PA and obesity was significant ($\beta = -.07, p < .001$). Length of residence indirectly affected obesity ($\beta = 0.47, p < .05$), further supporting partial mediation effect of PA ($\beta = 2.54, p < .001$).

CONCLUSIONS: These findings may encourage long-term immigrants to participate in PA for lowering the risk of obesity.

**1587 Board #181 May 28 10:30 AM - 12:00 PM
Physical Activity In The Early Postpartum Period In Primiparous Women**

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Purpose: Little is known about physical activity (PA) during the early (≤ 6 weeks) postpartum period. Therefore, the purpose of this study was: 1) to describe the amount and types of PA done during early postpartum, and 2) to compare minutes/day of moderate-vigorous PA (MVPA) at 12-25 days (T1) and 33-46 days (T2) postpartum. **Methods:** Participants were primiparous women that delivered vaginally. The amount and types of PA women did was measured using wrist-accelerometry (≥ 4 days) and completing an activity checklist (N (%)) by questionnaire at T1 and T2. Median (IQR) was calculated for minutes/day of light, moderate, and vigorous PA and MVPA at T1 and T2. PA data reflect total minutes and 5- and 10-minute bouts. The Wilcoxon Signed Rank test was used to compare daily minutes of MVPA in women at T1 and T2. **Results:** 577 of 645 eligible women after delivery (age: 28.3 (SD: 5.1)) with valid accelerometry at either T1 or T2 provided descriptive data and 405 (age: 28.7 (SD: 5)) with valid accelerometry at both T1 and T2 provided comparison data. Median (IQR) daily total minutes for light, moderate, vigorous and MVPA at T1 were 295.6 (256.3-331.8), 54.3 (39.4-72.4), 0.4 (0.2-0.8), and 55.1 (40-74.1), respectively, and at T2, were 327.3 (287.6-368.7), 63.1 (45.4-81.9), 0.6 (0.3-1.3), and 64.4 (45.7-83.7), respectively. Median (IQR) minutes/day of MVPA in 5- and 10-minute bouts were 1.6 (0-5.4) and 0 (0-3.7) at T1 and 2.6 (0-8.6) and 0 (0-5.2) at T2. At T1, 75% (406/541) and at T2, 72.4% (397/548) of women reported doing non-impact activities. Less than 4% of women at T1 and 13% of women at T2 reported doing activities with impact or straining. Amongst women with valid accelerometry data at both T1 and T2, minutes/day of MVPA was greater at T2 than T1 by all methods of reporting ($p < 0.001$ for all): total: median (IQR) = 64.7 (47-84.6) vs 56.5 (41-75) minutes; 5-minute bouts: median (IQR) 3 (0-9.8) vs 1.7 (0-5.6) minutes; and 10-minute bouts: 1.3 (0-6) vs 0 (0-3.8) minutes. **Conclusion:** Early postpartum women are active based upon total minutes of MVPA, but sustained MVPA in bouts was consistently low. Significant increases in MVPA from T1 to T2 were small and few postpartum women reported doing activities with impact or straining. Women may experience challenges when returning to sustained and/or higher intensity activities during postpartum.

**1588 Board #182 May 28 10:30 AM - 12:00 PM
Discordance Between Ldl Cholesterol Versus Particle Concentration And The Cardiovascular Risk Factor Profile**

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Although low-density lipoprotein cholesterol (LDL-C) levels have been associated with cardiovascular disease (CVD) risk, subjects with well controlled LDL-C are still at considerable residual risk for CVD. Alternative measures such as particle concentration of LDL (LDL-P) may be clinically useful for fully characterizing LDL associated risk.

PURPOSE: To compare CVD risk factor profiles among groups of people with discordant levels of LDL-C versus LDL-P concentration in the HERITAGE Family Study.

METHODS: Standard lipid panels and lipoprotein subclass profiles via nuclear magnetic resonance (NMR) spectroscopy were measured among 715 participants (34% Black, 55% Female). LDL-C and LDL-P values \geq the median value were considered high and values $<$ median were considered low. Four exclusive LDL-C/LDL-P groups were identified for LDL from these base categories: 1) low/low ($<$ median for both LDL-C and LDL-P), 2) low/high ($<$ median for LDL-C, \geq median for LDL-P), 3) high/low, and 4) high/high. Cross-sectional associations between baseline LDL discordance group and CVD risk factors were assessed via multivariable linear regression. All models were adjusted for age, race, and sex.

RESULTS: Sixty four (9.0%) participants were discordant with high LDL-C/low LDL-P, while 61 (8.5%) were discordant with low LDL-C/high LDL-P. Both concordant groups (low LDL-C/low LDL-P, high LDL-C/high LDL-P) were composed of 295 participants each (41.3%). Main effects ($p < 0.05$) of LDL discordant group were found for the following outcomes: triglycerides, HDL-C, HDL-P size and small and large HDL-P concentration, percent body fat, maximal oxygen uptake, fasting insulin, lipoprotein lipase activity, testosterone, GlycA, and C-reactive protein. In general, groups with lower LDL-P had more favorable CVD risk factor profiles relative to high LDL-P groups. **CONCLUSIONS:** In general, low LDL-P levels were associated with favorable CVD risk factor profiles regardless of LDL-C levels.

Table 1. CVD risk factor profiles among participants with discordant/concordant levels of LDL-C compared to LDL-P

	Low LDL-C/ Low LDL-P N=295 (41.3%)	Low LDL-C/ High LDL-P N=61 (8.5%)	High LDL-C/ Low LDL-P N=64 (9.0%)	High LDL-C/ High LDL-P N=295 (41.3%)	P-value
Demographics					
% Male	39.32	54.10	25.00	53.22	<.0001
% White	64.07	50.82	54.69	72.54	0.0012
Cholesterol Measurements, (mg/dL)					
Triglycerides	90.32 (3.58) ^{bd}	138.48 (7.29) ^{bc}	84.17 (7.21) ^{cd}	128.91 (3.5877) ^{bc}	<.0001
HDL-C	42.26 (0.60) ^a	36.00 (1.23) ^{ac}	45.76 (1.21) ^a	38.48 (0.60) ^{bc}	<.0001
LDL-C	87.40 (1.08) ^a	103.37 (2.20) ^a	122.79 (2.18) ^a	140.34 (1.08) ^a	<.0001
Lipoprotein Particle Size (nm)					
HDL-P size	9.30 (0.03) ^a	8.94 (0.05) ^{bc}	9.44 (0.05) ^a	8.95 (0.03) ^{bc}	<.0001
LDL-P size	20.86 (0.03) ^{bc}	20.52 (0.07) ^a	21.37 (0.07) ^a	20.86 (0.03) ^{bc}	<.0001
Lipoprotein particle concentrations (HDL: μmol/L; LDL: nmol/L)					
HDL-P	29.14 (0.30)	30.56 (0.61)	29.16 (0.60)	29.34 (0.30)	0.209
Small HDL-P	14.68 (0.25) ^{bd}	16.55 (0.52) ^{ac}	13.62 (0.51) ^{cd}	15.76 (0.26) ^{bc}	<.0001
Medium HDL-P	9.20 (0.28)	10.36 (0.57)	9.65 (0.56)	9.78 (0.28)	0.2396
Large HDL-P	5.26 (0.13) ^a	3.64 (0.27) ^{bc}	5.90 (0.27) ^a	3.81 (0.13) ^{bc}	<.0001
LDL-P	711.40 (11.23) ^a	1078.00 (22.91) ^a	850.02 (22.66) ^a	1256.42 (11.27) ^a	<.0001
Small LDL-P	379.51 (13.76) ^a	671.51 (28.07) ^a	311.12 (27.77) ^a	663.04 (13.81) ^{bc}	<.0001
Large LDL-P	230.63 (9.69) ^a	274.63 (19.77) ^a	383.85 (19.56) ^{ab}	409.25 (9.73) ^{ab}	<.0001
Anthropometrics					
BMI (kg/m ²)	25.14 (0.30) ^{bd}	28.47 (0.60) ^{ac}	25.87 (0.60) ^{bd}	28.47 (0.30) ^{bc}	<.0001
Body Fat (%)	25.30 (0.50) ^{bd}	30.48 (1.06) ^{ac}	26.19 (1.04) ^{bd}	30.78 (0.50) ^{bc}	<.0001
Cardiorespiratory Fitness (ml/kg/min)					
$\dot{V}O_{2max}$	32.61 (0.33) ^{bd}	30.10 (0.68) ^a	31.84 (0.67) ^a	29.15 (0.33) ^{bc}	<.0001
Blood Pressure (mmHg)					
Systolic blood pressure	120.22 (0.68)	120.66 (1.38)	117.98 (1.38)	120.93 (0.68)	0.2815
Diastolic blood pressure	69.33 (0.47)	69.49 (0.95)	69.15 (0.96)	70.25 (0.47)	0.5056
Carbohydrate/Lipid Metabolism					
Glucose (mmol/L)	5.06 (0.05)	5.26 (0.11)	5.06 (0.11)	5.08 (0.06)	0.4429
Insulin (pmol/L)	66.00 (3.18) ^{bd}	86.33 (6.42) ^{ac}	60.43 (6.35) ^{cd}	81.74 (3.18) ^{bc}	0.0002
Hepatic Lipase (nmol/mL/min)	186.46 (3.89)	187.42 (7.84)	184.67 (8.01)	182.19 (3.93)	0.87
Lipoprotein Lipase (nmol/mL/min)	60.65 (1.92) ^a	56.69 (3.87) ^a	76.48 (3.95) ^a	63.09 (1.94) ^a	0.0014
Sex Hormones (nmol/L)					
Progesterone	1.63 (0.12)	2.26 (0.25)	1.68 (0.25)	1.50 (0.12)	0.0544
Testosterone	8.99 (0.24) ^{bd}	7.05 (0.49) ^{ac}	8.78 (0.49) ^{bd}	7.60 (0.24) ^{bc}	<.0001
Inflammatory Markers					
GlycA (μ mol/L)	309.18 (3.25) ^{bd}	349.48 (6.62) ^{ac}	309.21 (6.55) ^{bd}	341.04 (3.27) ^{bc}	<.0001
C-Reactive Protein (mg/dL)	0.21 (0.03) ^{bd}	0.43 (0.06) ^{ac}	0.25 (0.06) ^{bd}	0.34 (0.03) ^{bc}	0.0011

^a P<0.05 between low HDL-C/low HDL-P, ^b P<0.05 between low HDL-C/high HDL-P, ^c P<0.05 between high HDL-C/low HDL-P, ^d P<0.05 between high HDL-C/high HDL-P. * P<0.05 between all other groups

**1589 Board #183 May 28 10:30 AM - 12:00 PM
Changes In Health Behaviors And Anxiety Prevalence Among College Students: 2012-2017**

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College presents unique challenges, including independent development and control of healthy behaviors (ie. nutritious diet, physical activity (PA), and mental health practices). **PURPOSE:** To evaluate relationships among these variables and changes in these variables over the course of two repeated administrations of the National College Health Association (NCHA) survey at a mid-sized Southern university.

METHODS: Data were combined from two administration of the NCHA campus survey (2012 (n = 798) and 2017 (n = 402)). No individual student identifiers were collected. It is unlikely that any student participated in both years given the five year spacing between administrations. Moderate (Mod), vigorous (Vig), and strength training exercise (ST); fruit and vegetable (F&V) consumption; and anxiety within the last year were self-reported. From the exercise questions, students were classified as meeting the PA guidelines or not. Descriptive statistics, Chi-Square analyses and Odds Ratios with 95% Confidence Intervals (CI) were calculated for changes from 2012 to 2017 and for Anxiety based on PA.

RESULTS: Students were at lesser odds of reporting 3+ servings of F&V per day in 2017 (20.1%) than in 2012 (31.7%) (OR: 0.54, CI: 0.41-0.72). Days of Mod PA (past 7 days, 30 minutes) did not change significantly, but there were decreases in Vig PA (past 7 days, 20 minutes) and ST. Students were at lesser odds of reporting 3+ days of Vig PA in 2017 (23.8%) than in 2012 (35.1%) (OR: 0.58, CI: 0.44 - 0.76). Students were at lesser odds of reporting 3+ days of ST in 2017 (20.8%) than in 2012 (29.8%) (OR: 0.62, CI: 0.47-0.82). Students were also at lesser odds of meeting the PA guidelines as a whole in 2017 (39.8%) than in 2012 (51.8%) (OR: 0.61, CI: 0.48-0.78). Students were at greater odds to report “overwhelming anxiety” in the last month in 2017 (50.4%) than in 2012 (39.4%) (OR: 0.56, CI: 1.2-2.0). In both surveys, there were significantly lower odds of Anxiety in the last month for students who met the PA guidelines compared to those who did not. This protective effect was stronger in 2017 (OR: 0.50, CI: 0.33 - 0.74) than in 2012 (OR: 0.71, CI: 0.53 - 0.94).

CONCLUSIONS: Decreases in PA and increases in Anxiety are concerning. Future work is needed to determine whether there is a causal relationship between these variables.

1590 Board #184 May 28 10:30 AM - 12:00 PM
Associations Of Objectively-measured Floor Climbing With Type 2 Diabetes

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Purpose: Self-reported floor climbing (FC) significantly predicts major health outcomes, including mortality. There are no data on objectively-measured FC, independent of total physical activity, with health outcomes in older adults. We examined the associations between FC and the prevalence of type 2 diabetes mellitus (DM) in older adults. **Methods:** This cross-sectional study included 488 older adults (56% women; mean age 72 years) who were without heart attack, stroke, or cancer in the past 5 years. FC was assessed with an accelerometer (FitBit Charge 2) worn on the non-dominant wrist for seven days. Average daily steps were assessed using a pedometer (Omron HJ-321). Participants were categorized into tertiles of FC or steps. For a joint analysis, participants were dichotomized into low (lower FC tertile) or high climbers (middle/upper FC tertiles) and inactive (lower step tertile) or active (middle/upper step tertiles). DM was defined by self-report, fasting glucose ≥ 126 mg/dL, or taking insulin. Logistic regression was used to calculate the odds ratios (ORs) and 95% confidence intervals (CIs) of DM while adjusting for sex, age, smoking, heavy alcohol consumption, percent body fat, hypertension, hypercholesterolemia, and FC or steps in respective analyses. **Results:** Of the 488 adults, there were 47 (10%) DM cases. Compared with the lower FC tertile, the ORs (95% CIs) of having DM were 0.42 (0.18–0.94) and 0.31 (0.11–0.87) for the middle and upper FC tertiles, respectively, after adjusting for the full model including steps/day. Compared with the lower step tertile, the ORs (95% CIs) of having DM were 0.45 (0.20–0.99) and 0.47 (0.19–1.20) for the middle and upper step tertiles, respectively, after adjusting for the full model including FC. In a joint analysis, compared with the inactive and low climbers, the ORs (95% CIs) were 0.38 (0.15–0.97), 0.33 (0.11–0.94), and 0.16 (0.07–0.38) for the active and low climbers, inactive and high climbers, and active and high climbers, respectively.

Conclusions: Objectively-measured FC was associated with reduced odds of DM, regardless of daily physical activity. However, the joint analysis indicated the lowest odds of DM were among those who climbed ≥ 4 floors per day (high climbers) and walked $\geq 4,000$ steps/day (active).

1591 Board #185 May 28 10:30 AM - 12:00 PM
Abstract Withdrawn

1592 Board #186 May 28 10:30 AM - 12:00 PM
Relationship Between Cardiorespiratory Fitness Level And Hypertension In Japanese Olympic Athletes In Tokyo 1964; A Cohort Study.

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INTRODUCTION: Few cohort studies have assessed the relationship between cardiorespiratory fitness and incidence of hypertension among top athletes.

PURPOSE: To examine the relationship between cardiorespiratory fitness level

and the incidence of hypertension in Japanese Olympic athletes in Tokyo 1964.

METHODS: This was a retrospective cohort study of Japanese Olympic athletes. The participants were 156 Olympic athletes who took physical fitness tests in 1964 and followed up until 2016. A cardiorespiratory fitness level was evaluated by the Harvard Step Test (tertile). We determined the incidence of hypertension in self-reported questionnaires in 2005, 2008, 2012 and 2016. Odds ratios and 95% confidence intervals (95%CI) for the incidence of hypertension were obtained using logistic regression models while adjusting for age, sex, and body mass index. In addition, a trend test was conducted to examine the relationship between cardiorespiratory fitness level and hypertension. **RESULTS:** There were 156 participants (135 men, 21 women) with a median age of 23 years old (range: 15-33 years) in 1964. During the follow-up period, 68 participants developed hypertension. Using the lowest cardiorespiratory fitness (1st tertile) group as a reference, odds ratios and 95% CIs for the 2nd and 3rd tertiles were 0.75 (0.34-1.67) and 0.59 (0.27-1.31), respectively (p for trend = 0.19). **CONCLUSION:** These results suggest that a low cardiorespiratory fitness level is a risk factor for the incidence of hypertension in Japanese Olympic Athletes.

1593 Board #187 May 28 10:30 AM - 12:00 PM
Pre-participation Evaluations And The Relative Risk Of Injuries In Ugandan Sports

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PURPOSE: The aim of this study was to examine the relative risk of sports injuries based on pre-participation evaluation among Uganda athletes. **METHODS:** This cohort included 546 athletes, ≥ 18 years old, who were free from injury at the beginning of the study. This investigation focused on the relative risk of injuries from 4 main sports (football/soccer n= 161, track and field, n= 106, basketball, n = 120 and rugby, n= 159). **RESULTS:** After a one year follow up, seventy- five lost-time injuries (n= 75) in both male and female athletes who sustained abrasions, concussion, contusion, dislocations, laceration, fainting, fractures, sprains and strain injuries were reported. There was an increased risk of sports injuries among athletes who didn't undergo pre-participation evaluation compared to those who did. The relative risk for sports injuries in athletes without pre-participation evaluation was greater in rugby (relative risk, 21.8, 95% CI, 13.6 - 33.88), followed by football/soccer (relative risk, 21.6, 95% CI, 3.1 - 33.78), followed by track and field (relative risk, 14.1, 95% CI, 9.0-23.17) and basketball (relative risk, 12.2, 95% CI, 7.56 to 19.63). **CONCLUSION:** Pre-participation evaluation is an important risk factor in sports injury acquisition. Our findings reveal gaps in practice among personnel involved in the prevention of sports-related injuries in Uganda, thus warranting specific sports regulations.

1594 Board #188 May 28 10:30 AM - 12:00 PM
Translating The Moderate-to-vigorous Physical Activity Recommendation To Steps Per Day: Influence Of The Cut-point Method

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The Organization recommends adolescents to engage in at least 60 minutes/day in moderate to vigorous physical activity (MVPA). However, this recommendation is not easily understood by both adolescents and their parents. Although a more practical steps/day recommendation is available, empirical studies examining total daily steps translation of the MVPA recommendation in adolescents are scarce and inconsistent, offering a wide range from 7,500 to 14,000 steps/day. Variation between instruments, methods, and statistical considerations may also contribute to the variability in daily steps thresholds. To our knowledge there are not previous studies examining the influence of the optical cut-point method to translate MVPA recommendation into steps/day. **PURPOSE:** To examine the influence of the optical cut-point method on the translation of the 60 minutes of MVPA recommendation to steps/day in adolescents. **METHODS:** 126 Chilean adolescents (70 males and 56 females) aged 12-15 years old wore ActiGraph GT3X accelerometers for eight consecutive days. Activity counts/min $\geq 2,296$ were used to determine MVPA. ROC analyses (daily MVPA as reference standard: < 60 min/day and ≥ 60 min/day; and daily total steps as index test) with the 34 available optical cut-point methods were performed using the web-tool easyROC version 1.3.1. **RESULTS:** A small percentage (10.3%) of adolescent participants achieved ≥ 60 min/day of MVPA. ROC analyses showed an excellent accuracy (AUC = 0.95, 0.90-1.00) for translating the MVPA recommendation to steps per day. The daily

step-based recommendation greatly varied between the 34 examined optical cut-point methods (mean = 10,318; median = 9,898; minimum = 3,262; maximum = 14,899; $P_{25} = 8,656$; $P_{75} = 13,581$). **CONCLUSION:** The optical cut-off methods to determine the optimal steps/day cut-point threshold based on current MVPA recommendation for adolescents may drastically affect the step-based recommendation. Further studies should examine the daily step-based thresholds adopting the best evidence-based decisions regarding the optical cut-point method.

1595 Board #189 May 28 10:30 AM - 12:00 PM

Effectiveness Of Virtual Reality On Individuals' Physiological, Psychological, And Rehabilitative Outcomes: A Systematic Review

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PURPOSE: Considering the benefits of VR-based exercise on sports and health compared to traditional exercise alone, this review synthesized the literature examining the effects of VR-based exercise on physiological, psychological, and rehabilitative outcomes in various populations. **METHODS:** Hundreds of articles were retrieved using key words such as "VR", "exercise intervention", "physiological", "psychology", and "rehabilitation" through multiple databases including Google Scholar, Academic Search Premier, and PubMed. Articles which met the following criteria were included in the review: (1) peer-reviewed; (2) published in English; (3) randomized controlled trials (RCTs) or controlled trials; (4) interventions using VR devices; and (5) examined effects on physiology, psychology, and/or rehabilitation. Descriptive and thematic analyses were used. **RESULTS:** In total, 14 studies (10 RCTs, 4 controlled trials) met the criteria across various ages. Most articles observed a cross-influence on physiological, psychological, and rehabilitative outcomes. Of the 11 articles examining physiology, 63.6% showed a positive effect on physical fitness, muscle strength, balance, and extremity function. Only four articles examined the effects on psychological outcomes, 75% of which showed positive effects such that VR exercise could ease fatigue, tension, and depression, induce calmness, and enhance quality of life. Eight articles investigated the effects of VR-based exercise on rehabilitative outcomes with physiological and/or psychological outcomes, 62.5% of which showed significant positive changes. In detail, patients who suffered from chronic stroke, hemodialysis, spinal-cord injury, cerebral palsy in early ages, and cognitive decline usually saw better improvements using VR-based exercise. **CONCLUSIONS:** Findings suggested VR exercise has potential to exert positive impact on individuals' physiological, psychological, and rehabilitative outcomes compared with traditional exercise. However, the quality, quantity, and sample size of existing studies are far from ideal. Therefore, more rigorous studies are needed to confirm the positive effect and more efforts should be made on this aspect in future studies.

1596 Board #190 May 28 10:30 AM - 12:00 PM

The Relationship Of Habitual Physical Activity With All-cause Mortality Among Obese Adults In US.

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Obesity is associated with increased risk for all-cause mortality. It is unclear if obese individuals need to engage in the same or more levels of physical activity in order to reap the benefits of an active lifestyle.

PURPOSE: We test the hypothesis that regular habitual physical activity of 5 or more times a week among obese individuals, regardless of duration, intensity or mode, will be associated with lower all-cause mortality when compared to sedentary obese adults. **METHODS:** We used data from the Third National Health and Nutrition Examination Survey (NHANES III) conducted from 1988 to 1994. Participant records were linked to mortality data from the National Death Index to establish all-cause mortality. Detailed health information was obtained via a home interview and a medical examination. Measured weight and height were used to calculate obesity with a body mass index (kg/m^2) ≥ 30 . Self-reported participation in leisure time physical activity was used to classify participants as inactive (0 times/wk), infrequently active (1-4 times/wk) and habitually active (5+times/wk). Cox proportional hazard was used to study the association of physical activity and all-cause mortality after controlling for age, socioeconomic status, smoking and chronic diseases.

RESULTS: We studied 16,573 adults aged 20+ years. Both obesity and physical inactivity were independent risk factors of all-cause mortality. The prevalence of obesity in this group was 22.23%. We then studied the relationship between frequency of physical activity and all-cause mortality among obese persons. Obese individuals

who exercised during leisure time habitually (5+ times/wk) had significantly lower risk (HR=0.74, 95% CI: 0.62,0.89) of all-cause mortality than the physically inactive obese group.

CONCLUSION: For obese individuals, exposure to habitual physical activity 5+ times/wk is associated with lower all-cause mortality. All people should engage in habitual physical activity regardless of body weight.

1597 Board #191 May 28 10:30 AM - 12:00 PM

Differences In Physical Activity, Calcium And Vitamin D Intakes In Caucasian, East-asian, And South-asian Women

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In addition to genetic factors, inadequate non-genetic factors, such as physical activity, and calcium and vitamin D intake can limit the achievement of optimal peak bone mass and increase the risk of fractures later in life (Heaney et al, 2000). These lifestyle factors are however subject to cultural variations and their adherence and importance varies among ethnic groups. **PURPOSE:** The purpose of this study was to determine differences in physical activity levels and dietary calcium and vitamin D intakes in premenopausal women aged 18-45 years belonging to three different racial/ethnic groups: Caucasians, South-Asians, East-Asians. **METHODS:** This was a cross-sectional study consisting of 108 participants. Based on their race/ethnicity the participants were categorized into one of the three independent racial/ethnic groups: Caucasian (Cau; n= 46); East-Asian (EA; n= 34); and South-Asian (SA; n= 28). Physical activity was measured using bone specific physical activity questionnaire (BPAQ) and international physical activity questionnaire (IPAQ), while calcium and vitamin D were assessed using calcium and vitamin D food intake questionnaires, and sun exposure questionnaire. **RESULTS:** Past (Cau: 60.62 ± 7.79 vs. EA: 30.51 ± 9.31 , SA: 22.76 ± 5.25 ; $p=0.004$; $\eta_p^2=0.103$) and total (Cau: 33.13 ± 4.17 vs. EA: 17.13 ± 4.94 , SA: 13.67 ± 2.67 ; $p=0.005$; $\eta_p^2=0.098$) BPAQ scores were significantly greater in Caucasians in comparison to East- and South Asian women. Although no significant differences were observed for daily vitamin D intake, sun exposure scores were significantly higher in Caucasian and East-Asian women in comparison to South-Asians (Cau: 18.26 ± 1.54 , EA: 21.90 ± 1.98 vs. SA: 12.21 ± 1.41 ; $p=0.001$; $\eta_p^2=0.136$). Moreover, daily calcium intake (mg/day) was higher in Caucasians and South-Asians compared to East-Asians (Cau: 893.07 ± 52.95 , SA: 964.21 ± 110.20 vs. EA: 608.15 ± 52.65 ; $p=0.002$; $\eta_p^2=0.116$). **CONCLUSION:** The results of this study can be used for creating awareness among the at-risk ethnicities regarding the importance of adequate calcium and vitamin D intake and role of physical activity in enhancing cardio-metabolic fitness and bone density apart from merely reducing or maintaining of body weight.

1598 Board #192 May 28 10:30 AM - 12:00 PM

Effectiveness Ofhealth Risk Behavioron Physical Activity And Mental Health In Chinese Adolescents: A Cross-sectional Study

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PURPOSE: Risky behaviors have significantly impacted on youth physical and psychological health among adolescents, which can result in a tremendous public health issue. The purpose of this study is to exam the association clustering of risk behaviors with physical activity and mental health and identify what extent the clustering of various risk behaviors is associated with psychological health and physical activity in Chinese adolescent.

METHODS: Participants were randomly chosen from 30 high school of 10 regions that consisted of 4630 students, male 2199 (47.5%), female 2431(52.5%), aged 16-18 years, male 16.2 ± 1.03 , female 16.3 ± 1.56 . A structured questionnaire was developed to be based on 2017 State and Local Youth Risk Behavior Survey, which was revised, modified, translated into Chinese. Reliability of questionnaire was analyzed by Cronbach's alpha ($\alpha=0.72$). Construct validity was evaluated by factor analysis after the Kaiser-Meyer-Olkin (KMO=0.81) and Bartlett test ($\chi^2=2.2$, $p=0.00$) had been performed. Symptom Checklist 90 (SCL-90) was used to investigate the mental health status for Chinese adolescent.

RESULTS: Two-step cluster analysis (TCA) identified four clusters in risk behaviors that details are presented. Logistic regression demonstrated the relationship between risk behaviors and mental health based on the different clustering. In somatization, compared with cluster 1 in factor 1, the odds ratios (ORs) and 95% confidence intervals (CIs) were 0.97(0.83-1.13), 1.01(0.91-1.11) and 0.99(0.85-1.16) for cluster 2, cluster 3, cluster 4, respectively. In the hostility, compared with cluster 3 in factor 5, the odds ratios (ORs) and 95% confidence intervals (CIs) were 1.16(1.00-1.33), 1.12(0.98-1.29), 1.06(0.90-1.24) for clusters 1, 2 and 4. The result found that physical activity affects significantly sedentary behavior and screen time and bully behavior.

CONCLUSION: This study found that the specific cluster behaviors influence significantly on mental health and physical activity among Chinese adolescents. This study suggest that more effective and feasible clustering-based intervention programs may be designed to prevent adolescent risk behaviors and mental health.

1599 Board #193 May 28 10:30 AM - 12:00 PM
Daily Step Counts And Cardiometabolic Risk In Adults
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Physical activity (PA) is known to contribute to improvements in cardiometabolic risk (CMR) factors, but doses of PA necessary to achieve healthy CMR profiles are not well understood.

PURPOSE: To quantify the relationships among various expressions of PA and CMR profiles in adults. **METHODS:** Between 6:00 and 9:00 am, participants arrived at the laboratory having fasted for at least 10 hours. Height and body mass were measured, and 4-compartment body composition (percent body fat [%BF], fat mass [FM] and fat-free mass [FFM]) was determined using data derived from bioelectric impedance analysis and dual energy X-ray absorptiometry. Resting heart rate, systolic and diastolic blood pressure were measured, and mean arterial pressure (MAP) was calculated. Blood samples were collected and plasma lipids (total, HDL, and LDL cholesterol [TOT-C, HDL-C, LDL-C]), triglycerides (TG), insulin (INS), and glucose (GLU) were measured. Quantitative insulin sensitivity check index (QUICKI) and TOT-C:HDL-C ratio were calculated. Accelerometers were then provided and were worn for 21-28 days. Thereafter, associations between markers of PA and CMR factors were analyzed. **RESULTS:** A total of 21 females (age = 31.3 ± 4.1 years, weight = 80.3 ± 22.7 kg, height = 167.4 ± 8.0 cm, BMI = 28.6 ± 7.5 kg·m⁻²) and 20 males (age = 32.2 ± 5.4 years, weight = 93.7 ± 19.1 kg, height = 180.4 ± 7.2 cm, BMI = 28.8 ± 5.3 kg·m⁻²) participated. STEPS expressed in absolute terms (STEPS·day⁻¹) was not associated with any CMR factors. STEPS expressed relative to body mass (STEPS·kg⁻¹·day⁻¹) was correlated with %BF (-0.44), MAP (-0.48), HDL-C (0.41), TG (-0.33), TOT-C:HDL-C ratio (-0.36), INS (-0.56), and QUICKI (0.59). STEPS relative to FM (STEPS·kgFM⁻¹·day⁻¹) was correlated with %BF (-0.72), MAP (-0.32), HDL-C (0.38), TOT-C:HDL-C ratio (-0.42), GLU (-0.39), INS (-0.37), and QUICKI (0.47). STEPS expressed relative to FFM (STEPS·kgFFM⁻¹·day⁻¹) was correlated with INS (-0.32). Power regression analysis showed that STEPS·kgFM⁻¹·day⁻¹ was the best predictor of %BF (r² = 0.85), QUICKI (r² = 0.47) and TOT-C:HDL-C ratio (r² = 0.29). **CONCLUSIONS:** These findings suggest that STEPS expressed relative to FM are strongly associated with CMR factors, and that prescribing STEPS relative to FM may be efficacious for improving CMR profiles in adults.

1600 Board #194 May 28 10:30 AM - 12:00 PM
Associations Among Physical Activity, Measures Of Adiposity, And Serum Vitamin D Levels In Healthy Women
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PURPOSE: Although physical activity, body weight status, and serum vitamin D [25(OH)D] levels are associated with various health outcomes in women, the associations among these variables are not well-defined in this population.

METHODS: 7553 healthy women received a comprehensive preventive examination between 2007 and 2018. Measures included self-reported physical activity (PA), body mass index (BMI), waist circumference (WC), waist:height ratio (W:HT), percent body fat (%Fat), and 25(OH)D. Participants were divided into 4 categories of PA based on current guidelines: <500 (not meeting guidelines), 500-1000 (meeting guidelines), 1000-2500 (1 to 2.5 times guidelines), and >2500 (>2.5 times guidelines) MET-minutes/week, respectively, and were also classified by clinical cut points for adiposity measures and 25(OH)D. We examined trends of PA and adiposity exposures across 25(OH)D categories, as well as trends of 25(OH)D and adiposity exposures across PA categories. We calculated odds ratios (OR) of vitamin D deficiency across categories of each adiposity exposure adjusted for age, menopausal status, ethnicity, smoking status, exam season, and PA.

RESULTS: A positive trend was observed for PA across ordered 25(OH)D categories, as well as for 25(OH)D across ordered PA categories (p<.001 for both). Using normal weight women as the referent, OR for 25(OH)D deficiency were significantly higher for women in the upper category of each adiposity measure. When examining joint associations, 25(OH)D was higher across ordered PA groups within each stratum of BMI, WC, W:HT, and %Fat (p trend <.007 for all). When utilizing PA and BMI as continuous variables, OR for vitamin D deficiency were 0.95 (95% CI:0.93-0.96) per 250 MET-minutes/week increment in PA and 1.20 (95% CI:1.17-1.23) per 2 kg/m² increment in BMI.

CONCLUSIONS: 25(OH)D levels are positively associated with PA and negatively associated with various measures of adiposity. 25(OH)D levels are also positively associated with PA within each category of each adiposity exposure. Prospective studies are needed in order to further examine the associations among these variables.

1601 Board #195 May 28 10:30 AM - 12:00 PM
Identifying Threshold Of Daily Sedentary Behavior Time For Prevention Of Obesity
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PURPOSE: Sedentary behavior (SB) has been related to the prevalence of obesity. The need for establishing SB guidelines is being recognized; however, there has been limited research on the threshold of SB time influencing obesity in adults. Therefore, the purpose of this study was to determine the threshold of SB time through the relationship between SB and obesity. **METHODS:** Data from the 2003 to 2006 National Health and Nutrition Examination Survey (NHANES) were analyzed for this study. A total of 5,127 adults (>17 years old), who wore an accelerometer (Actigraph AM-7164) for a minimum of 4 valid days (which included at least three week and one weekend days) were included in the analysis. Accelerometers were used to measure the average duration of minutes spent in SB. To determine the threshold of SB time, five sub-groups were created according to daily SB hours (e.g., < 6 hours, 6 hours [i.e., 6 hours to 6 hours and 59 minutes], 7 hours, 8 hours, ≥ 9 hours). Obesity status was classified by body fat percentage measured by Dual-energy X-ray absorptiometry (DEXA). Logistic regression was used to examine the association between SB time and obesity after controlling for covariates (i.e., age, race/ethnicity, gender, education, income, accelerometer wear-time). A total of five logistic regression analyses were conducted by changing the reference group to calculate the odds ratio between all possible groups. The SAS v9.4 SURVEYLOGISTIC procedure was used to account for the complex nature of the NHANES sampling scheme. **RESULTS:** An estimated 70.67% reported obesity among US adults. Participants who spent in SB time for 8 hours, and 9 hours or more were more likely to report obesity (OR = 1.54; 95% CI: 1.11, 2.12 and OR = 1.60; 95% CI: 1.24, 2.06, respectively) compared to those who spent in SB time below 6 hours. However, participants who spent in SB time ≥ 9 hours were not more likely to be obese (OR = 0.96; 95% CI: 0.77, 1.20) compared to those who spent in SB time for 8 hours. **CONCLUSIONS:** We found sitting up to 8 hours did not affect obesity, but sitting more than 8 hours was related to obesity negatively. In the future, an additional validation study for establishing the threshold is warranted.

1602 Board #196 May 28 10:30 AM - 12:00 PM
Role Of Leisure Centers Supporting Active Living: Data Shows Impact And A Significant Gender Challenge
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Physical inactivity is one of the most important public health problems of the 21st century, being a key contributor to the increased risk of several chronic conditions. However, the number of people failing to achieve the minimum recommended amount of physical activity (PA) is still too high. In this context, leisure centers could play a potential positive role supporting inactive individuals to achieve PA recommendations. PURPOSE: To compare physical activity levels reported by paying members of Spain's largest operator of leisure centers' GO fit, against the 2018 Physical Activity and Sport Special Eurobarometer data from Spain. **METHODS:** Data from the seven questions of the International Physical Activity Questionnaire (IPAQ) were collected from all consenting GO fit members' annual survey (n = 4,062). Data were analyzed and compared through Z-Score tests for two population proportions considering the Spain's 2018 Eurobarometer data (n = 1,001) regarding physical inactivity for the whole sample, and men and women separately. Additionally, sex differences were also analyzed through Z-Score tests for two population proportions comparing women and men in each sample. **RESULTS:** Prevalence of physical inactivity of leisure centers' members (14.9%) was lower in

comparison with the general Spanish population (34%) for the whole sample (Z-score: 13.88; p-value < 0.001) and women (17.4%, 37.2%; Z-score: 10.06; p-value < 0.001) and men (12.1%, 30.0%; Z-score: 9.42; p-value < 0.001), separately. Additionally, higher prevalences were observed in women in comparison with men in both samples (GO fit: Z-score: 4.77; p-value < 0.001; Spanish population: Z-score: 2.39; p-value = 0.0017), but these differences were lower in GO fit (+5.3 percentage points) than in the Spanish sample (+7.2 percentage points).

CONCLUSIONS: GO fit members showed a lower prevalence of physical inactivity for both women and men and higher levels of PA in comparison with the general Spanish population. These findings indicate the suitability of Spanish leisure centers in promoting an active lifestyle, so policymakers should consider leisure centers when searching for effective partners tackling physical inactivity tide introducing specific actions to support women active behaviors during leisure time.

1603 Board #197 May 28 10:30 AM - 12:00 PM

The Mediating Effect Of Physical Activity On Relationship Between Sleep And Weight Status

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(No relevant relationships reported)

PURPOSE: The relationship between sleep and weight status is well known. However, the extent to which physical activity (PA) may act as a mediator in this relationship is uncertain. Therefore, it is crucial to investigate whether PA mediates the influence of sleep on weight status. The purpose of this study was to examine the association between sleep and weight status and determine the potential mediational role of PA on this relationship.

METHODS: Data from a total of 3,214 adults who participated in the National Health and Nutrition Examination Survey (NHANES) from 2005 to 2006 were analyzed for this study. PA was measured via accelerometry (Actigraph AM-7164) for a minimum of 4 valid days (which included at least three weekdays and one weekend day), and at least 10 hours of wear time were required to be considered a valid day. Weight status was measured via Body Mass Index (BMI) while utilizing established cut-points to determine normal weight, overweight and obesity. Sleep was measured using an NHANES validated question, namely "How often do you have trouble falling asleep?" Sleep quality was categorized into three levels: (1) Never; (2) 1-15 times a month; (3) 16-30 times a month. The analysis was conducted using SPSS (v. 25). The Hayes SPSS macro was utilized for the mediational analysis. The bootstrapping method was employed with 5,000 bootstrap samples to evaluate indirect effects.

RESULTS: For the overall sample, sleep (Never vs. 16-30 times a month) was positively related to PA ($a = 0.596, p < .001$). PA was negatively predicted weight status while controlling for sleep ($b = -0.003, p < .001$). A bootstrap confidence interval for indirect effect of sleep (ab) was 0.015 to 0.233, meaning that there was evidence of an indirect effect of sleep on weight status through PA. The direct effect of sleep on weight status of $c' = 0.536$ was not statistically significant ($p = .267$).

CONCLUSIONS: Our findings demonstrate that the indirect relationship between sleep quality and weight status which is mediated via PA. Longitudinal studies are warranted to further conform this study finding.

1604 Board #198 May 28 10:30 AM - 12:00 PM

Association Of Physical Activity With Physical Functioning In Adults With Intellectual Disability

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(No relevant relationships reported)

Adults with intellectual disability (ID) have very low levels of physical functioning. They also have low levels of physical activity (PA), high levels of sedentaryness, and high rates of obesity; together with age, these factors may account for the low physical functioning levels of adults with ID. **PURPOSE:** This research examined if PA and sedentaryness levels, age, and body mass index (BMI) are associated with physical functioning in adults with ID. **METHODS:** The sample included 58 adults with ID (29 women & 29 men; age 44 ± 14 years; BMI 34.2 ± 8.4 kg·m⁻²). We measured physical functioning with the Short Physical Performance Battery (SPPB) and PA and sedentary time with an accelerometer (wGT3X-BT; Actigraph) worn on the dominant hip for 7 days. We determined time in light, moderate, and vigorous, PA, and sedentary behavior. We explored bivariate associations among these variables with Pearson's correlation coefficients. We entered variables significantly associated with the SPPB score into a hierarchical regression model; order of entry was based on the magnitude of correlations. **RESULTS:** Mean ± SD for measured variables were: SPPB score 7.7 ± 2.4; sedentary time 492.8 ± 130.1 min·day⁻¹; light PA 351.8 ± 105.1 min·day⁻¹; moderate PA 18.8 ± 21.0 min·day⁻¹; and vigorous PA 0.2 ± 0.6 min·day⁻¹. Moderate PA and age were significantly associated with the SPPB score ($r = 0.39$ and 0.34, respectively; $p < 0.01$). Sedentary time, light PA, vigorous PA, and BMI had

non-significant associations with the SPPB score. In the hierarchical regression model, moderate PA significantly predicted SPPB ($p < 0.001$; $R^2 = 0.153$). Adding age to the model did not contribute significantly ($p = 0.123$; $R^2 = 0.189$; R^2 change = 0.036), but moderate PA remained a significant predictor ($p = 0.027$). **CONCLUSIONS:** Moderate PA predicts SPPB score even after accounting for age among adults with ID. Moderate PA may be an important factor for improving the functional performance and health profiles of adults with ID.

1605 Board #199 May 28 10:30 AM - 12:00 PM

Yoga, Health-Related Quality Of Life And Mental Well-Being: A Meta-Analysis Using The Quality Effects Model

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Robust and practically relevant information regarding the association between yoga, health-related quality-of-life (HRQOL) and mental well-being (MWB) in older adults has not been established. **PURPOSE:** Provide robust and practically relevant information regarding the association between yoga, health-related quality-of-life (HRQOL) and mental well-being (MWB) in older adults. **METHODS:** Data were derived from a meta-analysis of 12 randomized controlled yoga trials representing 752 adults ≥60 years of age. Standardized mean difference effect sizes (ES's) were pooled using the recently developed quality effects model and 95% compatibility intervals (CI). Small-study effects were examined using the Doi plot and Luis Furuya-Kanamori (LFK) index. Sensitivity and cumulative meta-analyses were conducted as well as percentile improvement, number needed to treat (NNT), and number to benefit. The GRADE instrument was used to assess the strength of the evidence. **RESULTS:** Yoga was associated with improvements in both HRQOL (ES = 0.51, 95% CI, 0.25 to 0.77, $F = 63.1\%$) and MWB (ES = 0.39, 95% CI, 0.15 to 0.63, $F = 56.2\%$). Percentile improvements were 19.5 for HRQOL and 15.3 for MWB while the NNT was 4 for HRQOL and 5 for MWB. An estimated 378,222 and 302,578 US yoga-practicing adults ≥65 years of age could potentially improve their HRQOL and MWB, respectively. Major asymmetry suggestive of small-study effects was observed for MWB (LFK = 2.23) but not HRQOL (LFK = 0.27). Overall strength of evidence was considered "high" for HRQOL and "moderate" for MWB. **CONCLUSIONS:** Yoga is associated with improvements in HRQOL and MWB among older adults. Studies to determine the dose-response effects of different types of yoga on HRQOL and MWB and minimally important thresholds for improvement are needed.

1606 Board #200 May 28 10:30 AM - 12:00 PM

A Meta-analysis Of The Acute And Chronic Effects Of Exercise Training On Paraoxonase-1 (PON1)

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Paraoxonase 1 (PON1) is a high-density lipoprotein (HDL) - associated enzyme partially responsible for the anti-atherogenic properties of HDL. However, a lack of consensus exists regarding the effects of exercise training on PON1 concentration and activity. **PURPOSE:** Determine the acute and chronic effects of exercise training on PON1 concentration and activity. **METHODS:** A literature search was performed in English and Spanish languages using 16 electronic databases and the keywords "PON1", "exercise", "paraoxonase", "paraoxonase-1", "paraoxonase 1", "aerobic", "resistance", "training", and "concurrent". Experimental studies in adults 18 years of age and older were included. Dual selection and data abstraction were conducted. Results were pooled using the random-effects model. Effect sizes (ES) were computed and two-tailed alpha values <0.05 and non-overlapping 95% confidence intervals (95%CI) were considered statistically significant. Statistical heterogeneity (Q) and inconsistency (I²) were examined as well as small-study effects using the Doi plot and LFK index. **RESULTS:** Seventeen studies representing 360 participants met the criteria for inclusion. The acute effects of exercise on PON1 concentration were trivial and non-significant (ES = -0.03, 95%CI = -0.39 to 0.34, $p > 0.05$), heterogeneous (Q = 17.22, $p = 0.05$), moderately inconsistent (I² = 48%), with minor asymmetry (LFK index = 1.34). The chronic effects of exercise on PON1 concentration were also trivial and non-significant (ES = -0.04, 95%CI = -0.53 to 0.45, $p > 0.05$), homogenous (Q = 0.85, $p = 0.65$), displayed low inconsistency (I² = 0%), and minor asymmetry (LFK index = -1.14). The acute effects of exercise on PON1 activity were trivial and non-significant (ES = 0.11, 95%CI = -0.02 to 0.24, $p > 0.05$), homogenous (Q = 18.58, $p = 0.85$), showed low inconsistency (I² = 0%), and no asymmetry (LFK index = 0.82). The chronic effects of exercise on PON1 activity were small but significant (ES = 0.39, 95%CI =

0.01 to 0.77, $p < 0.05$), homogenous ($Q = 6.43$, $p = 0.17$), moderately inconsistent ($I^2 = 38\%$), with no asymmetry (LFK index = 0.94). **CONCLUSION:** Exercise training, overall, exerted a trivial effect on PON1 while chronic exercise had a small but more pronounced effect on PON1 activity. Additional research is needed before any firm conclusions can be drawn.

1607 Board #201 May 28 10:30 AM - 12:00 PM

The Economic And Social Impact Of Leisure Centre Membership Across Spain: A Preliminary Analysis

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An active behavior is associated with a range of positive social outcomes. Accordingly, the Global Action Plan on physical activity 2018-2030 (World Health Organization, 2008) indicates that the guiding principle of the implementation of the policy action should be based on the active evaluation of impact. **PURPOSE:** To analyze the 2017 economic and social impact in international Dollar (INTS) of GO fit, the largest leisure center operator in Spain, with 18 facilities and more than 200,000 members.

METHODS: The Social Return on Investment (SROI) was estimated from 114,000 active members, with data collected through the access control of each individual. The SROI is a framework for measuring and understanding non-market economic and social values produced by an organization. For this analysis, reductions in physical and mental health spending, absenteeism costs, disability-adjusted life years avoided, and increases in subjective wellbeing were studied, considering the prevalence of main illnesses and quantifying the annual healthcare cost of an inactive Spanish person.

RESULTS: For the year 2017, GO fit generated more than \$378 million of social impact. This includes \$27 million on health care spending savings (\$23 million in physical illness and \$4 million in mental illness), \$9 million in savings related to reducing workplace absenteeism, and \$87 million derived from the maintained productive capacity as a better quality of life as a result from the disability-adjusted life years prevented. Additionally, \$255 million were generated due to improvements in subjective wellbeing among GO fit members. As a positive consequence of this, GO fit contributes to generating benefits among its members valued at \$3.17 for every INTS of turnover.

CONCLUSIONS: An extensive economic and social impact is attributable to the active behavior of GO fit members, indicating the critical role that leisure centers have in improving wellbeing and tackling a myriad of community-level social threats. Examples of this are helping to reduce health care spending, increasing subjective wellbeing, and increasing years without disability. Considering these findings, policymakers should account for leisure centres as an ally in the public health agenda.

1608 Board #202 May 28 10:30 AM - 12:00 PM

The AHA'S 7 Health Metrics And Chronic Disease Mortality In Patients With CHD, Stroke, And Cancer

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(No relevant relationships reported)

PURPOSE: The impact of the AHA's 7 health metrics on mortality risks from chronic disease in patients with CHD, stroke, and cancer remains less explored. We investigated the association between AHA's 7 health metrics and chronic disease mortality in patients with CHD, stroke, and cancer.

METHODS: We followed 8,021 men and women, aged 20 to 85 years, who participated in the National Health and Nutrition Examination Survey (1988-1994 and 1999-2014). All participants completed baseline health factors, lifestyle behavior questionnaires, and a personal history of CHD, stroke, or cancer at baseline. The AHA's 7 ideal health metrics were defined as untreated blood pressure, untreated total cholesterol, untreated fasting glucose, physically active, never smoked, a healthy diet, and normal body weight. We further categorized these variables as having 0, 1, 2, 3, 4, or 5 or greater combined ideal health metrics. We also categorized patients as having 1, 2, or 3 combined history of CHD, stroke, and cancer at baseline. Cox proportional hazards regression was used to investigate the associations of a combined number of 7 health metrics and combined personal history of CHD, stroke, and cancer with chronic disease mortality.

RESULTS: During an average of 6.6 years of follow-up (53,179 person-years), there was a total of 1,420 chronic disease deaths. After adjustment for multiple risk factors, the hazard ratios (95% CI) across 0 (reference), 1, 2, 3, 4, or 5 or greater combined ideal health metrics were 0.72 (0.60, 0.86), 0.52 (0.43, 0.62), 0.44 (0.36, 0.53), 0.37 (0.28, 0.47), and 0.27 (0.17, 0.43) (p for trend < 0.001). Men and women with all 5 or greater combined ideal health metrics had a 73% (95% CI: 57% to 83%) lower risk of chronic disease mortality compared with men and women with zero ideal health

metrics. Men and women with 2 or 3 combined CHD, stroke, or cancer at baseline had 1.48 (1.30, 1.68) and 2.08 (1.57, 2.75) times the risk of chronic disease mortality compared with men and women with 1 combined CHD, stroke, and cancer at baseline (p for trend < 0.001).

CONCLUSIONS: The AHA's 7 ideal health metrics are associated with a lower risk of chronic disease mortality in men and women with a personal history of CHD, stroke, or cancer. The AHA should recommend maintaining AHA's 7 ideal health metrics across persons who suffer from CHD, stroke, or cancer.

1609 Board #203 May 28 10:30 AM - 12:00 PM

Cardiometabolic Characterization Of People Living With HIV Seeking Treatment In The South Texas Region

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PURPOSE: To characterize the cardiometabolic profile of people living with HIV (PLWH). We hypothesized that a majority of PLWH would have 3 or more cardiometabolic risk markers. **METHODS:** A large dataset from electronic medical records (EMR) of PLWH seeking care at several public health care institutions was used for this investigation. 200 PLWH from the South Texas Region were included. We identified cardiometabolic risk markers from the EMR system to characterize the cardiometabolic profile of PLWH in this region. The cardiometabolic variables considered were: cholesterol (≥ 200 mg/dL), triglycerides (TG) (≥ 150 mg/dL), glycated hemoglobin (HbA1C) ($\geq 6.5\%$), body mass index (BMI) (≥ 30 kg/m²), and blood pressure (SBP ≥ 140 mmHg / DBP ≥ 90 mmHg). Demographic variables retrieved from the EMR were: height (in), weight (lbs), age (yrs), gender (M/F), race, viral load (copies/mL), and CD4+ T-cell percentage (%CD4). We identified the first encounter as representation of the initiation of care. Descriptive statistics such as percentages, means, standard deviations (SD) or ranges were calculated for all variables. **RESULTS:** The sample was comprised of 35% Hispanics and 65% Non-Hispanics, primarily Caucasians (75%) and Black (19%). Approximately 77% classified themselves as men. Age, weight, and height were 49.88 ± 12.2 yrs; 179.1 ± 44.3 lbs; 67.4 ± 3.8 in, respectively. %CD4 and viral load were $20.8 \pm 10.5\%$ and $27,102 \pm 102,813$ copies/mL, respectively. On average, the values of the cardiometabolic risk markers were borderline high: HbA1C = $6.17 \pm 1.84\%$ (range: 4-13); TG = 190 ± 156.1 mg/dL (range: 37-1,099); cholesterol = 177 ± 42.7 mg/dL (range: 80-362); SBP = 129.9 ± 17.2 mmHg (range: 92-187); DBP = 78.2 ± 11.8 mmHg (range: 52-117); BMI = 29.5 ± 7.4 kg/m² (range: 21-53). However, after evaluating the range of values of the sample, close to 50% of PLWH had elevated values in at least 3 of the cardiometabolic risk markers. **CONCLUSIONS:** PLWH in the South Texas region exhibit an elevated cardiometabolic risk profile. Due to the greater morbidity and mortality in PLWH with cardiometabolic disease, early intervention is imperative. Exercise professionals should be included as part of the healthcare team at the initiation of care to improve the cardiometabolic profile of PLWH.

1610 Board #204 May 28 10:30 AM - 12:00 PM

Effect Of Traditional And Non-traditional Pre-sporting Activities On Perceived And Actual Motor Competence

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Previous research has analyzed the effect of motor interventions (MI) on perceived motor competence (PMC) and actual motor competence (AMC) on children and adolescents. No research had focused on pre-sporting activities (PSA) as part of MI. **PURPOSE:** To analyze the effect of traditional and non-traditional PSA on PMC skills (perceived locomotion [PL], perceived object control [POC], perceived gross motor [PGM], and global PMC [GPMC]) and AMC skills (locomotion [L], object control [OC], gross motor [GM]) on elementary boys and girls. **METHODS:** 72 children from fourth grade of elementary school (mean age 9.6 ± 0.6 yrs. old) had their parents' authorization and volunteered to participate in the study. Four treatments were randomly assigned to four intact classes: traditional PSA (T), non-traditional PSA (NT), combined PSA (C), and control group (CG). The intervention consisted of 7 sessions of 80 minutes each, once per week. T group ($n=18$) received track and field and gymnastics PSA; NT group ($n=21$) received goalball and field hockey PSA; C group ($n=15$) received PSA of the four sports, and CG ($n=18$) had no physical education. PMC was assessed with the Pictorial Scale for Perceived Movement Skill Competence for Young Children; while AMC was assessed with the Test of Gross

Motor Development-2. **RESULTS:** A two-way ANOVA (groups by measurements) showed no significant results for POC (M±SD values for pretest [T: 3.3±0.4, NT: 3.3±0.5, C: 2.99±0.6, CG: 3.1±0.4] and posttest [T: 3.3±0.5, NT: 3.2±0.5, C: 3.2±0.4, CG: 3.2±0.4]) nor PGM (M±SD values for pretest [T: 3.1±0.4, NT: 3.1±0.4, C: 3.0±0.5, CG: 3.0±0.3] and posttest [T: 3.2±0.5, NT: 3.2±0.3, C: 2.99±0.4, CG: 3.1±0.3]). PL, GPMC, L, OC, and GM did not show normal distribution, therefore a one-way ANCOVA (4 groups; pretest as co-variable) was used. The ANCOVA revealed that the three experimental groups (T: 3.9±1.8, NT: 3.5±2.0, C: 4.3±2.1) had significantly higher scores at posttest than the CG (1.1±0.4) in OC. No significant differences were found between groups at posttest for L (T: 4.9±1.7, NT: 4.9±1.7, C: 4.4±1.9, CG: 2.3±1.3), GM (T: 8.6±1.9, NT: 7.8±3.3, C: 9.0±3.3, CG: 3.5±1.4), PL (T: 3.2±0.6, NT: 3.1±0.5, C: 3.0±0.5, CG: 3.2±0.4), and GPMC (T: 3.0±0.5, NT: 3.0±0.3, C: 3.0±0.4, CG: 3.0±0.3). **CONCLUSION:** Traditional and non-traditional PSA can be used to enhance OC in fourth graders.

1611 Board #205 May 28 10:30 AM - 12:00 PM
The Effects Of Aerobic Exercise On Free Radical Expression In Hippocampus Of Aging Rats

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(No relevant relationships reported)

PURPOSE: The effects of aerobic exercise on free radical expression in hippocampus of aging rats.

METHODS: Eighty male SD rats were divided into 4 groups (n=20) at random: control group (C), D-galactose aging model group (A), pre-aging aerobic exercise intervention group (S1), aerobic exercise intervention on aging group (S2). Following a 1 week acclimation to laboratory conditions, D-gal were injected in D, S1 and S2 groups rat's peritoneal to make aging model, the injection dosage via body weight of the rats, 100mg/kg, once a day for 6 weeks. Group C were injected the same dosage of saline. We did 1 hour per day, six times per week's swimming training separately before and during the injection of D-gal administration in group S1 and S2. At the end of modeling and swimming, Morris water maze was used to evaluate the spatial learning and memory function of rats; the activities of SOD, GSH-Px and MDA expression in hippocampus of rats in each group were measured. All data were processed with one-way ANOVA, level of significance was set at $\alpha=0.05$.

RESULTS: (1) Compared with group C, group A had obvious symptoms of aging. (2) Water maze navigation trial showed that group C, S1 and S2 formed stable spatial learning and memory function on day 3 but that of group A formed on day 4; in the space exploration experiment group C reached the destination for most times, the percentage of the original site quadrant of group C was the highest, and there were significant differences between other groups ($P<0.01$); group S2 followed but group A and S1 were relatively low. (3) Morphological observation showed that the hippocampal neurons of rats in group A appeared derangement, deepening of cell staining and cytoplasmic edema. (4) The activities of SOD and GSH-Px in the hippocampus of group S2 were similar to group C, and the activities of group A and S1 were significantly lower than group C ($P<0.01$); the expression levels of MDA were significantly down-regulated in group C, group S2 followed, and all significantly lower than those in group A and S1 ($P<0.05$).

CONCLUSIONS: Swimming in the process of aging can improve and maintain the spatial learning and memory function of brain and delay brain aging. The mechanism may be related to reduce free radical expression's regulation.

1612 Board #206 May 28 10:30 AM - 12:00 PM
Accelerometer-derived Physical Activity Intensities And Its Correlation With Cardiovascular Disease Risk In Factory Workers

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PURPOSE: Physical activity (PA) is known to be associated with the prevention of cardiovascular disease (CVD), yet there data describing the objective measurement and correlates of this lifestyle behaviour in low-to-middle-income countries are limited. The aim of this present study was to describe accelerometer-derived PA patterns and determine the correlation of PA intensity with indicators of CVD risk in adult factory workers

METHODS: Valid PA and cardiometabolic disease data were obtained from a sample of 87 adult workers (age (mean ± SD) 39.4 ± 10.1 years; body mass index (BMI) 29.6 ± 6.64; waist circumference 91.7 ± 12.5 cm; 59% female). Activity AX3 wrist worn data were analysed using the R-package GGIR version 1.10-7 and characterized into four PA intensities (1: inactivity, 2: light, 3: moderate, 4: vigorous). Ten-year CVD risk and vascular age were determined using the Framingham algorithm. Correlates with PA intensities were determined using univariate analysis.

RESULTS: More males (33%) than females (19%) were in the highest quartile of moderate-vigorous PA (MVPA). Females had lower MVPA (106 ± 52.6 min/day) than males (129 ± 49.6 min/day), but higher BMI (31.5 ± 6.96 kg/m² vs 26.8 ± 4.99 kg/m² respectively). Males had higher CVD risk score (10.4 ± 10.8) and higher vascular age (vascular age 49.4 ± 16.5 years) than their female counterparts (3.99 ± 5.02 CVD risk score and 43.4 ± 17.4 years respectively). CVD risk score (rho: 0.32, p=0.003) and vascular age (rho: 0.32, p=0.003) were positively correlated with light PA. MVPA was inversely correlated with vascular age (rho: -0.27, p=0.01) and waist circumference (rho: -0.22, p=0.046).

CONCLUSIONS: Despite females having higher BMI and lower MVPA than males, CVD risk is higher in males. There were significant correlations between MVPA and lower vascular age, while light PA was correlated with higher CVD risk in factory workers.

1613 Board #207 May 28 10:30 AM - 12:00 PM
Implementation Of Physical Activity Prescription For People With Non-communicable Diseases In Ile-de-France

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Purpose: Recognized by law in 2016, the prescription of PA for people with NCDs is promoted and implemented by the regional state sports and health offices. The "Prescri'forme" plan aims to increase the use of PA as non-drug therapy for NCDs. Based on the implementation of the Ile-de-France program and its surrounding context, the objective of this evaluation was to identify the obstacles and benefits related to the integration of PA into the healthcare system of patients with NCDs.

Methods: Through the review of the scientific literature, institutional reports, and grey literature on the recognition and development of PA within public health policy, 21 semi-directed interviews identified challenges and difficulties in the implementation of the "Prescri'forme" plan. Particular attention was given to the changes currently happening within the organisation of the healthcare system, in order to propose a method to integrate PA into the healthcare system for patients with NCDs.

Results: The deployment of the plan is still in progress, with its advances varying based on location, affected largely by the maturity of the PA prescription-practice systems already in place and the strength of the links established between the actors. For example, a program to provide support and guidance for the prescription and supervision of adapted PA. In Ile-de-France, local coordination is gradually being established. At a regional level, there is a lack of support for steering the system, particularly to gather data from patient follow-up visits in order to demonstrate more robustly the value of integrating PA into the care of these patients. In addition, a regional level of coordination would provide a space for exchange between actors involved with promoting PA as part of the healthcare system.

Conclusion: To strengthen the legitimacy of PA in the care of patients suffering from NCDs, it is necessary to link PA prescription systems with organizational changes already in progress in the healthcare system. The desire to provide a flat-rate coverage for NCDs represents an opportunity to propose models of a healthcare system that integrates PA. These models must demonstrate the benefits of these programs in terms of public health, medicine, and economics, whilst also responding to the challenges around prescription pricing and PA dispensation.

1614 Board #208 May 28 10:30 AM - 12:00 PM
Sedentary Behavior, Insulin Resistance, And Arterial Stiffness In Individuals Meeting Physical Activity Guidelines

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PURPOSE: To examine the association between the average amount of sedentary behavior (SB) per day and insulin resistance (IR), along with sedentary behavior and arterial stiffness (AS) in those who meet physical activity (PA) guidelines. **SUBJECTS:** N = 59, 37 females and 22 males, age, 43 ± 7.5 years, height, 167.8 ± 10.2 cm, weight, 77.9 ± 9.7 kg, body fat, 24.4 ± 9.7 %, resting heart rate 56.9 ± 9.5 bpm, 122.9 ± 14.6 mmHg, 75.1 ± 8.7 mmHg, resting SBP and DBP respectively. **METHODS:** Subjects were pre-screened using the International Physical Activity Questionnaire to subjectively confirm they met PA guidelines. ActivPal accelerometers were placed on the thighs of subjects for 7 full days to monitor time spent in sedentary behaviors including sitting and lying in a reclined position. At the completion of 7 day wear time, measurements of pulse wave velocity (PWV; Sphygmocor XCEL), an estimation of AS, were completed to record AS, along with a 10mL fasting blood draw to analyze for glucose (mg/dL) and insulin (μIU/mL)

concentrations. Glucose concentrations were measured with the colorimetric glucose assay, (CV = 6.22 % ± 3.36). Insulin concentrations were measured with an ELISA, (CV = 5.21 % ± 3.19). Insulin resistance was calculated utilizing the homeostatic model assessment of insulin resistance (HOMA-IR). **RESULTS:** Participants averaged 8.6 ± 1.6 h/day of SB, had a fasting glucose concentrations 80.6 ± 10.2 mg/dL, fasting insulin of 1.8 ± 2.1 µIU/L, HOMA-IR of 0.5 ± 0.9, and an average PWV of 7.8 ± 1.38 m/s. Two regression analyses were conducted: SB did not significantly predict IR, $F(1, 57) = .949, p > 0.05, R^2 = 0.018$, nor PWV, $F(1, 57) = 2.597, p > 0.05, R^2 = 0.044$. **CONCLUSION:** Healthy individuals who meet PA guidelines of at least 150 minutes of moderate-vigorous intensity per week is not expected to develop insulin resistance or excessive arterial stiffness even when averaging 8.6 ± 1.6 h of SB/day. The benefits of PA remain intact even when healthy, middle-aged adults have sedentary jobs or spend more than half of their wakeful day in a reclined or seated position. PA guidelines, therefore, should remain a solid benchmark goal for those who participate in 8 or more hours of sedentary behaviors per day and may be the negating catalyst for the development of type 2 diabetes and/or cardiovascular diseases.

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1615 Board #209 May 28 10:30 AM - 12:00 PM
Predictors Of Physical Activity Level Among Brazilian Military Law Enforcement Personnel

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Police officers (PO) need to engage in training and duty activities in which one's performance might be affected by their physical activity level (PAL).

PURPOSE: To evaluate predictors of PAL among Brazilian military law enforcement personnel.

METHODS: We performed a cross-sectional study of 418 volunteers, recruited by convenience in a state of Brazil. PAL was calculated using the IPAQ-questionnaire as the sum of total min/week of walking (3.3 METs), moderate (4.0 METs), and vigorous activity (8.0 METs). The effect of independent variables on the PAL, as a continuous outcome, was first assessed using simple linear regression. Variables that had a p-value ≤ 0.2, namely age, BMI, gender, role, rank, partner status, educational level and the 4 domains of quality of life (QoL) assessed by WHO QoL questionnaire, were included in the final multivariate regression model.

RESULTS: The majority of the volunteers were men (88%) with an average age 38.6 ± 6.6 years. Average BMI was 26.5 ± 3.4 kg/m² with 16% of the participants being obese (BMI ≥ 30 kg/m²) while 185 (44%) did not meet the physical activity guidelines. After adjusting for covariates BMI, educational level, and QoL Environmental domain were significantly associated with PAL (Table 1). Each unit decrease in BMI was associated with a 56 METs/min/week increase in PAL and each unit increase in QoL Environmental Domain was associated with 13 METs/min/week increase in PAL. Also, having a college degree or above, vs. having only secondary education, was associated with an increase of 381 METs/min/week in PAL, which corresponds to more than half of the PAL guidelines. **CONCLUSION:** In this sample of military PO, BMI, educational level and the Environmental Domain of QoL showed to be significant predictors of IPAQ-based PAL.

Table 1: Multivariate linear regression with PAL as continuous variable (METs/min/week)

	β	SE	p
Age	6.7	9.9	0.50
BMI (kg/m ²)	-56.2	17.6	0.001
Gender	251.9	191.4	0.19
Role	-53.0	126.8	0.68
Rank	83.6	149.7	0.58
Educational level	381.1	134.7	0.005
QoL Physical domain	7.2	5.1	0.15
QoL Psychological domain	-5.7	5.8	0.33
QoL Environmental domain	12.8	5.6	0.02

Role: field or administrative; rank: officer or enlisted; educational level: ≤secondary or ≥higher; QoL: quality of life

1616 Board #210 May 28 10:30 AM - 12:00 PM
60 Min Daily Vs Average Of 60 Min/day, Are There Differences In Health Status?

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The physical activity (PA) guidelines for Americans 2nd Ed. recommend children and adolescents (6-17 years old) to engage in at least 60 min/day of moderate-to-vigorous PA (MVPA). However, it is common to report that participants meet guidelines when they average 60 min/day of MVPA instead of 60 min daily as recommended. **PURPOSE:** To determine if there were differences in health status (high-density lipoprotein cholesterol (HDL), total cholesterol (TC), triglyceride (TRG), BMI, and diastolic and systolic blood pressure (DBP, SBP)) between children and adolescents that engage in MVPA for an average of 60 min/day (group 1) or 60 min daily (group 2). **METHODS:** Data from 724 (Group 1 = 371, Group 2 = 353) children and adolescents (aged 6-17 yrs) that had 6+ valid days of accelerometer data from the 2003-2006 National Health and Nutrition Examination Survey (NHANES) were included in this analysis. One-Way ANOVA was used to compare mean values between the 2 groups for all measures and ANCOVA was used to control for covariates. **RESULTS:** Mean MVPA (82±20 and 128±37 min/day), age (10±3 and 8±2 years) and BMI (19±4 and 17±3 Kg/m²) were significantly different between groups (p<.001). However, HDL (57±12 and 59±13 mg/dL, p=.10), TC (165±30 and 162±29 mg/dL, p=.23), TRG (77±38 and 78±47 mg/dL, p=.89), SBP (103±10 and 101±10 mmHg, p=.08), and DBP (53±14 and 53±14 mmHg, p=.70) were not different. When variables were adjusted for age and gender, no significant mean differences were found for BMI (p=.21), and other health measures. **CONCLUSION:** Although there were mean differences in MVPA between children and adolescents that engage in MVPA an average of 60 min/day or 60 min daily, there were no significant health differences. More studies are needed to confirm these initial findings leading to a possible change in the wording of the guidelines.

1617 Board #211 May 28 10:30 AM - 12:00 PM
Physical Activity And Anxiety In Gamers And Non-gamers

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 (No relevant relationships reported)

Competitive video game play (gaming) has become increasingly popular in the past decade. However, behaviors of those who actively participate in gaming ("gamers") is not well understood. Gaming is typically a sedentary activity, therefore it is possible that "gamers" may be more sedentary and less physically active than their "non-gamer" peers. Additionally, it is possible gamers may be prone to outcomes associated with an inactive lifestyle (e.g., elevated body mass index (BMI), anxiety). **PURPOSE:** To compare physical activity, sedentary behavior, BMI, and anxiety in "gamers" versus "non-gamers." **METHODS:** College students (N=337, 20.92±1.81 years old) at a public university in the American Midwest completed a questionnaire that assessed demographics, gaming habits (reported whether or not they identified as a "gamer" and min/week of video game play), physical activity and sedentary behavior (via the International Physical Activity Questionnaire), and anxiety (via Beck's Anxiety Inventory). A Multivariate Analysis of Variance (MANOVA) was conducted comparing these aforementioned variables in "gamers" versus "non-gamers". **RESULTS:** As expected, "gamers" (n=90, 908±621 min/week) allocated significantly (p<0.001) more time to gaming than "non-gamers" (n=226, 67±124 min/week). "Gamers" also participated in significantly (p≤0.042) less vigorous (217±282 min/week), light

(634±704 min/week) and total physical activity (4938±4111 MET min/week) than “non-gamers” (296±325 min/week vigorous, 980± 012 min/week light, and 6849±5260 MET min/week total). “Gamers” (4296±1854 min/week) allocated significantly ($p<0.001$) more time to sedentary behavior than “non-gamers” (3316±1581 min/week). Lastly, there were no differences ($p\geq0.29$) between “gamers” and “non-gamers” for BMI, moderate intensity physical activity, or anxiety. **CONCLUSION:** College-aged individuals who self-identified as “gamers” had a >13 fold greater amount of weekly video game play than “non-gamers.” This robust difference in time allocated to gaming was associated with lower vigorous, light, and total physical activity and greater sedentary behavior in “gamers” versus “non-gamers.” This is concerning as inadequate physical activity and elevated sedentary behavior are independent risk factors for cardio-metabolic disease.

1618 Board #212 May 28 10:30 AM - 12:00 PM
The Associations Of Objectively Measured Physical Activity With Exercise Capacity And Health-related Quality Of Life In Patients With Congenital Heart Disease

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Although self-reported moderate to vigorous physical activity (MVPA) levels and exercise capacity are associated with various health parameters, the relative contributions of objectively measured MVPA levels and exercise capacity to health-related quality of life (HRQoL) remain unclear in patients with congenital heart disease (CHD). **PURPOSE:** This study examined the independent associations of objectively measured MVPA and exercise capacity with HRQoL in patients with CHD. **METHODS:** Eighty-two Korean patients with CHD (19.3±1.9 years, 21.7±3.7 kg/m²) who visited an outpatient clinic were consecutively recruited to participate in this study. Objectively measured MVPA levels were assessed using the accelerometer device (GENEActiv) worn on the wrist for seven consecutive days. Exercise capacity (EC) was directly measured by peak oxygen uptake (VO_{2peak}) using progressive, symptom-limited maximal treadmill exercise testing to volitional fatigue. HRQoL was evaluated using the PedsQLTM 4.0 Generic Core Scale questionnaire. **RESULTS:** In a univariate correlational analysis, objectively measured MVPA was positively correlated with EC (VO_{2peak}) ($p=.31$, $p=.024$) and HRQoL ($p=.21$, $p=.048$). When both variables were entered into the same regression models, EC, but not objectively measured MVPA ($\beta=.088$, $p=.535$), was independently associated with HRQoL ($\beta=.348$, $p=.016$). In the mediation analysis, exercise capacity showed a mediating effect in the association between objectively measured MVPA and HRQoL ($z=1.973$, $p=.048$). **CONCLUSIONS:** These findings suggest that objectively measured MVPA levels and EC were associated with better HRQoL, but the association between objectively measured MVPA and HRQoL was fully mediated by EC, highlighting the importance of improving exercise capacity to potentially enhance quality of life in patients with CHD.

1619 Board #213 May 28 10:30 AM - 12:00 PM
Abstract Withdrawn

1620 Board #214 May 28 10:30 AM - 12:00 PM
Impact Of Sports Participation On Healthcare Costs: Findings From A Brazilian Longitudinal Study

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PURPOSE: To identify the potential impact of sports participation on healthcare costs among Brazilian adults. **METHODS:** The sample was composed of 620 adults (166 males and 454 females) aged 50 years or older followed from 2010 to 2014 in the city of Bauru, Sao Paulo, Brazil (FAPESP Research Project). Physical activity was assessed using questionnaire (Baecke et al. Am J Clin Nutr, 1982 [face-to-face interview]) and subjects were stratified according to the engagement in sports in leisure-time (180 minutes/week over the last four months) as: Engaged (n= 99) and Non-engaged (n= 521). Annual healthcare costs covered by the Brazilian National Health Service were assessed from 2010 to 2014 (in US dollar [US\$]), including expenditures with medicine, appointments and exams. Analysis of covariance (ANCOVA) adjusted by sex, age and body mass index compared monetary values between the two groups, while statistical significance (p-value) was set as p-value lower than 0.05 and effect-size was expressed using eta-squared values. **RESULTS:** From 2010 to 2014, the

amount of money spent by these 620 adults accounted US\$ 207,175.00. Adults engaged in sports spent less with healthcare services (US\$ 260.61 [95%CI: 184.09 to 337.14]) than their peers non-engaged in sports (US\$ 348.12 [95%CI: 315.01 to 381.23]). The magnitude of the difference was small (eta-squared= 0.007 [0.7%]), but significant (p-value= 0.040). **CONCLUSIONS:** Sports participation was a determinant factor on decreasing the expenditure with healthcare services among Brazilian adults. This finding highlight the importance of public health actions promoting healthy behaviors aiming the prevention of harmful health outcomes and reduced healthcare costs, especially in countries with unified health systems.

1621 Board #215 May 28 10:30 AM - 12:00 PM
Limitations In Knowledge And Practice Of Healthy Lifestyle Guidelines In A Sample Of Australian Adults.

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PURPOSE: Cardiovascular disease (CVD) is the leading cause of death in Australia. Physical activity (PA), optimal sleep, ample fruit/vegetable consumption, reduced screen time, limited alcohol consumption and not smoking are all protective against CVD, however, evidence shows that knowledge of Australian health guidelines and engagement in healthy behaviors is less than sufficient. We aimed to identify knowledge and engagement in 6 lifestyle behaviors in a convenience sample of Australian adults. **METHODS:** Australian adults (>18 years) were invited through social media to complete an online anonymous survey via Survey Monkey assessing healthy lifestyle behavior choices and knowledge of Australian health guidelines. Data were reported as means and standard deviation or percentages. Simple linear regressions were performed to identify any significant associations between knowledge and practice. **RESULTS:** Australian adults (n=219; 69% female; M=30±14; range 18-73) completed the survey. Only 26% of the sample knew and self-reported BMI (M=23.00±5.7) and only 32% of the sample reported their health as very good or excellent. Correct knowledge of individual health guidelines was 67% PA, 61% sleep, 42% fruit and 41% vegetable consumption, 30% screen time, and 29% alcohol, of which 30%, 84%, 23%, 16%, 21%, 53% met the guidelines respectively. Eighty percent of the sample reported smoking as harmful; however, only 28% of the sample had not smoked in the prior 6 months. Alarming, on average participants reported spending 8.6±4.2 hours/day watching a screen and sat for 8.4±3.6 hours/day. Knowledge of the guidelines was associated with adherence to the guidelines for moderate PA (r=0.22; p<0.01), sleep (r=0.15; p=0.04) and fruit (r=0.41; p<0.01) and vegetable (r=0.38; p<0.01) intake. **CONCLUSIONS:** On average, less than 50% of this sample of the Australian adult population are aware of the national guidelines for 4 out of 6 healthy lifestyle behaviors and less than 30% meet the national health guidelines for PA, screen time and fruit/vegetable consumption. Moreover, greater than 70% of the sample have smoked or tried smoking in the past 6 months. More research is needed to identify ways to not only help Australians become more aware of the individual health behavior guidelines but also to improve healthy lifestyle choices.

1622 Board #216 May 28 10:30 AM - 12:00 PM
Barriers To The Practice Of Physical Activity Among Adults According To Socioeconomic Status In Chile

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PURPOSE: to identify personal and environmental barriers for physical activity practice and the stage of change in residents of communes with three different socioeconomic status (SES). **METHODS:** Cross-sectional analytical study. Three communes of the city of Santiago de Chile with high, medium and low SES were selected. The stage of behavior change was determined with the “Physical Activity Stages of Change Questionnaire” and the barriers for physical activity practice through the “Barriers to Being Active Quiz”. The precontemplation, contemplation and preparation stages were grouped as inactive state, and the action, maintenance as active state. The barriers were compared between communes and associated with the inactive state with a multivariate regression. **RESULTS:** 296 participants were surveyed, age = 49 (P₂₅ = 37-P₇₅ = 57) years, 60.1% women. In an inactive state, 48.5% in high SES, 60% in medium SES and 63.1% in low SES. The most prevalent barrier to physical activity according to SES was: lack of

time for high SES (74.2%); lack of will for medium SES (62%) and lack of resources for low SES (59.2%). The lack of skills is the only barrier that presents a significant difference $p < 0.05$ among all communes, 31.8% high SES, 46% medium SES and 19.2% low SES. The lack of skills presented an OR 1.15 (1.02-1.31) $p = 0.025$ for the inactive state in a multivariate analysis.

CONCLUSIONS: the barriers to practice physical activity differ according to SES and can be a guide for personal and environmental interventions. Overcoming the lack of skills barrier could increase the active subjects.

1623 Board #217 May 28 10:30 AM - 12:00 PM

Associations Of Occupational And Leisure-time Physical Activity With Cardiovascular Disease

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PURPOSE: Emerging evidence describes opposing effects of occupational and leisure-time physical activity (LTPA) on cardiovascular health although little research has been done in the U.S. This analysis examines cardiovascular disease (CVD) prevalence associated with occupational physical activity and LTPA in a nationally representative U.S. sample. **METHODS:** This is a cross-sectional analysis of the 2015 National Health Interview Survey (NHIS) data and its occupational health supplement from the National Institute for Occupational Safety and Health (NIOSH) (n=19,429). Logistic regression estimated the odds of self-reported composite CVD (coronary heart disease, heart attack, stroke, or angina) with self-reported total occupational activity (TOA), occupational exertion (OE), occupational standing (OS), and LTPA. Occupational activity was measured using two questions: "How often does your job involve repeated lifting, pushing, pulling, or bending?" (OE) and "How often does your job involve standing or walking around?" (OS) where participants responded to a 5-item Likert scale (0=Never, 4=Always). Total occupational activity (TOA) was categorized similarly after summing the individual OE and OS scores. LTPA was defined as three categories: 0, 1-149, or ≥ 150 minutes/week of reported moderate-to-vigorous activity. Additional analyses were stratified by sex, smoking status, and LTPA level. All models were adjusted for age, sex, race/ethnicity, smoking status, alcohol consumption, family income, body mass index, education, U.S. nativity, LTPA, and TOA. **RESULTS:** "Always" performing TOA, OE, and OS was associated with higher odds for CVD, compared to "never" (OR=1.65, $p=0.026$, OR=1.63, $p=0.003$, and OR=1.56, $p=0.031$, respectively). LTPA level was not associated with odds of CVD ($p > 0.05$). Associations of high OE with CVD outcomes were equally apparent in females and males and stronger in lower LTPA levels. Associations between TOA, OE, and OS with CVD were stronger in the sample restricted to never smokers. **CONCLUSIONS:** While LTPA was not associated, individuals with higher TOA, OE, and OS had higher rates of CVD. While uncontrolled confounding is still possible even after adjustment, the seemingly paradoxical adverse associations with occupational activity and CVD should be investigated further.

1624 Board #218 May 28 10:30 AM - 12:00 PM

Menstrual Cycle Symptoms In 6,812 Exercising Women And The Development Of A Novel Symptom Score

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PURPOSE: More than half of athletes report detrimental effects on exercise caused by their menstrual cycle. However, the specific menstrual cycle symptoms experienced by exercising women, and a means to quantify occurrence and prevalence of symptoms is lacking. Therefore, we aimed to: identify the most common menstrual cycle symptoms experienced; devise a way to quantify symptoms; and to ascertain the impact of that they have on both exercise and work behaviours. **METHODS:** 6,812 women using an exercise tracking app of a reproductive age who were not using combined hormonal contraception from 7 geographical regions (Brazil, n=1,288; France, n=1,911; Germany, n=1,178; Spain, n=1,204; UK & Ireland, n=2,311; and USA, n=2,479) completed a 39-part questionnaire, translated and localised to each geographical region. The questionnaire captured current and previous exercise behaviours; current menstrual status; the presence of, and frequency of symptoms; use of medication

for symptoms; effects of the menstrual cycle on exercise and work behaviours; and hormonal contraception use. A menstrual cycle symptom score (MCSS) was defined based on the presence and frequency of 18 commonly reported symptoms.

RESULTS: The most frequent symptoms reported included mood changes/anxiety (90.6%), tiredness/fatigue (86.2%), stomach cramps (84.2%), and breast pain/tenderness (83.1%). Participants in Germany and France had a significantly lower MCSS and reported fewer MCSS than those in Spain, the UK & Ireland, the USA and Brazil ($p < 0.05$). After controlling for BMI, training volume and age, those participating in running ($p=0.038$), swimming ($p=0.033$), cycling ($p=0.001$), team sports ($p=0.027$), racket sports ($p=0.010$), and dance ($p=0.001$) had a lower MCSS. While participation in gym-based activities ($p=0.023$) and weight training ($p < 0.005$) were associated with a higher MCSS. Total MCSS was correlated with a greater need to miss or change training ($r=0.44$; $p < 0.0005$) and work/academic absenteeism ($r=0.31$; $p=0.001$).

CONCLUSIONS: Menstrual cycle symptoms are common in exercising women and can have a detrimental effect on elements of health and wellbeing. The derivation of a MCSS enables an easy way to quantify menstrual cycle symptoms. Future research needs to investigate risk factors and non-pharmacological treatment options.

1625 Board #219 May 28 10:30 AM - 12:00 PM

Gender As A Determinate Of Exercise Type Preference

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(No relevant relationships reported)

Regular physical activity decreases the risk for many diseases such as obesity, stroke, osteoporosis, type 2 diabetes, and certain types of cancer. Garber and colleagues (2011) found that the health benefits from exercise depend not only the duration and amount of exercise but also on the type of exercise, indicating that cross training athletes experience the most benefits. Despite health benefits of cross training many athletes tend to abide by either aerobic or weight training regimes. **Purpose:** To investigate the predictability of gender differences on type of exercise equipment preference at one university gym. **Methods:** A small gym with both cardiovascular and weight training equipment, easily observable from a single concealed location, was selected. Two pairs of observers each collected data, participants were assigned as the first 25 people (n females, n males) to walk into the exercise area from the locker rooms or stairwell. Participants were coded as participating in either cardiovascular exercise, strength training exercise, or both and were observed until they left the gym. This process was repeated on different days at varying times for a total n=150. A Chi-square analysis was used to determine correlation of gender and exercise type. **Results:** Pairs of observers demonstrated inter-rater reliability on the "exercise type" measure, Pair 1, gamma=1; Pair 2, gamma=1. The overall sample size for this study was N=150 (female n=68, male n=82). The female participants showed a preference for cardiovascular exercise with n=40 participating in cardiovascular exercise only. Male participants showed a preference for strength training exercise with n=48 completing exclusively strength training while n=15 participated in cardiovascular training only. Both males and females had similar amounts of cross training with 19 of the men and 14 of the women participating in this type of exercise. The study revealed a significant predictive relationship between gender and exercise type completed $p = 5.13 \times 10^{-8}$. **Conclusion:** Gender is a predictive factor of the type of exercises and equipment individuals use in a college campus gym setting. This information may be beneficial when prescribing exercise regimes and educating individuals on health benefits of exercise and further investigating social determinants of health.

1626 Board #220 May 28 10:30 AM - 12:00 PM

Associations Of Lifestyle Behaviors With Body Mass Index In Adolescents: A Quantile Regression Analysis

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PURPOSE: The purpose of this study was to examine the associations between lifestyle behavior variables such as physical activity, television watching, computer use, and school night sleep duration with Body Mass Index percentile (BMI%) using quantile regression within a representative sample of adolescents who completed the 2017 US National Youth Risk Behavior Survey (YRBS).

METHODS: A multi-stage cluster sampling procedure obtained a representative sample of US adolescents. The target population consisted of public and private high schoolers from grades 9 through 12. The number of sampled adolescents submitting questionnaires with BMI% data was 13,146. To examine the associations between lifestyle behaviors and BMI%, simultaneous quantile regression was employed. Relationships were modeled at 10 percentile increments and examined independent variables on the continuous measurement scale to determine how the parameter estimates (b-coefficients) vary across percentiles. Post hoc analysis involved modeling the relationships across BMI%'s interquartile range, specifically at the 25th, 50th, and 75th percentiles, in addition to using independent variables treated on the categorical measurement scale.

RESULTS: When relationships were modeled at every 10th percentile, more precise parameter estimates were observed at higher percentiles. Across the interquartile range, physical activity associated with lower BMI% at the 50th and 75th percentiles ($b_{\text{range}} = -2.27\%$ to -5.24% , $p < 0.05$), television watching associated with higher BMI% at the 25th to 75th percentiles ($b_{\text{range}} = 2.29\%$ to 4.16% , $p < 0.05$), sleep durations less than 8 hours per school night associated with higher BMI% at the 25th and 50th percentile ($b_{\text{range}} = 2.81\%$ to 8.26% , $p < 0.05$), and 10 or more hours of school night sleep associated with higher BMI% at the 50th and 75th percentile ($b_{\text{range}} = 3.43\%$ to 7.53% , $p < 0.05$). **CONCLUSIONS:** Higher levels of physical activity associated with lower BMI% and longer time watching television, school night sleep durations less than 8 hours, and school night sleep durations of 10 hours or more at higher quantiles associated with higher BMI% in adolescents. Estimates of association were more precise within higher quantiles.

1627 Board #221 May 28 10:30 AM - 12:00 PM
Occupational Sitting And Work Engagement Among University Faculty And Staff

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Acute periods of sedentary behavior, particularly uninterrupted sitting, can negatively affect physiological outcomes (e.g., reduction in blood flow, endothelial dysfunction, and arterial stiffness) related to cardiovascular disease development. This is of importance, given that many occupations require their employees to sit for extended periods of time (i.e., 6-8 hours). For example, evidence suggests that university employees spend a majority of their time sitting; however, little is known about the relationship between sedentary behavior and work engagement in this population. **PURPOSE:** To determine the relation between occupational sitting and work engagement among university employees. **METHODS:** Participants included 103 university employees (mean age 48.5±10.4 years, 80% female, 77% staff), who completed an online survey based on the Utrecht Work Engagement Survey (UWES) and the Occupational Sitting and Physical Activity Questionnaire (OSPAQ). The UWES assessed elements of work engagement (vigor, absorption, dedication) and workplace well-being. The OSPAQ assessed time spent sitting, standing, walking, and in heavy labor during a typical workday in the previous 7 days. **RESULTS:** Compared to staff members, faculty members self-reported less time seated during the workday (373.8±109.7 min/day vs. 321.1±97.3 min/day, $p = 0.03$). Elements of work engagement were comparable among faculty and staff members (vigor: $p = 0.44$; absorption: $p = 0.68$; dedication: $p = 0.71$). After adjusting for covariates, associations of work engagement with occupational sitting were not significant. **CONCLUSIONS:** These pilot findings suggest that university staff members tend to engage in more occupational sitting compared to faculty members. However, being absorbed and engaged at work is not associated with occupational sitting.

1628 Board #222 May 28 10:30 AM - 12:00 PM
Physical Activity And Bullying In Adolescents With Overweight And Obesity

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Adolescents with overweight and obesity, are more likely that their healthy weight peers to experience bullying behaviors; including, being a bully victim and both a bully perpetrator and victim. However, it is unknown whether engagement in physical activity (PA) is associated with bullying behaviors in this population. **PURPOSE:** To examine associations between bullying behaviors (perpetrator, victim, both, or neither) and PA. **METHODS:** Analyses included 9,114 (56% male) adolescents classified as overweight or obese, ages 10-17 years (mean 13.6 ± 2.3 years), from the 2016-17 National Survey of Children's Health. Adolescents were grouped into categories based on PA frequency (≥ 60 minutes): none, 1-3 days/week, 4-6 days/week, or daily. Outcomes included bullying behaviors: neither perpetrator nor victim of bullying, bully perpetrator, bully victim, or both bully perpetrator and victim. Logistic regression models, adjusted for age, sex, household income, education, and comorbid ADHD assessed the odds of each outcome comparing PA categories. **RESULTS:** Overall, approximately 13% of adolescents with overweight and obesity engaged in no PA throughout the week, 45% engaged in 1-3 days, 28% engaged in 4-6 days, and 14% engaged in daily PA. Compared to their inactive peers with overweight and obesity, adolescents with overweight and obesity that engaged in PA were less likely to be victims of bullying: 30% less likely for 1-3 days/week, 58% less likely for 4-6 days/week, and 61% less likely for daily PA ($p \leq 0.05$). Further, adolescents who engaged in PA were less likely to be both a bully perpetrator and victim compared to their inactive peers with overweight and obesity. Adolescents who engaged PA were 46%, 65%, and 71% less likely to be both a bully perpetrator and victim for 1-3 days/week, 4-6 days/week and daily PA, respectively in comparison to their inactive peers ($p \leq$

< 0.05). **CONCLUSIONS:** Adolescents with overweight and obesity, who engage in PA, are less likely to experience bullying behaviors than their inactive peers with overweight and obesity. This suggests that PA may be protective against engagement in bullying victimization as well as co-occurring bully perpetration and victimization.

1629 Board #223 May 28 10:30 AM - 12:00 PM
Association Between Chronic Diseases, Sports Participation And Obesity: Findings From A Brazilian Longitudinal Study

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PURPOSE: To analyze the association between leisure-time physical activity (specifically sports participation), obesity and the incidence of chronic diseases among Brazilian adults. **METHODS:** The sample was composed of 620 adults (166 males and 454 females) aged 50 years or older followed from 2010 to 2014 in the city of Bauru, Sao Paulo, Brazil. Physical activity was assessed using a questionnaire (Baecke et al. Am J Clin Nutr, 1982 [face-to-face interview]) and subjects were stratified according to the engagement in sports in leisure-time (180 minutes/week over the last four months) as: Engaged (n= 99) and Non-engaged (n= 521). Body mass index (kg/m²) was used as diagnosis of obesity (BMI ≥30). Sports participation and obesity were combined and participants were stratified as follow: Obese/Non-sport (n= 230), Obese/Sport (n= 33), Non-obese/Non-sport (n= 291) and Non-obese/Sport (n= 66). The incidence of new cases of arterial hypertension, dyslipidemia and diabetes mellitus were verified through medical records. Chi-squared test for linear trend analyzed associations and statistical significance was set as p-value <5%. **RESULTS:** The incidence of arterial hypertension was not associated with the combination of sports participation and obesity (p-value= 0.853). However, the incidence of new cases of dyslipidemia (Obese/Non-engaged [37.8%], Obese/Engaged [30.3%], Non-obese/Non-engaged [27.8%] and Non-obese/Engaged [22.7%]; p-value= 0.004) and diabetes mellitus (Obese/Non-engaged [15.2%], Obese/Engaged [12.1%], Non-obese/Non-engaged [8.6%] and Non-obese/Engaged [6.1%]; p-value= 0.006) were associated with the lack of sports participation and obesity. **CONCLUSION:** There was an association between non-engagement in sports, obesity, and the incidence of dyslipidemia and diabetes mellitus among Brazilian adults. This finding highlight the importance of public health actions promoting healthy behaviors aiming the prevention of chronic diseases, especially in countries with universal health systems. Supported by the Sao Paulo Research Foundation (FAPESP), process number: 2018/01744-7 and CAPES.

1630 Board #224 May 28 10:30 AM - 12:00 PM
Relation Between Physical Activity, Sedentary Behavior And Chronic Disease Risk Factors Using Principal Component Analysis.

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INTRODUCTION: The overall health status of individual's with chronic disease (CD) are positively and negatively affected by physical activity (PA) and sedentary behavior (SB), respectively. The purpose of this study was to examine the relation between PA, SB and selected indices of health in a diverse CD population using a principal component analysis (PCA). **METHODS:** Participants (n=237, 54.4% female, age (mean±SD) 62.2±11.1 yr) were recruited at induction to a community-based exercise program for CD. Primary CD included cardiovascular (n=101), respiratory (n=48), cancer (n=80), diabetes (n=34), arthritis (n=26) and unclassified (n=78). BMI and waist to hip ratio (WHR) were measured and calculated using standard procedures. Upper and lower body strength, flexibility and cardiorespiratory fitness were assessed using a hand-grip test, sit-to-stand test (STS), sit and reach test (SRT), and 6-min time trial (6MTT), respectively. PA and SB were recorded using an activPAL³ micro accelerometer. QoL was assessed using the EQ5D VAS and the PHQ8. Fasting serum levels of glucose, triglycerides, HDL-C, LDL-C and CRP were measured. Blood pressure (BP) was measured using a 24-hour ambulatory BP monitor. ActivPAL generated PA and SB variables were analyzed using PCA. General linear models were used to investigate the association between PA and SB and indices of health. **RESULTS:** PCA analysis of sedentary time, standing time, stepping time,

LIPA, MVPA, step count, sedentary bout lengths and total number of sedentary bouts generated three distinct factor; i) prolonged sedentary behavior (PSB), ii) physical activity (PA), and iii) broken sedentary behavior (BSB). The three derived variables account for 86% of the total variance in PA and SB. There was a significant main effect for PSB on LDL-C ($F(1,189) = 9.06$) and PHQ8 scores ($F(1,162) = 6.82$). There was a significant main effect for PA on BMI ($F(1,199) = 14.48$), WHR ($F(1,199) = 5.77$), STS ($F(1,222) = 77.08$), 6 MTT ($F(1,222) = 77.08$), EQ5D VAS ($F(1,162) = 14.13$), triglycerides ($F(1,188) = 4.95$), CRP ($F(1,155) = 4.28$), and systolic BP ($F(1,199) = 4.94$). There was a significant main effect for BSB on HDL cholesterol ($F(1,188) = 6.25$). **CONCLUSIONS:**

The PCA derived factors PSB, PA and BSB are associated with established disease risk factors in patients with CD

1631 Board #225 May 28 10:30 AM - 12:00 PM
Personal Social Capital And Health: Exploring The Role Of Physical Activity And Socioeconomic Status

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Personal social capital (PSC), which refers to the scope and quality of individual's social networks within a community, has received an increasing attention as a potential sociological factor associated with better individual health; yet, the mechanism relating PSC to health is still poorly understood. **PURPOSE:** This study examined the associations between PSC and self-rated health (SRH) while exploring the mediating and/or moderating roles of leisure time physical activity (LTPA) and socioeconomic status (SES) among middle-aged and older adults. **METHODS:** Cross-sectional data were collected from 677 adults aged ≥ 40 years old using the Qualtrics survey panel. PSC scale was used to measure bonding and bridging SC and SRH was assessed by a single item with a 5-point Likert scale. The International Physical Activity Questionnaire was used to assess LTPA levels by categorizing individuals into no-, low-, and high-LTPA groups. SES variables included education level (EL), household income (HI), and home ownership (HO). Hierarchical multiple logistic regression models were established in which a set of independent variables was sequentially added in order to examine the independent, mediating and moderating effects of PSC, LTPA, and SES. Odds ratio (OR) predicting the likelihood of reporting good SRH was reported along with 95% confidence interval (CI). **RESULTS:** Overall, a greater bonding score was significantly associated with greater odds for reporting good SRH before and after controlling for LTPA and other covariates (OR=1.14; 95% CI = 1.05, 1.24). The inclusion of HI and HO attenuated the association of PSC with SRH, implying modest evidence for mediation effects; yet, no such effect was found for EL. However, LTPA was still independently associated with SRH in the full model. The additional moderation analyses indicated varying mediation effects according to EL (i.e., part mediation was found among low- and medium-level of education groups, whereas no mediation appeared among upper-level of education group). **CONCLUSIONS:** Findings suggest that PSC and LTPA are associated with better SRH. However, depending on the EL, the beneficial influences of PSC are partly mediated by HI and HO. Hence, health policymakers can address both SC and PA for enhancing health but may need to consider SES background.

1632 Board #226 May 28 10:30 AM - 12:00 PM
Sustainability Strategies Of A 3-week Preventive Measure In Patients With Knee Osteoarthritis

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(No relevant relationships reported)

Knee osteoarthritis as a degenerative joint disease is particularly relevant for occupational groups whose activities are associated with high loads or unfavorable postures over long periods of time. In the sense of effective secondary prevention, the BG Trauma Hospital of Hamburg uses a multimodal therapy concept, the so-called Kniekolleg. Data are now available for a two-year follow-up so that not only acute effects of the three-week start-up intervention, but also sustainability effects for long-term exercise adherence after two refresher courses, each after 12 month, can be reported.

Purpose: Craftsmen and workers in the construction industry are at an increased risk of developing knee osteoarthritis due to their work-related burdens. In order to maintain the ability to work, occupational co-operative measures for secondary prevention can be carried out (Kniekolleg). The aim was to evaluate the efficacy after two years, depending on the degree of exercise adherence. **Methods:** In a repeated measurements design (T1 before, T2 after Kniekolleg, T3 after one year (first refresher), T4 after two years (second refresher)), 140 construction patients were assessed for their dynamic muscular strength (knee extension, 60°/s), their quality of

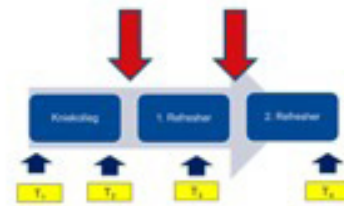
life (SF-36) and their characteristics for knee osteoarthritis (WOMAC). They were evaluated using analyses of variances, whereby one group trained after the Kniekolleg in the gym with instruction (G1 n=63), one group completed a home training program (G2 n=38) and one group did not train (G3 n=39).

Results: For all parameters, significant acute efficacy and 2-year sustainability effects were observed ($p \leq 0.05$, d: 0.2-0.8). There was no interaction with adherence during training after the Kniekolleg ($p > 0.05$). **Conclusion:** The Kniekolleg has proved to be effective in the long term, with a critical questioning of future research, why there are no differences between guided, reduced or even missing long-term maintenance training.

• G1: KK + 12 month fitness studio + 1.Rf + 12 m.f.s. + 2.Rf

• G2: KK + individual home training program + 1.Rf + 1.h.t.p. + 2.Rf

• G3: KK + no sport + 1.Rf + no sport + 2.Rf



C-43 Free Communication/Poster - Physical Activity Interventions I

Thursday, May 28, 2020, 9:30 AM - 12:00 PM

Room: CC-Exhibit Hall

1633 Board #227 May 28 10:30 AM - 12:00 PM
Just How Credible Is Online Physical Activity Advice? Investigating Kinesiology Knowledge Translation In Lay Resources

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PURPOSE: In the U.S. and globally, adults independently seek out online advice to support their personal health and fitness goals. In this study, we examined web articles specific to physical activity promotion. Our objectives were to determine the rate that web articles at least once provided advice consistent with national physical activity guidelines (PAGs) and determine if consistency with PAGs varied on the basis of production source (i.e., commercial, governmental, professional association, or voluntary health agency). **METHODS:** The Google search engine was used to locate free-to-access web articles focused on physical activity promotion, written in English, and used text as the main communication medium. Valid lay search strategies independently reviewed by three experts were used. The 2008 *Physical Activity Guidelines for Americans* 18 to 64 years of age were used to appraise the credibility of messages. Seventeen potential PAGs were referenced. **RESULTS:** A sample of 72 web articles published or updated between 2008 and 2018 was obtained ($M = 2016.34$, $SD = 2.02$). All web articles that comprised the sample presented PAG-related messages. The percent of the sample that lacked at least one consistent message ranged from 61.1% to 100% across the 17 PAGs. The level of inconsistency was significant for 15 PAGs, all $p < .05$. Production source was associated with consistency for five PAGs, all related to aerobic (endurance) physical activity, $p \leq .05$, Cramer's $V \geq .30$. For the remaining 12 PAGs, the rate of consistency was equivalent across the production source groups, $p > .05$, Cramer's $V = .11-.26$. Message consistency was lowest with guidelines for adults who have sedentary or modestly active lifestyles, $M \approx 3\%$ of the study sample. **CONCLUSION:** Knowledge translation of physical activity guidelines is low in free online resources that lay adults may independently locate. This observation was irrespective of production source. The implications of this study's results will be discussed, including ways that they pertain to ACSM's *National Roadmap to Improve Equity in Physical Activity Participation*. In consideration of this study's findings, as well as broader knowledge translation issues that have been raised by others, including in other countries (e.g., Canada), recommendations for future research will be provided.

1634 Board #228 May 28 10:30 AM - 12:00 PM
Does Current Activity Status Impact Goal Recommendation Adherence In A Worksite Walking Intervention?

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Goal setting is a common motivational behavior change technique used by individuals trying to increase their current physical activity levels. However, it can be difficult for people to set realistic goals based on their current and past activity experiences.

PURPOSE: To examine if adherence to goal setting recommendations differ between active versus inactive individuals. **METHODS:** Adult participants (N=38) enrolled in a four-week worksite walking intervention completed a demographic and stage of change questionnaires. Active (n=14) and inactive (n=24) participants wore blinded accelerometers for 7 days to obtain baseline average daily step counts. Participants reviewed baseline numbers with a researcher to determine daily step goals for each week of the intervention. First, participants were informed that setting daily goals to increase 10% each week from baseline is recommended for safe and effective step increases. Then participants were able to choose their daily step goals for each week of the intervention. Goals set by participants in Week 1 were used to examine if activity status influenced adherence to the 10% step increase recommendation. **RESULTS:** A one-way between subjects ANOVA was conducted to compare the effect of activity status on Week 1 goal setting in active and inactive participants. There was a significant effect of activity status on Week 1 goal setting at the $p \leq .05$ level for the two conditions [$F(1, 36) = 4.834, p = 0.034$]. Post hoc comparisons using the Tukey HSD test indicated that the mean score for inactive participants ($M = 701.74, SD = 1397.81$) was significantly different than active participants ($M = -242.59, SD = 1029.58$). **CONCLUSION:** Participants who were currently inactive set their goals higher than the recommended 10% increase from baseline for Week 1 while participants currently active set their goals lower than the recommendation. Goal setting should be realistic but challenging and activity status may impact a client's desire to adhere to suggested recommendations. Considering a client's current physical activity status may be valuable to consider when advising during the goal setting process and can be applied for a beneficial rehabilitation or exercise program.

1635 Board #229 May 28 10:30 AM - 12:00 PM
Effects Of A Multi-ingredient Dietary Supplement And Tai Chi On Physical Function In Adults

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PURPOSE: To examine the effects of a 12-week multi-ingredient dietary supplementation (MIDS) or Tai Chi training on physical function compared to a placebo in middle-aged and older adults.

METHODS: In a randomized, double-blind, placebo-controlled design, seventy-five men and postmenopausal women aged 45-75 years were randomly assigned to one of three experimental groups: 1) MIDS (n=30), 2) placebo tablet (PL, n=30), or 3) Tai Chi training (EX, n=15). The supplementation groups took one tablet daily (MIDS or PL), while the EX group performed a 24-form Yang Tai Chi exercise program (1hr/session, 3x/week) for 12 weeks. Physical function was assessed using Tandem Romberg test, single leg stance (SLS) test, dynamic balance test via Biodex Balance System (BBS), timed up and go test (TUG), and functional reach test (FRT) pre- and post-intervention. Data were analyzed with a 3x2 mixed ANOVA and Bonferroni pair-wise comparisons. Significance was accepted $p \leq .05$.

RESULTS: In TUG test, there was a significant group x time interaction, as the EX group improved significantly more than the PL group (EX: 8.07 ± 1.18 to 7.08 ± 0.80 s vs. PL: 8.19 ± 1.32 to 8.16 ± 1.36 s). There were significant main time effects in both BBS dynamic test level 2 anterior/posterior scores (EX: 7.94 ± 4.78 to 3.31 ± 1.51 AU, +58.43%), and TUG test (EX: 8.07 ± 1.18 to 7.08 ± 0.80 s, -14%). In addition, the EX group showed significant improvements in SLS from pre- to post-intervention (7.57 ± 7.31 to 13.31 ± 14.25 s, +43.13%). Both the MIDS and EX groups had a significant main time effect in physical health scores in the SF-36 survey (MIDS: 81.6 ± 13.0 to 85.7 ± 10.7 , +5%, EX: 79.0 ± 18.6 to 86.1 ± 13.3 , +9%) after the interventions. The PL group remained unchanged in aforementioned physical function tests.

CONCLUSIONS: In middle-aged and older adults, 12 weeks of Tai Chi exercise improved both static and dynamic balance ability, which is essential in reducing the risk of falls. Tai Chi exercise also significantly improved TUG scores, which indicates

advantageous effects on gait and strength. Both the MIDS and Tai Chi interventions improved self-perception of health status, suggesting beneficial effects on the quality of life. Overall, both MIDS and Tai Chi can be beneficial to physical function and quality of life in older adults.

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1636 Board #230 May 28 10:30 AM - 12:00 PM
Short-term Run Sit Improves Cardiovascular Health But Does Not Affect Body Composition In Undergraduate Students

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The population around the world indicates that lack of time is the principal barrier to practice physical activity (PA). This perception is preponderant in undergraduate students (UE). The UE is a population characterized by show high levels of psychological stress and low PA levels; these conditions increase the risk to suffer metabolic diseases. The Sprint interval training (SIT) is a training modality that show an efficient time to modify cardiovascular variables and body composition in healthy, unhealthy population and athletes. However, the impact of SIT on UE is not completely catheterized. **Purpose:** To characterize the cardiovascular and anthropometric effects of short-term running SIT in UE. **Methods:** 19 physically active males UE (age: 22 ± 2 yrs; weight: 67 ± 6.3 kg; height: 1.7 ± 0.07 m) participated in this study. They were randomly assigned to control (CON) (n=9) or SIT (n=10). After baseline parameters (systolic and diastolic blood pressure -SBP and DBP-, resting heart rate (HR_{rest}), resting double product (DP)) and body composition measurements were obtained, both groups performed a graded exercise test to determine VO_{2max} and the running speed associated with their VO_{2max} (VO_{2peak}). The exercise protocol consisted of 12 sessions (For sessions 1-3, participants ran at 100% VO_{2peak} with recovery periods at 40% sVO_{2peak} , with interval ratios of 2:2 min for a total of three intervals; For sessions 4-7, the interval ratio was 2:1 min with 4 intervals and finally from the 8 to 12 session, the interval ratio was 2:1 with 5 intervals). Baseline cardiovascular, and body composition were repeated within 2 days post-intervention. **Results:** Body composition did not change significantly by group or over time. In the SIT group, HR_{rest} was significantly lower after training ($p = 0.018$). Resting SBP and DP were also decreased in the SIT group compared to CON ($p < 0.05$). **Conclusions:** The data presented in the current study indicate that resting hemodynamic variables are improved by short-term run SIT in active males UE. Thus, the running SIT could be an alternative model of training with lower volume of activity for the improvement of cardiovascular health in UE. Further studies are necessary to establish the impact of the gender in response to run SIT.

1637 Board #231 May 28 10:30 AM - 12:00 PM
The Energy Cost Of Successive Match Play Events For The Singaporean Men's Walking Football Team

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Competitive walking football, an international sport that is less than 10 years old, has great potential to help address the international problems of sedentarism and obesity as a unique form of team-based competitive exercise. While recent research has documented the energy cost of women engaged in match play walking football (Heil et al. IJPEFS 2017), no such data yet exists for men's teams. **PURPOSE:** This study sought to characterize the metabolic intensity of match play walking football for one men's team during successive matches at the 2019 International Walking Football Federation World Cup competition. It was hypothesized that metabolic intensity (i.e., metabolic equivalents, or METs) during match play would meet or exceed the established thresholds for improving physical health and disease risk (≥ 3.0 METs). **METHODS:** The Singaporean men's team (Mean \pm SD: 58 ± 6 yrs age; 26.6 ± 5.4 kg/m² BMI; n=9) was monitored during a semi-structured warm-up (WU) and then during 7 successive 15-min competitive matches (M1-M7), all of which happened during a single day. All matches were played at the Leyton Orient outdoor football stadium (East London, England) that was split into four regulation mid-sized fields (40 m x 20 m) under warm and mildly humid ambient conditions ($79-81^\circ F$; 38-43%). Predicted METs were derived from accelerometry-based activity monitors (AM) that were worn by each player within a neoprene waist pack. The AM data were later downloaded,

transformed to units of energy expenditure, and then converted to METs using standard algorithms. A one-sample t-test was used to compare each mean predicted MET value (WU + M1-M7) to the 3.0 MET threshold and a Bonferroni corrected alpha of 0.006 (0.05 overall alpha). RESULTS: Average MET values for the WU (Mean±SE: 4.3±0.06 METs), as well as all seven matches (M1: 4.3±0.09, M2: 4.1±0.07, M3: 4.2±0.09, M4: 4.4±0.10, M5: 3.9±0.12, M6: 3.9±0.14, M7: 4.1±0.10 METs, respectively) exceeded the 3.0 MET threshold ($P<0.001$). CONCLUSIONS: The results of this study support previous research with women's walking football that the metabolic intensity of competitive walking football typically meets or exceeds the 3.0 MET threshold for promoting positive changes in both metabolic fitness and cardiovascular health risk. Support provided by Edith Cowen University to the lead author.

1638 Board #232 May 28 10:30 AM - 12:00 PM
Chronic Lower Back Pain And Hamstring Flexibility From A Population In An Urban Midwestern University

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Introduction: Chronic lower back pain (CLBP) is defined as pain, muscle tension, or stiffness localized at the lumbar region that persists for 12 weeks or more (Chou, R. 2011). It can be caused by tight hamstrings in both active and inactive people. Studies suggest that stretching the hamstrings improves pain and flexibility in adults (Lee, 2014, Sattar, 2015, Gordon, 2016). It is not known if a flexibility training intervention would have similar effects in faculty, staff, and students in a Midwestern University.

Purpose: To investigate the effects of a 6-week static stretching intervention on perceived pain and sit and reach scores, as surrogate measurements of hamstring flexibility and CLBP risk in faculty, staff, and students at an Urban Midwestern University. **Methods:** Participants ($n=41$) were recruited and consented to participate in this study. Males had an average age of 31 years ($n=12$, $SD=13.8$) and females 33 years ($n=29$, $SD=13.4$). At the initial visit, flexibility was tested by performing the sit and reach test. Perceived pain was assessed using a pain scale between 1-10. Participants were then taught an at-home hamstring flexibility protocol to complete 3 days a week for 6 weeks. Check-ins for reassessment occurred at 3 and 6 weeks. **Results:** Baseline mean score in sit and reach of CLBP group was 28.0 cm ($SD=10.1$) and control group was 27.3 cm ($SD=10.5$). At week 3, CLBP scored a mean of 29.3 cm ($SD=11.2$) and controls scored 26.9 cm ($SD=7.5$), indicating 8.9% and 5.9% flexibility increases, respectively. At week 6, only 9 individuals from CLBP continued and scored a mean of 32.2 cm ($SD=10.8$), representing a 6.85% flexibility increase, but it was not significant ($p=0.07$). Mean baseline pain score for CLBP group was 3.3 ($SD=1.2$) and for controls was 1 ($SD=0.7$). At week 3, participants in the CLBP group scored a 3 ($SD=1.6$) - a 10% reduction in pain - and the controls scored 1 ($SD=0.5$). At week 6, only 9 individuals from CLBP continued and scored a 1.88 ($SD=0.64$), representing a decrease in pain by 43%. Changes were not significant ($p=0.06$). **Conclusion:** Following a 6 week stretching protocol, participants in the CLBP group tended to have reduced perceived pain and increased flexibility, as assessed by the sit and reach test, suggesting that static stretching protocols may be an important part of CLBP management.

1639 Board #233 May 28 10:30 AM - 12:00 PM
Change In Perceived Barriers To Physical Activity In A Weight Loss Intervention

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 (No relevant relationships reported)

Physical activity (PA) is an important aspect of behavioral weight loss programs, but the adoption of PA behavior is incumbent on overcoming individual level barriers. It is unclear whether perceptions of barriers change through the course of a behavioral weight loss intervention, or whether the dose of prescribed PA impacts perceived barriers.

Purpose: To investigate the change in perceived PA barriers within a 12-month behavioral weight loss intervention with differing doses of prescribed PA. **Methods:** 383 adults with overweight or obesity (age=46.2±7.7 years; BMI=32.1±3.8 kg/m²) were randomized into one of three 12-month intervention groups: Diet alone (DIET, $n=127$, no prescribed PA); Diet plus Moderate Dose PA (DIET+MOD, $n=127$, 150 min/week prescribed PA); Diet plus High Dose PA (DIET+HIGH, $n=129$, 250 min/week prescribed PA). All intervention conditions received the same prescribed diet (1200-1800 kcal/day) and behavioral intervention. Perceived PA barriers were assessed at baseline, 6 months, and 12 months. Barriers were analyzed on a Likert scale (1=strongly disagree; 5=strongly agree) as Total barriers and three subcategories of Time (e.g., too busy), Effort (e.g., lack of motivation), and Obstacles (e.g., family obligations) barriers.

Results: There was significant weight loss in all intervention conditions across the 12-months (DIET=-9.8 kg; DIET+MOD=-10.2 kg; DIET+HIGH=-10.3 kg) ($p<0.05$). Total barriers to PA decreased significantly across the 12 months (2.67 to 2.44; $p<0.0001$), with no difference between groups. A similar pattern was observed for obstacle barriers (2.11 to 2.01; $p=0.0337$). Effort barriers decreased significantly across the 12 months ($p<0.001$), with a Group X Time interaction ($p=0.0133$) also observed (DIET: 3.04 to 2.76; DIET+MOD: 3.00 to 2.51; DIET+HIGH: 2.97 to 2.32). **Conclusion:** Perceived barriers to PA decreased across a 12-month behavioral weight loss intervention, and this was observed regardless of the amount of PA that was prescribed within the intervention. It does not appear that prescribing a higher amount of physical activity within the context of a behavioral intervention negatively impacts perceived barriers to PA participation. However, time barriers appear to persist, which may have implications for interventions to promotion PA in adults with obesity.

1640 Board #234 May 28 10:30 AM - 12:00 PM
Interaction Effect Of Smoking And Physical Activity On Cardiopulmonary Endurance In Male Adults

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Cardiopulmonary endurance was a crucial part of health in people. The physical activity benefited the cardiopulmonary endurance, while both active smoking and passive smoking made it decrease. **PURPOSE:** To determine whether there existed the interaction effects between cigarettes smoking and physical activity on cardiopulmonary endurance.

METHODS: 420 male adults were recruited in Beijing and Hezhou, Guangxi. The investigation on cigarette smoking and physical activity were carried out by the international PA questionnaire and the health P.E. questionnaire, according to the smoke, all the subjects were divided into two main groups (CS group and nCS group), and then each main group were further divided into three sub-groups (CSL, CSM, CSH group and nCSL, nCSM, nCSH group) depending on their individual daily light, moderate or heavy physical activity. The subjects numbers of each group (CSL, CSM, CSH group and nCSL, nCSM, nCSH group) in turn were 45, 69, 74 and 38, 92, 102 respectively. The peak $\dot{V}_{O_{2max}}$ were measured by GXT protocol on cycle ergometer.

RESULTS: (1)Cardiopulmonary endurance of the smokers were lower than that of the nonsmokers significantly (25.94±6.11ml/kg/min VS 27.87±7.17ml/kg/min, $P=0.003$), and smoke index (Number of daily smoking multiply years of smoking) had negative relation with cardiopulmonary endurance ($r=-0.395$, $p<0.01$). The study found that the higher smoke index led to the lower cardiopulmonary endurance in men. (3)Cardiopulmonary endurance of the nCSH group showed significantly different with nCSM or nCSL group ($P<0.05$, $p<0.01$), but statistical difference were not found between nCSM group and nCSL group ($p>0.05$). (4)Smoking and physical activity showed no interaction effect on cardiopulmonary endurance ($p>0.05$).

CONCLUSIONS: (1)The cardiopulmonary endurance of the male adults who smoke cigarettes were lower than that of nonsmokers. (2)The high level of physical activity displayed greater effect on cardiopulmonary endurance. (3)The interaction effects were not found between smoke cigarettes and physical activity on the cardiopulmonary endurance in this study. Acknowledgements: National Key Research and Development Program (2016YFC1300202).

1641 Board #235 May 28 10:30 AM - 12:00 PM
Effect Of Post-meal Individualized Exercise Timing On Postprandial Glycaemia In Insufficiently Active Overweight/Obese Young Males

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Postprandial glucose (PPG) elevation is a risk factor for cardiovascular disease and mortality. An acute bout of post-meal exercise effectively lowers PPG. However, the optimal timing for the initiation of post-meal exercise remains to be elucidated. Since there is great inter-individual variability in the PPG response, the optimal timing for the initiation of exercise to lower PPG should be personalized. **PURPOSE:** To investigate the effect of post-meal individualized exercise timing on PPG in overweight/obese young males. **METHODS:** Fifteen males (age: 23.2±4.0 years; body mass index: 27.0±2.4 kg·m⁻²) completed three 4-hour trials in a randomized order: 1) SIT: Sitting for 4 hours; 2) iP: Walking initiated at individual PPG peak time; 3) 20iP: Walking initiated at 20 minutes prior to individual PPG peak time, with each trial separated by 6-14 days. Walking was performed at 50% $\dot{V}_{O_{2max}}$ for 30 minutes in iP and 20iP trials. PPG peak time was determined by continuous glucose monitoring

(CGM) during preliminary testing. White bread was provided to participants upon arrival and venous blood was collected every 15 minutes for the first 2 hours and every 30 minutes during the 2-4 hours after the meal to measure plasma glucose. Generalized estimating equations were used for comparison between trials. **RESULTS:** Compared to SIT, the 2 hour - total area under the curve (tAUC) for glucose was reduced in iP (-0.7, 95% CI [-1.7, 0.3] mmol·L⁻¹·h, *p*=0.027), whereas 2 hour - incremental area under the curve (iAUC) (*p*=0.036 in iP and *p*=0.035 in 20iP) and 4 hour - iAUC (*p*=0.04 in iP and *p*=0.036 in 20iP) for glucose were reduced in both iP and 20iP respectively. Mean, coefficient of variance (CV), and peak value glucose were not affected by both walking trials (all *p* > 0.05 vs. SIT). **CONCLUSION:** Post-meal brisk walking for 30 minutes initiated at individualized PPG peak time is more effective in blunting PPG response than that initiated at 20 minutes prior to individualized peak time when compared to sitting in overweight/obese young males.

1642 Board #236 May 28 10:30 AM - 12:00 PM
Comparison Of Urban Adolescents' Physical Activity And Psychosocial Outcomes During Small-Group And Full-Class Exergaming
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PURPOSE: This study examined differences in urban middle school students' physical activity (PA), enjoyment, and self-efficacy during small-group and full-class exergaming sessions.
METHODS: Forty-seven urban middle school students (83% African American; 25 females; $\bar{X}_{BMI} = 24.3 \pm 3.1$ kg/m²) completed two separate 15-minute exergaming sessions: (1) Xbox One Kinect Just Dance in small groups (*n* = 3-4); and (2) Xbox One Kinect Just Dance as a full-class (*n* = 23-24). Participants' time in sedentary behavior, light PA (LPA), and moderate-to-vigorous PA (MVPA) and steps were retrieved from ActiGraph GT3X+ accelerometers worn at the right hip, with enjoyment and self-efficacy assessed immediately after each exergaming session via validated Enjoyment and Self-efficacy Surveys. A dependent *t*-test examined mean differences for all outcomes between the two exergaming sessions with the significance level set at *p* < 0.05. Lastly, effect sizes were calculated using Cohen's *d*.
RESULTS: Significant differences between the two exergaming sessions were observed for time in sedentary behavior and MVPA, steps, and enjoyment (*t* = 3.9-7.4). In detail, participants spent significantly more time in sedentary behavior during the full-class session compared to the small-group session (5.9 ± 5.2 minutes; 3.5 ± 2.7 minutes, respectively; *p* < 0.001, *d* = 0.57) and significantly more time in MVPA during small-group session compared to full-class session (5.5 ± 2.2 minutes; 2.1 ± 2.8 minutes, respectively; *p* < 0.001, *d* = 0.85). Moreover, the small-group session resulted in significantly higher steps than the full-class session (504.2 ± 132.1; 387.8 ± 122.1, respectively; *p* = 0.01, *d* = 0.50). Lastly, participants reported significantly greater enjoyment during the small-group session compared to the full-class session (3.5 ± 1.1; 3.2 ± 1.0, respectively; *p* = 0.02, *d* = 0.37). There were no statistically significant differences between sessions for time in LPA and self-efficacy (*p* > 0.05).
CONCLUSION: Findings suggested small-group exergaming offered less time in sedentary behavior, but had greater time in MVPA, greater steps, and greater enjoyment compared to full-class exergaming, suggesting small-group exergaming to be ideal for promoting enjoyable exercise at higher intensities and lower sedentary time in urban adolescents.

1643 Board #237 May 28 10:30 AM - 12:00 PM
Does Exercise Choice Matter For Cardiorespiratory Fitness Improvements?
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Low cardiorespiratory fitness (CRF) is an important risk factor for cardiometabolic disease and individuals with prediabetes tend to have low CRF. Trials that have compared High-Intensity Interval Training(HIIT) to Moderate-Intensity Continuous Training(MICT) by imposing individuals to HIIT or MICT have established that HIIT is effective for improving CRF. However, to maintain these improvements, individuals need to adhere to HIIT. Self-determination theory states that providing choice has a positive impact on exercise adherence. **PURPOSE:** To address whether having the choice to engage in HIIT or MICT for 6-months (CHOICE) leads to greater changes in CRF (absolute and relative VO_{2peak}) at 6-months when compared to IMposed HIIT (IM-HIIT) or IMposed MICT (IM-MICT) in adults with prediabetes. **METHODS:** In this single-site randomized trial, 68 low-active adults (56.8±6.6 yrs, mean±SD) living with prediabetes were randomized to CHOICE (*n*=24), IM-HIIT (*n*=21), or IM-MICT (*n*=23). After an initial supervised training period (6 sessions over 3 weeks)

participants exercised unsupervised on their own in free-living conditions for 6 months. A ramp increase cycle ergometer test to exhaustion was conducted by the same technician pre- and post-testing to determine VO_{2peak}. Missing data was accounted for using linear interpolations generated with SPSS®v.20.0. **RESULTS:** ANCOVA results with baseline CRF as a covariate revealed no significant differences between increases in absolute VO_{2peak} (CHOICE: 0.38, 95% CI; 0.20, 0.55, vs. IM-HIIT: 0.56, 95% CI; 0.37, 0.74 vs. IM-MICT: 0.30, 95% CI; 0.12, 0.48 L/min, *F*_{2,64} = 1.99, *P* = .14), with similar findings for relative VO_{2peak} (*F*_{2,67} = 0.32, *P* = .73). Within group changes over time indicated small effect sizes (Hedge's *g*) for increases in absolute (CHOICE = 0.00; HIIT = 0.26; and MICT = 0.01) and relative VO_{2peak} over time (CHOICE = 0.11; HIIT = 0.33; and MICT = 0.15). **CONCLUSION:** Changes in CRF between groups randomized to perform HIIT or MICT, or given the choice of HIIT or MICT, were not significantly different at 6-months post-intervention. Providing choice for selecting HIIT or MICT did not appear to enhance the benefits of exercise for improving fitness in low active adults. Supported by the Research Endowment from the *American College of Sports Medicine Foundation.*

1644 Board #238 May 28 10:30 AM - 12:00 PM
Perceptual Responses To Reduced Exertion High Intensity Interval Training (REHIT) In Adults Differing In Cardiorespiratory Fitness
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Participation in physical activity (PA) in the US is low, as less than 50% of adults achieve at least 150 min/wk of moderate-intensity continuous training (MICT) or 75% of vigorous-intensity exercise (CDC, 2017). Low participation in PA is a problem because inactivity is one of the leading causes of premature mortality (Mokdad et al., 2004). The current recommendations including high volume MICT and resistance training require about 4 h/wk which is unrealistic for adults, as "lack of time" is cited as the primary reason for low PA (Trost et al., 2002). REHIT is a form of sprint interval training that requires only 10 minutes per session and elicits similar health related adaptations as chronic MICT (Cuddy et al., 2019). However, there are concerns that it may be too aversive (Ekkekakis et al., 2011). **PURPOSE:** To compare changes in affective valence and enjoyment to a single session of REHIT in adults with varying fitness level. **METHODS:** 85 healthy non-obese subjects participated in the study. Baseline testing consisted of incremental cycling to assess VO_{2max} during which participants were familiarized with reporting Rating of Perceived Exertion (RPE) and affective valence. The VO_{2max} results were used to group subjects into above and below average cardiorespiratory fitness (CRF). Subsequently, they completed a REHIT session consisting of two 20-second sprints interspersed with 3 minutes of active recovery. During the session, heart rate (HR), RPE, affective valence, blood lactate concentration (BLA), and enjoyment were assessed. **RESULTS:** RPE increased and was highest after sprint 2 (*p* < 0.001), but there was no significant group X time interaction (*p* = 0.41). Affective valence decreased but remained positive in both groups (*p* < 0.001), and there was no significant difference between groups (*p* = 0.86). Enjoyment was high in both groups (93.2 ± 20.8 vs. 91.1 ± 16.4 in above and below average CRF, respectively), and there was no significant difference between groups (*p* = 0.64). BLA increased 9-fold during REHIT (*p* = 0.001); however, there was no significant difference between groups (*p* = 0.64). **CONCLUSION:** There was no effect of CRF on perceptual changes in response to REHIT, indicating that low-volume SIT may be suitable for individuals with below average CRF.

1645 Board #239 May 28 10:30 AM - 12:00 PM
The Effects Of Visual Feedback On Physiological And Perceptual Responses During A Virtual Cycling Class
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BACKGROUND: Virtual cycling classes offer riders a unique exercise experience through cycling feedback of cadence, resistance and total work output on multi-touch counsels; however, despite popularity, little is known regarding physiological and perceptual responses when cycling with performance feedback in comparison to a typical Spin bike which lacks feedback. **PURPOSE:** This study compared intensity selection and perceptual responses between receiving cycling feedback vs. no feedback when completing a virtual Spin class. **METHODS:** Individuals (*N* = 14) of varying aerobic fitness (VO_{2max} 41.0 ± 8.0 ml/kg/min) completed a VO_{2max} trial and two cycling sessions. Each session, completed on a Peloton bike, consisted of a preselected 30-minute Spin class; one session was completed with cycling feedback (VIS) of cadence, resistance, and total work output, and the other with no feedback (NOF). Following each bout, session RPE (SRPE) was estimated and a Physical Activity Enjoyment Scale (PACES) was completed. Paired *t*-tests were used to compare

cadence, resistance, and total work of the warm-up, workout, and cool-down of each session. Perceptual measures of SRPE and PACES were also compared between sessions using paired t-test. **RESULTS:** Warm-up cadence was significantly higher ($p < 0.01$) for VIS (93.3 ± 6.7) vs. NOF (85.3 ± 12.3); whereas, cool-down resistance was significantly lower ($p < 0.01$) for VIS (30.2 ± 3.4) vs. NOF (36.0 ± 6.0) with no significant differences for workout portion. Perceptual measures were not significantly different, except for accomplishment approaching significance ($p = 0.09$) with a greater response for VIS vs. NOF. Lastly, the majority (93%) of participants preferred VIS over NOF. **CONCLUSION:** Results suggest cycling feedback could assist exercisers in achieving instructor suggested intensity during warm-up and cool-down. Additionally, with greater preference and sense of accomplishment with cycling feedback there is the potential to increase exercise adherence.

1646 Board #240 May 28 10:30 AM - 12:00 PM
Is High-intensity Stair Climbing An Effective Alternative To Traditional Cardiac Rehabilitation Exercise?

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Engagement in exercise-based cardiac rehabilitation following cardiac procedures reduces the risk of secondary coronary artery disease (CAD) events. Interval training can be a time-efficient and effective alternative to traditional moderate-intensity exercise in cardiac rehabilitation programming, and an accessible way to deliver interval training is through stair climbing. **PURPOSE:** To assess the feasibility and effectiveness of high-intensity interval training intervention, using stair climbing as the modality, in standard cardiac rehabilitation care. **METHODS:** Twenty participants with CAD (61 ± 7 y, $18M/2W$) were randomly assigned to one of two exercise programs: traditional moderate-intensity exercise (TRAD) or high-intensity interval stair climbing (STAIR). VO_{2peak} was assessed at baseline, one month and three months after exercise initiation. Exercise was completed two times/week for one month under clinical supervision, and three times/week for two months unsupervised. Each participant completed sessions of either an accumulation of 45 min at $80\%HR_{peak}$ (TRAD) or 3 bouts of 6 flights of 12 stairs at a self-selected vigorous intensity ($\sim 90s$ /bout) separated by recovery periods of walking ($\sim 90s$) (STAIR). **RESULTS:** Eighteen participants (90%) completed the intervention without any adverse events. Following one month of supervised exercise, the STAIR versus TRAD group achieved a higher peak HR 131 ± 9 vs. 111 ± 13 bpm ($p=0.002$, means \pm SD), and exercise intensity 106 ± 11 vs. $89 \pm 1\%HR_{peak}$ across a shorter time 3.1 ± 0.8 vs. 36.7 ± 5.5 min ($p < 0.001$). Peak VO_2 increased in both TRAD and STAIR, (23 ± 3 to 25 ± 4 and 21 ± 5 to 24 ± 6 mL/kg/min) respectively ($p=0.03$). Additional unsupervised training (2mo), the STAIR group achieved a higher peak HR, 126 ± 13 vs. 111 ± 9 bpm ($p=0.018$) and less time at prescribed intensity 6.5 ± 3.9 vs. 24.2 ± 17 min ($p=0.012$), when compared to the TRAD group. There was no difference in exercise intensity 96 ± 8 vs. $87 \pm 8\%HR_{peak}$ ($p=0.055$) or adherence 3.0 ± 3.2 vs. 3.2 ± 2.2 ($p=0.70$) exercise sessions/week, between the STAIR and TRAD groups. **CONCLUSIONS:** High-intensity interval training using stair climbing as the modality, is safe and effective within cardiac rehabilitation programming.

1647 Board #241 May 28 10:30 AM - 12:00 PM
Functional Fitness Is An Effective Training Modality In Firefighters

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Firefighting is a physical profession requiring at least adequate levels of fitness for performance of necessary activities. Providing firefighters (FFs) with a safe and effective fitness program is essential for optimal performance on the fire ground. **PURPOSE:** To examine changes in various parameters of physical fitness and FF ability following a 7-week high intensity functional training (HIFT) program instituted as part of a Basic FF Academy. **METHODS:** Participants were FF recruits ($N=89$; age= 27.1 ± 4.2 yrs, 100% male) enrolled in a Midwest Basic FF Academy during Spring 2018, Fall 2018, and Spring 2019. Fitness (weight, cardiovascular fitness, muscular endurance, power, and flexibility) and FF ability (assessed via the Academy FF Challenge (AFC)) were assessed at Weeks 1 and 7 of the Academy. The AFC consisted of six tasks done sequentially: simulated forcible entry; victim search; dummy drag; hose advance; equipment-carry; and ladder raise. Total completion time was recorded, as well as the time to complete each of the six tasks. HIFT training

was done for 60 minutes each day during the 7-week Academy. The HIFT program gradually incorporated movements and equipment commonly used during fire-ground activities (e.g., hoses, sledgehammers, tires, stairs, weighted objects), while also utilizing interval training, group runs, and partner workouts. **RESULTS:** Significant improvements were seen in parameters of physical fitness and FF ability following a 7-week HIFT program. Specifically, fitness (weight, cardiovascular fitness, muscular endurance) yielded significant improvements from Week 1 to Week 7 [Hotelling's $T^2 = 8.96$ $F(5, 84) = 150.57$, $P < 0.001$, $\eta^2 = 0.90$]. Overall FF ability improved significantly as well [Hotelling's $T^2 = 3.95$, $F(7, 82) = 46.26$, $P < .001$, $\eta^2 = 0.80$]. **CONCLUSION:** A 7-week Basic FF Academy that included daily HIFT resulted in significant improvements in physical fitness and FF ability. This suggests that HIFT, in conjunction with the 7-week Basic FF Academy, appears to be an effective means of improving fitness and FF ability in recruit FFs. Further research is needed to examine the effects of HIFT training on fitness and FF ability in FFs who are not simultaneously enrolled in a physically demanding FF Academy.

1648 Board #242 May 28 10:30 AM - 12:00 PM
Boxing Training Effects On Cardiorespiratory Fitness In Individuals With Prehypertension

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Purpose: Boxing training is a type of exercise that involves high cardiovascular demands in an enjoyable environment. Previously, boxing training has shown to have excellent cardiovascular outcomes in obese population, however, research regarding the effects of boxing training on cardiovascular health in individuals with high blood pressure is scarce. The purpose of this study was to determine the effects of a boxing training intervention on maximum oxygen uptake (VO_{2max}), power output, and lactate and ventilatory thresholds in individuals suffering from prehypertension.

Methods: A total of 14 subjects with prehypertensive were randomly assigned to a boxing intervention group or a control group. The intervention had a duration of 6 weeks, meeting 3 sessions weekly. Each boxing session consisted on 10 rounds of 3 minutes and 1 minute rest in between. From those 10 rounds, 3 were set at $95\%VO_{2max}$ and 7 at $60\%VO_{2max}$. Before and at the end of the intervention, all subjects completed a graded maximal exercise test on an arm-crank ergometer in which VO_{2max} , power output, and lactate and ventilatory thresholds were obtain. **Results:** At the end of the intervention, there were significant improvements on power output ($p=0.002$), ventilatory threshold ($p=0.002$), and lactate threshold ($p=0.001$) in the boxing group compared to the control group. Additionally, there was a significant reduction on VO_{2max} in the control group ($p=0.04$).

Conclusion: Individuals with prehypertension who underwent 6 weeks of boxing training improve the peripheral component of their cardiovascular fitness based on a significant enhancement in their lactate thresholds and ventilatory thresholds, which in turn produces power output increments. Boxing training may be a suitable exercise alternative to be prescribed in high blood pressure population.

1649 Board #243 May 28 10:30 AM - 12:00 PM
Effect Of Ethnicity On Changes In Cardiorespiratory Fitness In Response To High Intensity Interval Training

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Prior data show that ethnicity does not mediate responsiveness to moderate intensity continuous training (Skinner et al. 2001; Slentz et al. 2004), although populations used in these studies were primary Caucasian (C) and African-American. It is unknown if Hispanics (H), who face elevated health risks and are reported to be less active than C (CDC 2017), exhibit a similar response to exercise training versus other populations. **PURPOSE:** To determine if ethnicity alters physiological responses to short-term HIIT in sedentary C versus H women. **METHODS:** Eleven C and seven H women ages 18 - 35 yr who were healthy, non-obese, and inactive (< 150 min/wk of physical activity in the last 12 mo) participated in the present study. Over a 3 week period, they completed nine sessions of progressive HIIT on a cycle ergometer at work rate equal to $85\%PPO$. Maximal oxygen uptake (VO_{2max}) was measured twice at baseline using incremental exercise followed by verification testing. Participants cycled for 2 min at 15 or 20 W followed by 15 - 20 W/min increases in power output until fatigue, during which an impedance cardiograph device was used to evaluate measures of hemodynamic function including stroke volume (SV) and cardiac output (CO). Habitual physical activity was assessed during the study using accelerometry. **RESULTS:** Training elicited a heart rate equal to $84\%HR_{max}$, and 99.4% of sessions

were completed. Results showed a significant main effect of training for $\dot{V}O_{2\max}$ in C and H (30.7 ± 3.7 to 33.6 ± 3.9 mL/kg/min and 30.1 ± 2.6 to 32.4 ± 1.8 mL/kg/min, $F = 11.6$, $p = 0.004$), but there was no group by training interaction ($p = 0.69$). Significant increases were also exhibited in PPO ($p < 0.001$), SV ($p = 0.02$), and CO ($p = 0.018$), but there was no group by training interaction for any variable ($p = 0.13 - 0.66$). Physical activity did not change during the study ($p = 0.33$) and there was no group by training interaction ($p = 0.60$). **CONCLUSION:** Our data show no effect of ethnicity on the cardiorespiratory and hemodynamic response to HIIT, although longer studies in similar populations are needed to verify this result.

1650 Board #244 May 28 10:30 AM - 12:00 PM
Can Financial Incentives Promote Exercise Adherence Amongst Cardiac Rehabilitation Graduates? A 24-week Pilot Randomized Controlled Trial

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The health benefits of cardiac rehabilitation (CR) and sustained physical activity (PA) post-CR are well known; yet, CR graduates often fail to adhere to their exercise prescriptions post-program. Financial incentives have shown promise in increasing PA in adults but have been rarely evaluated in a CR context. **PURPOSE:** To examine the impact of adding financial incentives to a multi-component eHealth (MCE) intervention on moderate-vigorous physical activity (MVPA) amongst CR graduates. Second, to determine whether financial incentives increased eHealth platform engagement compared to non-incentive controls. **METHODS:** In this 24-week pilot randomized controlled trial participants were recruited from a large outpatient CR program and randomized to control (CT) or intervention (FI) conditions. CTs were instructed to track their exercise daily using a MCE website that included self-monitoring, individual and group-level feedback, and virtual (non-monetary) rewards for exercise session completion. Only FIs could earn \$1.00 CAD per day when exercise was tracked and completed. Group differences in MVPA minutes per day (min/d) during the final intervention month were made using a one-way ANOVA. Participants with five or more 'valid' days during the final month (days with objectively measured step counts between 500 and 4000) were included in the analysis. **RESULTS:** Seventy-four CR graduates (63% male; mean age 69 ± 11 years) were randomized to CT ($n=38$) or FI ($n=36$) groups, and 34 participants (15/38 CT, 19/36 FI) had at least five valid days (mean 19.7 ± 6.4 days). No significant group difference in mean MVPA min/d in the final intervention month was observed (CT: 21.90 ± 18.56 ; FI: 27.18 ± 15.52 ; $p=0.41$), nor between the mean number of eHealth website logins over the six month intervention (CT: 101.2 ± 129.5 ; FI: 109.7 ± 91.5 ; $p=0.75$). **CONCLUSION:** While this pilot trial was not powered to detect group differences, our initial results suggest that adding modest financial incentives (\$1 per day) to a MCE intervention may not boost engagement (a main driver of eHealth program effectiveness), nor MVPA in a sample of Canadian CR graduates. However, higher study retention, mean MVPA min/d, and total logins in the FI compared to the CT shows intervention promise. These data will inform the design of a fully powered trial.

1651 Board #245 May 28 10:30 AM - 12:00 PM
Psychosocial Effects Of A Community-based And Mentored Mountain Biking Group In Adolescents

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Besides physical activity promotion, an adult mentored mountain bike program in at-risk youth has the potential to create positive role models and peer relationships. Further, the augmentation of group cohesiveness and enhanced individual self-esteem may be invoked. **PURPOSE:** To determine the effects of a mentored adolescent mountain biking group on self-esteem (SE), depression (DEP), and social connectedness (SC) from pre- to post-program. **METHODS:** Participants included (mean \pm SD) new members (NM, $n = 15$, age = 13.6 ± 1.8 yrs), returning members (RM, $n = 15$, age = 15.9 ± 2.3 yrs), and combined (NM + RM) members (CM, $n = 30$, age = 14.7 ± 2.4 yrs) in the Start the Cycle (STC), non-profit youth cycling program. Free mountain bikes were provided to participants by STC with a promise of ownership if the full program was completed. Participants met 16-wks, 1 x week, and 2-hrs-day⁻¹ starting late spring and into late summer. Indoor physical conditioning and bike maintenance + skills classes were implemented the initial 4-wks with mentored, group rides occurring the last 12-wks. Surveys were completed pre- and post-intervention following the indoor training sessions (i.e., after 4-wks) and immediately prior to a final, 28-mile organized bike race. Data was analyzed using paired t-tests

with significance set at $P < 0.05$. **RESULTS:** Significant differences were found from pre- to post-program (mean \pm SD) in SE and DEP scores, respectively, in the NM group (29.44 ± 5.13 vs. 33.33 ± 4.74 , $P = 0.043$ and 4.30 ± 2.87 vs. 2.20 ± 2.20 , $P = 0.040$). No significance ($P > 0.05$) occurred in NM for SC from pre- to post-program (36.70 ± 11.25 vs. 43.10 ± 6.95). Interestingly, CM from pre- to post-program, respectively, indicated significant differences for DEP (2.75 ± 2.79 vs. 1.71 ± 1.94 , $P = 0.029$) and SC (39.35 ± 10.12 vs. 42.74 ± 8.09 , $P = 0.041$). No significant results ($P > 0.05$) for SE from pre- to post-program were observed for CM. Lastly, composite scores were compiled for the included three surveys, from pre- to post-program, respectively, with significance found for NM (60.11 ± 17.86 vs. 73.44 ± 12.20 , $P = 0.038$) and CM (68.52 ± 16.82 vs. 75.43 ± 13.26 , $P = 0.021$). **CONCLUSION:** We demonstrated that adolescent physical activity paired with mentored relationships has positive impact on depression, social connectedness, and self-esteem.

1652 Board #246 May 28 10:30 AM - 12:00 PM
The Effect Of An 8-week Yoga Intervention On Inflammation And Perceived Stress: A Pilot Study

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There is conflicting research regarding the impact of yoga on cardiovascular disease (CVD). Research supports that inflammation and stress may be involved in the pathology of CVD. Yoga is purported to improve stress, but there is no clear indication of the relationship between yoga and inflammation. **PURPOSE:** To investigate the feasibility and impact of an 8-week yoga intervention on stress and inflammation, to provide insight on the relationship between yoga and the pathology of CVD. This study tested the hypothesis that an 8-week yoga intervention would be feasible and would improve markers of stress and inflammation. **METHODS:** The study included healthy yoga-naïve adults, 18-44 years. Participants had no recent mental health diagnosis, CVD, or limitations to performing yoga. The study design was a single-arm 8-week intervention with pre and post intervention data collection. During the visits participants were asked to complete the Perceived Stress Scale, collecting information on their level of stress, and to also provide a small blood sample to assess inflammation via erythrocyte sedimentation rate (ESR). Between the visits, participants were asked to attend two 60-minute flow style yoga classes each week. To be deemed feasible, $\geq 85\%$ of participants had attend $\geq 75\%$ (12 of the 16) of the yoga classes. **RESULTS:** A total of 32 individuals were screened and 14 were eligible for the study. Of those eligible, nine participants were enrolled in the study (25 ± 4.8 years; 78% female). Eight of the nine participants completed the study; one participant dropped out due to a surgery not related to the study. Six participants (67%) attended $\geq 75\%$ of the classes. Wilcoxon Signed Rank Tests showed that ESR was significantly reduced after the intervention (27.0 ± 18.1 mm to 17.4 ± 17.8 mm; $p < 0.05$). Perceived stress scores were reduced by 13.9% (19.75 ± 6.7 to 17.0 ± 8.9), however this was not significant. **CONCLUSIONS:** Despite the small sample size our findings provide preliminary evidence that an 8-week yoga intervention reduced the perception of stress in the participants and significantly reduced ESR, an established indicator of systemic inflammation. Further studies are needed to confirm and extend findings and find methods to improve feasibility in yoga interventions.

1653 Board #247 May 28 10:30 AM - 12:00 PM
Effects Of A 13-week Physical Education Class On College Aged Student's Exercise Motivation, Body Image, And Mood

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PURPOSE: More college students now participate in different types of exercises. Exercise motivation has been a topic well researched in the past, however, not many researches have been conducted on the relationship among the exercise motivation, body image and mood. The present study examined whether a 13-week physical education class will improve exercise motivation, body image and mood of college-aged students. **METHODS:** A sample of 280 students was recruited from university to participate in a 13-week physical education class. Measurement on exercise motivation and body image (Exercise Motivation Questionnaire and Body Image Questionnaire (Body Appreciation Scale-2) and mood questionnaire (The Positive and Negative Affect Scale) were used in the study. Data were analyzed at the significance level of $p < .05$ for the data set including 14 classes. **RESULTS:** The Mann-Whitney showed significance at the $p < .05$ for the body image and mood questionnaire. Students (18 ± 2.1 years; 1.60 ± 0.15 m; 52 ± 8.4 kg) reported increased body appreciation (mean value from 3.8 to 4.2) and positive mood (mean value from 3.9 to 4.3) after the 13-weeks class. The students reported to achieve health as the most important exercise

motivation. The majority students desired to participate in more exercises in the future. CONCLUSIONS: This study suggests that a 13-week physical education class showed increasing positive body image and enhancing mood after participating in physical education classes. Health was a very important concern of students when choosing to exercise. Since the participants in this study were all girls and future study can examine the gender difference on the topic.

- 1654** Board #248 May 28 10:30 AM - 12:00 PM
Combination Of High-intensity Interval Training And Moderate-intensity Continuous Exercise On Cardio-metabolic Responses In Physically Inactive Middle-aged Adults
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 (No relevant relationships reported)

High-intensity interval training (HIIT) has been proposed as a time-efficient exercise protocol to improve metabolic health. However, its combined training effects with traditional moderate-intensity continuous exercise (MICE) remains unclear. **PURPOSE:** This study evaluated the effects of 16-week MICE-HIIT combined training on cardio-metabolic and psychological responses in physically inactive middle-aged males. **METHODS:** Forty participants (mean age: 40.2 ± 5.3 years) were randomly assigned to four groups: HIIT (12 x 1-min run at 80-90% HR_{max} interspersed with 1-min active rest), MICE (40-min brisk walk at 65-75% HR_{max}), combined (COMB) (alternate between HIIT and MICE) or control (CON). Exercise sessions were conducted three times per week for 16 weeks under independent free-living conditions. Cardiovascular fitness, blood pressure, percentage body fat (% BF), waist circumference, lipid profile, glucose and insulin sensitivity were assessed at baseline and after the 16-week intervention. Enjoyment and self-efficacy were also assessed at the end of intervention. **RESULTS:** All exercise groups showed substantial (~15%) and similar increases in VO_{2max} (HIIT: 34.3 ± 4.4 to 39.1 ± 5.4 ; MICE: 34.9 ± 5.0 to 39.4 ± 7.2 ; COMB: 34.4 ± 5.0 to 40.3 ± 4.6 mL $kg^{-1}min^{-1}$, $p < 0.05$) compared to CON over the 16-week intervention. There was a similar reduction in weight, BMI, % BF and waist circumference in all groups compared to CON ($p < 0.05$). Compared to baseline, total cholesterol and LDL cholesterol decreased only following COMB intervention, while fasting insulin level significantly decreased and insulin sensitivity improved in the HIIT group. Enjoyment, self-efficacy and adherence were similar among all exercise groups. **CONCLUSION:** These findings suggested that combined MICE-HIIT training can elicit comparable improvements in cardiovascular fitness and adherence under free living conditions as performing HIIT and MICE alone in physically inactive middle-aged males, serving as an alternative exercise strategy for health promotion.

- 1655** Board #249 May 28 10:30 AM - 12:00 PM
Prehabilitation With High Intensity Interval Training Before Major Abdominal Surgery
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PURPOSE: Improving cardiopulmonary reserve, or peak oxygen consumption (VO_{2peak}) measured during cardiopulmonary exercise testing (CPET), may reduce complications after surgery. This feasibility study determined the effectiveness of a supervised, preoperative High Intensity Interval Training (HIIT) program in increasing VO_{2peak} by 2ml/kg/min. Clinical outcomes were documented to determine the endpoint most sensitive to improved fitness. **METHODS:** In this prospective study, participants aged 50-85 undergoing major abdominal surgery were randomised to standard care or 14 sessions of HIIT over 4-6 weeks. HIIT sessions involved approximately thirty minutes of stationary cycling (5 warm-up, 20 interval training, 5 cool-down). Interval training alternated 1 minute of high and low intensity pedalling, with the goal of reaching 90% maximum heart rate during the session. Clinical outcomes included complications, postoperative morbidity survey, length of stay, and Short Form-36 quality of life questionnaire (SF-36). **RESULTS:** Of 63 participants, 46 completed both CPETs and 51 completed clinical follow-up. On per protocol analysis, mean VO_{2peak} increased 14%, from 20.3-23.2ml/kg/min in the exercise group and 0.7%, from 21.8-22.0 ml/kg/min in the control group. Change in VO_{2peak} was 2.87 vs. 0.14 ml/kg/min ($p < .001$). Exercisers increased peak work rate by 25 watts. Although there were no significant differences in the clinical outcomes, those most responsive to improved fitness with exercise were: the total number of postoperative complications (0.64 in exercisers vs. 1.16 in controls per patient, $p = .07$) and the physical component score of the SF-36 ($p = .07$), with the greatest difference six weeks after surgery indicating a quicker postoperative recovery. **CONCLUSION:** There was a significant improvement in VO_{2peak} and peak work rate with preoperative HIIT. We also noted a trend

towards fewer postoperative complications and a more rapid recovery after surgery. Preoperative HIIT results in a clinically important improvement in cardiopulmonary reserve for patients undergoing abdominal surgery.

- 1656** Board #250 May 28 10:30 AM - 12:00 PM
Cardio-respiratory Fitness And Vigorous Physical Activity In Australian Truck Drivers Prior To A Hiit Intervention
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'Truck-Fit' is a cluster randomised controlled trial designed to test the efficacy of a 12-week high intensity interval training (HIIT) program delivered at driver depots. **PURPOSE:** To assess program need, this study examined baseline physical health (BMI, waist circumference and blood pressure), cardio-respiratory fitness (CRF), and vigorous physical activity (VPA) profiles of the Australian drivers recruited to the program. **METHODS:** Participants ($n=31$ men; mean [SD] age=44.5 [10.5] years) visited the University of Queensland exercise laboratory (June-August 2019) for clinical screening prior to intervention or control group allocation. Height, weight, waist circumference and resting blood pressure were measured using standard protocols. CRF (VO_{2peak}) was assessed during a graded exercise test to exhaustion on a cycle ergometer. In the week preceding their visit, drivers wore an accelerometer (Actigraph GT3X) on the non-dominant wrist for 24 hours x 7 days, and kept a log recording daily wear time; raw acceleration was extracted and open-source software (GGIR) used to calculate VPA across this time period. **RESULTS:** Mean (SD) body mass index (31.9 [6.8] kg/m^2) and waist circumference (108.4 [17.4] cm) scores were high; 45% ($n=14$) of drivers were hypertensive, with three medicated for high blood pressure. CRF was 'below percentile 25' relative to age and sex in 52% ($n=16$) of drivers (mean [SD] $VO_{2peak} = 29.7$ [7.5] mL $kg^{-1}min^{-1}$); 23% ($n=7$) of drivers ranked 'below percentile 5' compared to VO_{2peak} normative data. Accelerometer data (5.3 [1.6] valid days) indicated drivers did very little high intensity physical activity (mean [SD] VPA=3.1 [2.8] minutes/day; range of 0.4-9.7 minutes/day). **CONCLUSIONS:** The study findings strongly support the need for intervention in this driver sample. Implementation of 'Truck-Fit' is particularly warranted, given strong beneficial associations between HIIT, CRF improvement and reduced mortality risk in low fit, obese groups.

- 1657** Board #251 May 28 10:30 AM - 12:00 PM
Evidence For Temporal Patterns Of Physical Activity Related To The Girls On The Move Program
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 (No relevant relationships reported)

INTRODUCTION: Previous studies suggest that youth may follow temporal patterns of physical activity (PA). Research has provided evidence for both the compensatory and synergistic effects of PA among youth. It is unclear, however, how the presence of a PA intervention may play a role in children's normal patterns of physical activity. **PURPOSE:** To determine if the Girls on the Move intervention influenced the proportion of girls obtaining various levels of afterschool PA vs. during-school PA between intervention and control schools. **METHODS:** MVPA minutes were measured via accelerometers worn at the right hip for 7 days (5 weekdays, 2 weekend days). Monitors were set to start recording data at 5 A.M. on the day after distribution to at both the intervention and control schools. Data for the vertical axis were re-integrated to 15-s epochs and processed using Evenson cut-points. Average MVPA/hr was calculated from accelerometer data. MVPA was assessed at three different timepoints (e.g. pre-intervention, post-intervention, and 9-month follow-up) and examined for two time-blocks (during school, after school). **RESULTS:** Chi-square tests were performed to assess significant differences in the proportion of girls who achieved higher average MVPA/hr during school and girls who achieved higher average MVPA/hr after school in the intervention and control schools. The Chi-square test was not significant at baseline ($\chi^2=1.67$, $p=0.2$, $\alpha=0.05$), but was significant for both the post-intervention and 9-month follow-up, with the intervention group having a higher proportion of girls getting more PA after school ($\chi^2=14.82$, $p=.00014$, $\alpha=0.05$, $\chi^2=9.89$, $p=.0017$, $\alpha=0.05$, respectively). **CONCLUSION:** The Girls on the Move intervention significantly increased the proportion of girls who achieved higher average MVPA/hr after school compared to the girls in the control schools (synergistic effect of the intervention). These results suggest an after-school PA intervention may be effective in increasing girls' PA after school even after the completion of the

intervention. This study may inform future PA interventions to examine changes to temporal patterns (e.g. how much PA youth are getting during specific times of the day) in addition to total overall PA.

1658 Board #252 May 28 10:30 AM - 12:00 PM

Socioeconomic Status And The Quality And Accessibility Of Community Health Resources

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Health is multidimensional and can include aspects of physical, social, emotional, and spiritual wellness. Social Ecological Models (Sallis et al., 2012; Van Dyck, et al., 2010) suggest that health behaviors are influenced by community resources and built and natural environments. Inequalities exist in access to and quality of resources across socioeconomic status and other social strata, which, in turn, impact health behaviors (Byrne, 2012; Gordon-Larsen, et al., 2006). **PURPOSE:** To demonstrate differences in quality and accessibility of community health resources across neighborhoods of varying levels of household income in both rural and urban communities. **METHODS:** The Community Health Resources Checklist (CHRC) was used as a guide to structure observations of parks, trails, grocery stores, clinics, banks, and other health resources that represented various dimensions of health (physical, emotional, social, spiritual). Resources (rural n=27; urban n=51) in Iowa communities (2 rural; 1 urban) were evaluated, mapped, and overlaid with neighborhood household income to create a graphical representation of community resource quality between and within high-income and low-income neighborhoods in both rural and urban settings. **RESULTS:** Mapping analysis demonstrated less access to high-quality health resources in both low-income rural and urban settings. In particular, qualitative analysis of the data indicated that high quality resources clustered near the margins of higher-income neighborhoods, but were often scattered, absent entirely, or of significantly lower quality in lower-income neighborhoods. **CONCLUSIONS:** This preliminary study examined community health resources representing multiple dimensions of health and demonstrated notable disparities across household income in rural and urban communities. These disparities should be addressed through targeted, focused health promotion interventions.

C-44 Free Communication/Poster - Physical Activity Interventions II

Thursday, May 28, 2020, 9:30 AM - 12:00 PM

Room: CC-Exhibit Hall

1659 Board #253 May 28 10:30 AM - 12:00 PM

High-intensity Interval Low-volume Vs Moderate-intensity Continuous Training On Exercise Enjoyment And Quality-of-life In Metabolic Syndrome

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Exercise improves quality of life in patients with metabolic syndrome (MS). However, some people may not benefit because do not to meet the recommended amounts of exercise. The most argued reasons for that are lack of time and poor enjoyment. **PURPOSE:** to evaluate the efficacy of high-intensity interval training low-volume (HIIT-low volume) compared to moderate intensity continuous aerobic training (MICAT) on exercise enjoyment and quality of life in adults with MS. **METHODS:** a controlled, randomized, clinical trial using the minimization method, with two parallel groups for the purpose of showing superiority. Sixty patients with MS, of both genders, 40-60 years old, were included. A clinical evaluation, biochemical tests, Physical Activity Enjoyment Scale test for enjoyment (PACES), and Medical Outcomes Study Questionnaire Short Form 36 Health Survey version 2 (SF-36v2) test for quality of life were carried out, before and after a treadmill exercise program of 12 weeks, 3 sessions/week. Participants assigned to the intervention (n=29) received HIIT-low volume in 22 min sessions that included six intervals at a load of 90% of maximum oxygen consumption (VO_{2max}) for 1 min followed by 2 min at 50% of VO_{2max} . The control group (n=31) received MICAT at an intensity of 60% of VO_{2max} for 36 min. **RESULTS:** patients had a mean age of 50.8±6.0 years, body mass index of 30.6±4.0 kg.m², body fat percentage of 38.7±7.0% and VO_{2max} of

29.0±6.3 mL O₂.kg⁻¹.min⁻¹; 70% were women. Compared to MICAT, HIIT-low volume was not superior in increasing Ln of PACES test score (marginal mean difference: 0.041 [95% CI -0.015—0.098]; Cohen's d: 0.380; p value=0.153) and physical (-0.043 [-0.095—0.008]; Cohen's d: -0.438; p=0.101) and mental components (0.043 [-0.027—0.115]; Cohen's d: 0.325; p=0.220) of SF-36v2. When comparing before and after the intervention, both training groups increased physical component of SF-36v2 (Glass' Δ: 0.41 to 0.43) but only HIIT-low volume increased PACES test score (Glass' Δ: 0.30) and mental component of SF-36v2 (Glass' Δ: 0.64). **CONCLUSION:** HIIT-low volume, compared to MICAT, is not superior in increasing exercise enjoyment and quality of life in adults with MS. Supported by Colciencias 111562638757. Interinstitucional 2016-13041. Colciencias Doctoral scholarships 727-2015.

1660 Board #254 May 28 10:30 AM - 12:00 PM

Intervention-related On Aging Health State Over European Countries. May The Context Frame The Difference?

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The life quality, namely among aged population, has been widely studied. Observational data on behavioral context, especially regarding physical activity epidemiology, has shown efficiency in improving physical fitness with an impact on the dimensions of well-being. However, little research has been made regarding the impact of intervention on cardiorespiratory, strength, agility and quality of life, across different European contexts. **Purpose:** we aimed to investigate the impact of exercise intervention on life quality, among elderly from 4 different European countries [Portugal (PT), Italy (IT), Bulgaria (BL) and Hungary (HU)]. **Methods:** 364 (87 PT, 121 IT, 76 BL and 80 HU) older adults (68,9±6,3 yrs, 73,6±12,7 Kg, 1,61±0,08 m), male (26%) and female (74%), were recruited from local populations. Intervention program was based on 2 sessions/week (90 minutes each), supported on aerobic activities (40min), muscle strength (20min), body balance (10min), technical skill (10min) and stretching specific exercises (10 min). Pre (baseline assessment) and post one year intervention assessments were done on anthropometric measures, senior Fitness Test and EQ-5D-5L questionnaire, applied by trained technicians. ANOVA was performed to describe country's group differences and the adaptations observed among different determinants, in pre and post intervention. When a significant interaction effect was detected post-hoc comparisons were performed with Bonferroni adjustment to identify the locations of the difference. Significance was set at p<0.05. **Results:** The effect of the time (one year intervention) were found to be significant, indicating changes on health determinants (hip-to-waist ratio, F = 13.895, p < 0.001; chair to stand, F = 20.314, p < 0.001; and handgrip muscle force, F = 21.023, p < 0.001), in all groups. However, Post-hoc analysis with Bonferroni adjustment indicated that the changes over the time were similar between country's groups as the significance were maintained. **Conclusions:** Context, country environment, seems have not influence on intervention output. Rather than country or geographical location, the intervention features may be the most important factor in increasing health status, by the associations with health determinants.

1661 Board #255 May 28 10:30 AM - 12:00 PM

Effect Of A Personalized Community-based Exercise Program On Metabolic Syndrome Risk Factors

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Community exercise programs have been used to increase physical activity and reduce cardiovascular risks. **PURPOSE:** To investigate the effectiveness of a personalized community-based exercise program based on intensities personalized to individual ventilatory thresholds (VT) on decreasing metabolic syndrome (MetS) risk factors. **METHODS:** One hundred and fifty inactive community members were physician referred to a 12-week community exercise program between June 2016 and May 2019. Participants were separated into two groups: non-exercise control (age: M= 45.612.5 yrs) and exercise intervention (age: M= 46.6, SD= 16.7 yrs) prescribed via VT1 and VT2, exercising three times week. VT1 and VT2 measures were obtained by performing treadmill talk tests. MetS risk factors, abdominal obesity as measured by waist circumference (WC), hypertriglyceridemia, low HDL-C, hypertension as measured by systolic blood pressure (SPB) and diastolic blood pressure (DBP), and fasting blood glucose (BG), were analyzed retrospectively using MetS z-score. Paired and independent sample t-tests were used to compare within-group changes from pre- to post-intervention and between-group changes for all primary outcome measures, respectively. Significance was set at α<0.05. **RESULTS:** The non-exercise group experienced unchanged WC, triglycerides, and BG and had a statistically significant worsening in HDL-C (M±SD)(pre: 50.7 ± 18.2, post: 49.4 ± 16.5), SBP (pre: 119.0 ±

11.0, post: 121.2 ± 9.6), DBP (pre: 79.4 ± 8.4, post: 81.4 ± 6.6), and MetS z-score (pre: -4.14 ± 4.01, post: -3.68 ± -4.07). In contrast, the personalized exercise group showed statistically significant improvement in WC (pre: 84.0 ± 14.2, post: 83.1 ± 12.9), triglycerides (pre: 110.8 ± 54.4, post: 104.5 ± 45.7), HDL-C (pre: 54.2 ± 17.9, post: 57.8 ± 15.9), SBP (pre: 122.6 ± 14.1, post: 117.4 ± 13.1), DBP (pre: 79.7 ± 9.7, post: 77.3 ± 7.7), BG (pre: 92.5 ± 8.6, post: 89.7 ± 7.0), and MetS z-score (pre: -3.52 ± 3.82, post: -4.12 ± 3.24). **CONCLUSION:** These findings provide preliminary evidence that individualized programming can be implemented into community-based exercise programs to reduce MetS risk in previously inactive individuals.

1662 Board #256 May 28 10:30 AM - 12:00 PM
Estimated Versus Calculated Time From Home To Squares/parks, In Three Different Socioeconomic Status Neighborhoods

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Estimated Versus Calculated Time from Home to Squares/Parks, in Three Different Socioeconomic Status Neighborhoods.

Distance from homes to parks or squares, have shown to be related with environment interventions to increase physical activity (PA).

Purpose: Compare the estimated and calculated walking time from home to parks or squares according to sociodemographic variables and PA habits.

Methods:

Sample consisted of 296 individuals (18-70 years old) from 3 neighborhoods of low, medium and high socioeconomic status (SES) in a South American metropolitan city. The distance from home to the nearest square or park was calculated in meters and walking minutes using GoogleMaps and compared with the estimated time reported by the participants. Data were compared using Kruskal Wallis test, alpha 5%.

Results:

The median age was 49 years, 47,8% recognize public space as a place to practice leisure time PA. The estimated time was greater than the calculated with a difference $P_{50}=5$ ($P_{25}=3$ $P_{75}=13$) minutes. This difference was greater in the low SES neighborhood $P_{50}=9$ ($P_{25}=3$ $P_{75}=19$) minutes and in the groups of 30-44 $P_{50}=8$ ($P_{25}=2$ $P_{75}=16$) and 65-80 years $P_{50}=9$ ($P_{25}=4$ $P_{75}=16$). Those who recognized public space as a place to perform PA had a lower overestimation of distance than those who didn't $P_{50}=4$ vs $P_{50}=9$ min ($p<0,05$).

Conclusion:

There was an overestimation of the home - park/square walking time distance. The magnitude of overestimation was related to SES and subjects age. Recognizing public spaces as a place to do leisure time PA reduced bias. This should be considered in programs aimed to promote physical activity.

Key Words: Physical activity, public space, urban interventions, distance.

1663 Board #257 May 28 10:30 AM - 12:00 PM
Effect Of Aerobic Exercise On The Learning And Memorizing Abilities And Hippocampal Vegf In Depressive Rats

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PURPOSE: Depression model building in rats based on 4 weeks of CUMS (Chronic Unpredictable Mild Stress) and the investigation of the effect of aerobic exercise intervention on hippocampal VEGF expression and spatial learning and memorizing ability in depressive model rats.

METHODS: 30 male SD rats randomly divided into 3 groups: the Control group (C), the Model group (M), and the Exercise group (E). M and E were subjected to CUMS stimulation and/or aerobic exercise for 4 weeks respectively. E received swimming training for 4 weeks (60 min/day, 6 days/week). SPT was used to test rat's sucrose preference and detect the success of model. MWZ was performed to evaluate their spatial learning and memorizing ability. The expression of VEGF was tested by RT-PCR and WB. The experimental data was reported as mean±SE. The threshold of significance level was set at $P<0.05$.

RESULTS: 1) SPT: there was no difference in the total water consumption in each group ($P>0.05$). But depressive rats (M: 36.67±10.61; E:36.00±16.43) showed significant difference compared with C in consumption of sugar water (C:53.83±10.93, $P<0.05$); 2)MWZ detection: during 6 days of navigation experiment, M showed more difficulty to find the platform compared with C and E ($P<0.05$), while there was no significant difference between C and E ($P>0.05$); During the space exploring experiment, M spent much time to find the platform compared with C and E

(C:3.14±0.38; M:1.57±0.79; E:2.57±0.53, $P<0.05$); 3) mRNA and protein detection: compared with C, the mRNA (C:1.24±0.22;M:0.57±0.25;E:1.14±0.07) and protein level of VEGF (C:0.90±0.06;M:0.52±0.11;E:0.81±0.05) significantly decreased in group M, while increased in group E ($P<0.05$).

CONCLUSIONS: 4 weeks of aerobic exercise intervention effectively reverses the depression symptoms and improves their spatial learning and memorizing ability in rats pretreated by CUMS stimulation. In addition, aerobic exercise can rescue and significantly up-regulate the expression of VEGF in hippocampus which suppressed by CUMS stimulation. The correlation between the VEGF expression level and depressive behaviors in rats suggests that the enhanced expression of VEGF in hippocampus might be one of the neurobiological mechanisms mediating the effects of aerobic exercise on depression and spatial learning and memorizing ability.

1664 Board #258 May 28 10:30 AM - 12:00 PM
Influence Of Affective Valence And High Intensity Intervention On Exercise Engagement

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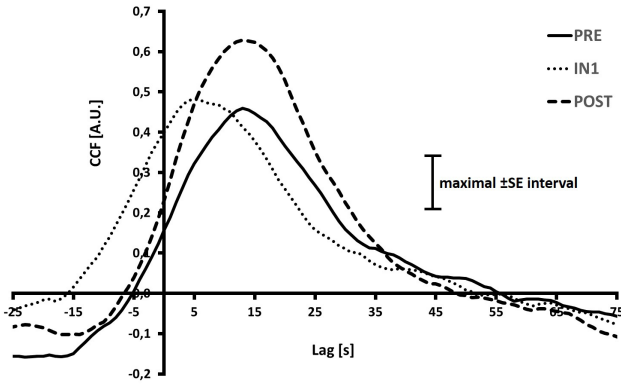
PURPOSE: This study aimed to determine the influence of affective valence and a structured high intensity exercise intervention on exercise habits and future participation at increased intensity than what one is accustomed to. **METHODS:** Participants (N=34; age=22.3±2.1 years) wore an accelerometer for a 7-day period to determine average exercise intensity. Affective responses were collected during voluntary exercise sessions using a smartphone app [self-efficacy 1-5 (5=confident), enjoyment scale 1-7 (7=most enjoyment), mood scale 1-7 (7=positive mood)]. An aerobic exercise intervention at 70%-85% of heart rate reserve was then administered. Accelerometers were then worn for an additional 7-day period. Participants logged information related to voluntary exercise engagement. **RESULTS:** The pre-intervention 7-day period, consisted of 75.7±9.4% sedentary and 4.0 ± 2.3% MVPA (3.5±1.6% moderate intensity, 0.5±0.7% vigorous intensity) while affective responses were positive as seen by self-efficacy (4.2±0.9), enjoyment (6.3±1.0), and mood (6.0±1.1). Participants maintained positive affective valence during the exercise intervention, although it was a significantly higher intensity than their daily average (self-efficacy=4.4±0.9, enjoyment=5.5±1.9, mood=5.9±1.2). Post-intervention 7-day period consisted of significant decrease in sedentary to 61.4±5.2% ($p<0.001$) while MVPA significantly increased to 9.1±2.1% ($p<0.001$) of the day (8.0±1.4% moderate intensity, 1.1±0.7% vigorous intensity). MVPA per day significantly increased from pre- to post-intervention (34.0±19.3 minutes and 44.4±15.8 minutes, respectively, $p=0.04$) while a positive affective valence was maintained (self-efficacy=4.7±0.4, enjoyment=6.6±0.5, mood=6.5±0.8). **CONCLUSION:** The high-intensity exercise intervention elicited only a minimal decrease in exercise enjoyment during the session which allowed participants to maintain an overall positive affective valence. This potentially influenced the decrease in sedentary behavior and increased MVPA. These results indicate recreational exercisers may misinterpret exercise intensity. To reduce this misinterpretation, it may prove beneficial for practitioners to further explain and demonstrate activities categorized as different intensities.

1665 Board #259 May 28 10:30 AM - 12:00 PM
LIVING 4 MONTHS IN CONFINEMENT AFFECTS CARDIORESPIRATORY REGULATIONS DURING EXERCISE - FIRST RESULTS FROM SIRIUS-19

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Purpose: A confined environment is typical for long term expeditions, i.e. Antarctica and Space. During a 4 months international Space mission simulation in the SIRIUS habitat in Moscow, the influence of isolation and different endurance exercise trainings (continuous/interval exercise) as countermeasures were studied. The analysis was focused on pulmonary oxygen uptake ($\dot{V}O_2$) and heart rate (HR) regulations and steady states. **Method:** Six healthy individuals (3 males, 35±6 y, 22±1 kg·m⁻²) received continuous and interval treadmill training (4 wk each in a cross over design). 7 exercise tests were performed: Before (PRE), after 1 wk of isolation (IN1), after 2, 4 wk of training (CON1/2, INT1/2) and 1 wk after isolation (POST). The protocol on a treadmill consisted of 300 s of constant speeds (3, 6, 9 km·h⁻¹) and pseudo-random changes of speed (3/6 km·h⁻¹). HR and $\dot{V}O_2$ kinetics responses were assessed by cross correlation functions (CCF) of speed vs. the respective parameter (Hoffmann et al.,

EJAP 113:1745-1754, 2013). ANOVA was applied to detect influences from mission day and training mode (MD) with Bonferroni's post-hoc test. Level of significance was set to $\alpha = 5\%$. **Results:** Regarding $\dot{V}O_2$, no effects of MD were found for kinetics but for steady states. HR was significantly influenced by MD for both, kinetics (see Fig.) and steady states. The detailed analysis revealed differences for PRE/IN1 compared to the other days. No significant differences were found between INT and CON. HR steady states decreased during the mission (e.g. CON2/9 km·h⁻¹: 120±11 bpm) compared to PRE and POST values (e.g. PRE/POST 9 km·h⁻¹: 142±11 bpm / 132±9 bpm). **CONCLUSIONS:** The specific environment and controlled daily routines influence $\dot{V}O_2$ and HR during exercise. Endurance exercise training during 4 months of confinement prevent or even improve HR regulations. These data are in line with findings from other simulation studies.



Time courses of before (PRE), after 1 wk (IN1) and after (POST) the mission (means of 6 subjects, SE as indicated in the diagram).

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The Effect Of A Low Volume Trunk-stabilisation Exercise Protocol On Biomechanical Function And Compliance.

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Sensorimotor control exercises (SCE) increase trunk stability by enhancing neuromuscular activity and strength, perhaps preventing low back pain (LBP). A trunk-specific intervention based on 4 exercises improved trunk stability, however a reduced set of 1 exercise may have similar effects and increase compliance concurrently. **Purpose:** To assess the response of a standard training (SG) and a low volume set of sensorimotor control exercises (EG) on trunk function and compliance.

Methods: 29 healthy subjects were randomly allocated to SG (n=15) or EG (n=14). A trunk-specific SCE protocol (3 weeks) was completed which differed in training volume (SG: 4 exercises; EG: 1 exercise). Training intensities were identical (1 familiarization session/ 6 home-based sessions; 3 sets; 10 repetitions). Pre-post intervention (M1; M2) isokinetic mean peak torque was measured for trunk extension (30°/s) and rightward rotation (30°/s) in concentric (CON), eccentric (ECC) and perturbed eccentric (PECC) mode. During testing neuromuscular activity of Mm. erector spinae, latissimus dorsi, external/internal obliquus and rectus abdominis were recorded by sEMG and summarized subsequently: dorso left (DL), dorso right (DR), ventral right (VR) and ventral left (VL). Mean peak torque was normalized to body weight (Nm/kg), EMG data was normalized to concentric MVC (%). Compliance was assessed using a training diary (sessions per week). Data was analysed descriptively (mean±SD) and by using a repeated measures ANOVA ($\alpha = .05$).

Results: Mean peak torque in CON/ECC extension and rotation showed no group differences. During PECC rotation, SG (M1: 2.3±0.3, M2: 2.5±0.2) showed a significant larger increase of mean peak torque compared to EG (M1: 2.5±0.3, M2: 2.7±0.3) (p=.035). Both groups showed a significant increase in EMG activity of DR muscles for unperturbed ECC rotation (SG M1: 93±18, M2: 118±10; EG M1: 83±9, M2: 121±17) (p < .001). In SG, DL (M1: 95±13, M2: 113±16) (p=.011) and VR (M1: 83±14, M2: 110±29) (p=.010) muscle activity improved significantly during ECC rotation. Overall compliance was 7±3 (SG) and 7±2 (EG) sessions.

Conclusion: Both protocols enhanced trunk function in terms of neuromuscular activity and mean peak torque in trunk rotation. LBP patients might benefit from a low volume approach due to improved time-efficiency.

1667 Board #261 May 28 10:30 AM - 12:00 PM
Cardiometabolic Effects Of Free Access To An Exergame In Inactive Adults: A Randomized Controlled Trial

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Exergames are videogames that require physical movement or exertion from the user. Exergames have been suggested to be a motivating alternative to increase physical activity for adults not engaged in traditional exercise. However, limited high-quality data is supporting the long-term effectiveness of exergames for improving health outcomes.

Purpose

To determine if providing sedentary adults access to a high-intensity exergame could improve cardiometabolic health.

Methods

This was a randomized controlled trial in which 52 inactive but otherwise healthy adults were randomly allocated to either an exergaming (EXG; n=25) or control (CON; n=27) group. Participants in EXG got free, unlimited access to the Playpulse exergaming platform for six months, whereas participants in CON continued with their normal daily routine. We measured maximum oxygen uptake ($\dot{V}O_{2max}$), blood glucose response to a 2-h oral glucose tolerance test, fasting blood variables (glucose, cholesterol, high-sensitivity C-reactive protein, triglycerides), body composition, blood pressure and physical activity levels before and after the intervention period. We also assessed exergaming frequency and enjoyment (according to the -5 to +5 Feeling Scale) in the EXG group. Data were analyzed using covariance analyses (ANCOVA) with baseline values as covariates or a two-way mixed ANOVA.

Results

There were no significant difference between CON and EXG for the primary outcome, post-intervention $\dot{V}O_{2max}$, after controlling for pre-intervention $\dot{V}O_{2max}$ (42.34 ± 0.76 vs 41.71 ± 0.82 mL·min⁻¹·kg⁻¹, p = 0.58). Even if not reaching statistical significance, there was a tendency of lower post-intervention low density lipoprotein cholesterol in EXG compared to CON (2.7 ± 0.7 vs 3.0 ± 0.7, p = 0.063). No other changes in secondary outcomes differed between groups. The participants in EXG played 15 ± 13 sessions (range, 0-42) during six months. Their rating of enjoyment was 3 ± 1 on the Feelings Scale.

Conclusion

Our data show that free, unlimited access to an exergaming platform was not sufficient to improve $\dot{V}O_{2max}$, blood markers of cardiometabolic health, body composition, or increase physical activity levels in sedentary adults, even if the participants rated the exergame as enjoyable.

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1668 Board #262 May 28 10:30 AM - 12:00 PM
Exploring The Physical Activity Counselling Practices Of Foundation Doctors: A Qualitative Study

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Introduction: The evidence in support of physical activity (PA) as an effective modality in the treatment and management of non-communicable diseases (NCDs) is promising and quite robust. Consequently, PA promotion is now seen integral to the role of the physician. The challenge however, has been translating PA as a preventive and therapeutic modality into doctor's routine clinical practice. Therefore, it has been proposed that producing future doctors that will be proficient for practice in this regards will require adequate training at the undergraduate medical level. Thus, the purpose of this study is to explore the PA counselling of newly qualified doctors when in their foundation year to gain more insight into how the undergraduate and foundation training influences their PA counselling practices.

Methodology: A qualitative study was conducted amongst eleven foundation doctors (FDs) recruited by purposive sampling. This sample was representative of FDs from seven different medical schools in the United Kingdom. Semi-structured interviews were digitally recorded and transcribed verbatim. Thematic analysis were undertaken to identify emerging themes and concept from the interviews.

Findings: Three overarching themes were developed from the data. They include: PA counselling attitude and practices, barrier to Pa counselling and enablers to PA counselling in clinical practice.

Conclusion: The attitude and practices of FDs towards PA counselling was poor both in primary and secondary care and this was more evident whilst in the hospital setting. A lack of training and support from clinical supervisors were major reasons for this. However, it was also found that unexplored opportunities exists for FDs to champion PA counselling both in the primary and secondary care settings. Leveraging these opportunities will entail but not limited to only curriculum change and review at both

undergraduate and postgraduate medical level. It will involve: adequate mentoring and support by clinical supervisors, understanding of the role of other health professionals in PA promotion and creating an enabling policy that will ensure doctors have time to stay physically active.

1669 Board #263 May 28 10:30 AM - 12:00 PM
Physiological Responses To Animated Narrative Vs. Nonnarrative Videos In Active Video Gameplay

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PURPOSE: Active video games (AVG) can induce similar physiological responses to physical activities in children. Narratives could be an alternative for increasing players' engagement due to their unique motivational properties. We investigated the effects of an animated narrative video (NV) vs. an animated non-narrative video (N-NV) on heart rate (HR) and rate of perceived exertion (RPE) during children's AVG play sessions.

METHODS: After consent/assent, anamnesis and anthropometrics assessment, we randomly assigned 21 children aged 8-12 years old with no previous AVG experience to watch either an NV or N-NV (duration: ≈11min). They played the AVG for as long as they wanted. HR was monitored pre, during and after the play session using a Polar® HR band ActiGraph Link. RPE was measured pre and post AVG session with Borg's scale. Participants reported their narrative immersion and game engagement via questionnaires. We applied independent samples t-test and repeated measures ANOVA to compare between and within groups. We used Pearson correlation coefficients for association analysis.

RESULTS: The NV and N-NV group did not differ significantly (age: 9.5 ± 1.1 vs. 10.3 ± 1.3 , $p=0.14$; BMI%: 42.0 ± 25.0 vs. 57.2 ± 36.2 , $p=0.28$). The NV group had significantly higher narrative immersion (3.5 ± 0.6 vs. 2.9 ± 0.6 , $p=0.03$, $d=1.03$) and game engagement (4.0 ± 0.4 vs. 3.2 ± 0.3 , $p<0.01$, $d=1.92$) than the N-NV group. Both HR and RPE had a within-group interaction (Time: $ps<0.01$), but not a between-group ($ps>0.33$) or interaction (Time×Group: $ps>0.35$). Narrative immersion was moderately correlated with HR post AVG ($r=0.53$; $p=0.01$) and game engagement ($r=0.46$; $p=0.03$).

CONCLUSIONS: We are the first to test the effect of N-NV vs. NV on physiological responses to AVG play. Although the narrative group did not show higher physiological response (HR and RPE) than the non-narrative group, those with higher immersion during the AVG session also had a higher HR post AVG, suggesting higher game engagement and play motivation.

1670 Board #264 May 28 10:30 AM - 12:00 PM
Effectiveness Of The Foreverfit Weight Loss Program

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 (No relevant relationships reported)

INTRODUCTION- Overweight and obesity is an increasing health concern amongst US adults, as 68% of the adult population are currently classified as such. Several health issues, including cardiovascular health, are associated with increased adiposity. The ForeverFit Program was designed to promote weight loss and cardiovascular fitness via behavior change and structured exercise sessions. Programs that demonstrate weight loss and improved health variables are essential for societal health.

PURPOSE- The purpose of the current study was to assess the effectiveness of the ForeverFit Weight Loss Program.

METHODS- Ten overweight and obese (BMI = $31.4 \text{ kg/m}^2 \pm 4.8$) women (49.4 years ± 11.4) were assessed for body composition, cardiovascular health, and exercise and nutrition self-efficacy prior to and following the ten week program. Bioelectrical impedance analysis (InBody 270, California, USA) measured body composition and weight. VO_2max was estimated via the Ebbeling treadmill protocol, and resting heart rate and blood pressure were measured by an oscillometric automated device (Omron 10 series, Illinois, USA). Self-efficacy was measured via Eating and Exercise Habits Confidence Surveys. The participants underwent a ten week exercise and education program in which they exercised in small groups led by a personal trainer twice each week and given weekly behavior challenges. Variables were analyzed pre and post via paired t-test ($p < .05$).

RESULTS- Participants showed significantly decreased body weight ($-2.54 \text{ kg} \pm 3.36$, $p=0.041$), BMI ($-0.84 \text{ kg/m}^2 \pm 1.11$, $p=0.040$), fat mass ($-2.47 \text{ kg} \pm 0.02$, $p=0.024$), and water weight ($-0.72 \text{ kg} \pm 0.17$, $p=0.002$). Diet (0.70 ± 0.58 , $p=0.025$) and exercise (0.66 ± 0.87 , $p=0.040$) self-efficacy demonstrated significant increases on the 5-point Likert scale. Percent body fat approached significance ($-1.59\% \pm 2.36$, $p=0.059$). Skeletal muscle mass, resting heart rate, blood pressure, and VO_2max did not change significantly.

CONCLUSION- Twice weekly exercise sessions combined with weekly behavior change challenges were effective at reducing body weight and improving self-efficacy

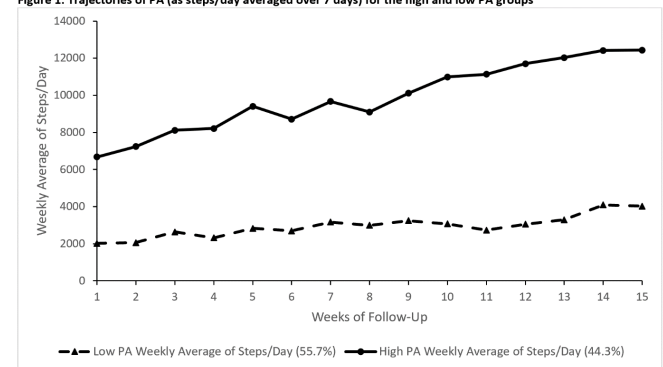
in overweight and obese individuals. Future iterations of the ForeverFit Weight Loss Program should augment the supervised exercise sessions to more effectively target cardiovascular changes.

1671 Board #265 May 28 10:30 AM - 12:00 PM
Trajectories Of Physical Activity In Adults After TKR: A Comparison Of Functional And Psychosocial Measures

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Despite improvements in pain and function, adults after total knee replacement (TKR) remain largely inactive on average and subsequently are at risk for cardiovascular disease, diabetes, and other lifestyle-related chronic diseases. However, there is large variability of change, and little is known about what distinct physical activity (PA) trajectories may exist. **PURPOSE:** To explore trajectories of objectively-measured PA in adults after TKR and describe baseline (BL) functional and psychosocial measures of the trajectory groups. **METHODS:** We used data from an ongoing PA intervention study in adults after TKR. Daily steps/day were collected via Fitabase and averaged across 7 days. We identified trajectory groups of PA via a group-based trajectory model. We selected the optimal number of trajectory groups by requiring the smallest group to include $\geq 5\%$ of the subjects in the sample. We used posterior probabilities of group membership from each individual to assess model fit. BL differences for functional [6 Min Walk, Timed Up & Go, 30 Sec Chair Rise] and self-reported [Pain Catastrophizing Scale (PCS), Tampa Scale of Kinesiophobia (TSK), Self-Efficacy for Exercise (SEE), SF-36] measures between the groups were assessed using independent t-tests and Cohen's d effect sizes. **RESULTS:** 27 subjects were allocated to two trajectory groups: high PA ($n=12$) and low PA ($n=15$) (Figure 1). The high PA group had more males (8 vs 3) and better scores on the PCS (13.4 ± 10.5 vs 5.6 ± 6.2 , $p=0.049$), TSK (33.2 ± 6.7 vs 27.6 ± 4.1 , $p=0.027$), and SF-36 (34.3 ± 18.6 vs 40.2 ± 29.2 , $p=0.037$), but were not different on age, functional measures, or pain, compared to the low PA group. **CONCLUSIONS:** We identified two potential trajectories of change in PA after TKR. Both groups showed improvement in PA after 15 weeks of intervention. Greater improvement may be influenced by psychosocial factors, such as pain and movement perception, rather than functional ability. Supported by NIH R21 AR07079

Figure 1: Trajectories of PA (as steps/day averaged over 7 days) for the high and low PA groups



1672 Board #266 May 28 10:30 AM - 12:00 PM
Quantifying Physical Activity After Concussion: The Relationship Between Sleep Quality, Symptoms, And Steps.

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BACKGROUND: Concussion management guidelines have evolved over recent years to include earlier introduction of physical activity. Determining optimal post-concussion physical activity levels with objective methods will further aid clinicians in counseling patients on the role of physical activity in concussion recovery.

PURPOSE: Our aim was to investigate the relationship of physical activity, as measured by daily step count, with post-injury sleep quality, symptom rating, and dual-task gait measures among youth athletes with concussion. **METHODS:** We conducted a longitudinal investigation of youth athletes who sustained a concussion and were evaluated at 2 time points: within 2 weeks of injury and at clearance for return-to-play. Following the initial visit, athletes wore an activity tracking device (Fitbit Charge 3).

Dual-task gait, Post-Concussion Symptom Inventory, and Pittsburgh Sleep Quality Index values were collected at both visits. We compared outcomes between those who recorded an average of $\geq 10,000$ steps/day (high physical activity) and $< 10,000$ steps/day (low physical activity) between initial and return-to-play clearance visits. **RESULTS:** Six concussed athletes were classified as having high physical activity (33% female; 14.9 ± 2.0 years of age; $13,900 \pm 3,390$ steps/day), and five were classified as having low physical activity (40% female; 15.8 ± 1.7 years of age; $8,415 \pm 1,775$ steps/day). There were no significant differences found at initial visit for total symptom severity (44.3 ± 30.8 vs. 58.2 ± 28.4 ; $p=0.46$), sleep quality (6.8 ± 4.4 vs. 8.8 ± 2.0 ; $p=0.38$), or dual-task gait cost ($-22.4 \pm 7.9\%$ vs. $-20.1 \pm 13.5\%$; $p=0.73$) between the high and low physical activity groups. At the time of return-to-play clearance, however, the high physical activity group reported significantly better sleep quality (1.3 ± 1.9 vs. 6.7 ± 1.5 ; $p=0.009$) and lower symptom severity (0.3 ± 0.8 vs. 3.0 ± 2.0 ; $p=0.02$) than the low physical activity group. **CONCLUSIONS:** Adolescents with a concussion who participated in more physical activity after their initial clinical visit reported better sleep quality and lower symptom severity at return-to-play clearance than the low physical activity group. These preliminary results further support the utility of physical activity in concussion management.

1673 Board #267 May 28 10:30 AM - 12:00 PM
Safety Of High-intensity Interval Training Low-volume Vs Moderate Intensity Continuous Aerobic Training In Metabolic Syndrome
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Moderate intensity continuous aerobic training (MICAT) and high-intensity interval training low-volume (HIIT-low volume) improve the alterations associated to the metabolic syndrome (MS). Patients with MS have multiple morbidities and low fitness, which may predispose them to adverse events when exercising. The safety of these interventions on patients with MS has not been evaluated in depth. **PURPOSE:** to evaluate the safety of HIIT-low volume compared to MICAT in adults with MS. **METHODS:** a controlled, randomized, clinical trial using the minimization method. Sixty patients with MS, of both genders, 40-60 years old, were included. A clinical evaluation, biochemical tests, and an ergospirometry were carried out, before and after a treadmill exercise program of 12 weeks, 3 sessions/week. Volunteers in the intervention group received HIIT-low volume ($n=29$) in 22 min sessions that included six intervals at a load of 90% of maximum oxygen consumption (VO_{2max}) for 1 min followed by 2 min at 50% of VO_{2max} . The control group received MICAT ($n=31$) at an intensity of 60% of VO_{2max} for 36 min. A new approach to record and classify the adverse events according to possible causality based in Naranjo's algorithm was developed. **RESULTS:** patients had a mean age of 50.8 ± 6.0 years, body mass index (BMI) of 30.6 ± 4.0 $kg \cdot m^{-2}$, body fat percentage of $38.7 \pm 7.0\%$ and VO_{2max} of 29.0 ± 6.3 $mL O_2 \cdot kg^{-1} \cdot min^{-1}$; 70% were women. In total, 60 clinical events were recorded in HIIT-low volume group and 48 in MICAT. Most of them (59.3%) were classified as general disease; there were no serious adverse reactions. Only 21 events (19.5%) were classified as an adverse reaction possibly related to exercise. HIIT-low volume and MICAT, had a similar frequency of musculoskeletal events (IRR: 1.1; 95% CI 0.6–1.8; p value=0.791), but higher of cardiovascular events (IRR: 2.9; 95% CI 0.4–22.8; $p=0.310$), after adjusting for age, sex and BMI (HIIT-low volume: chest pain ($n=1$) and symptoms of venous insufficiency of the lower limbs ($n=2$); MICAT: chest pain ($n=1$)). **CONCLUSION:** HIIT-low volume and MICAT are safe, however, we recommend a muscle-conditioning program prior to both and to avoid HIIT-low volume in treadmill in patients with history of venous insufficiency of the lower limbs. Colciencias 111562638757. Interinstitucional 2016-13041. Doctoral scholarships 727-2015

1674 Board #268 May 28 10:30 AM - 12:00 PM
Effect Of Single Resistance Training On Body Composition Of Females
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 (No relevant relationships reported)

PURPOSE: Resistance training (RT) is considered to be an effective way to increase muscle mass and reduce fat mass. This study analyzed the effect of single RT on fat mass (FM), body fat percentage (BF%), fat-free mass (FFM) and muscle mass (MM) of females, in order to clarify whether the role of single RT is also applicable to female subjects in reducing fat and increasing muscle mass.

METHODS: The literatures of PubMed and Web of Science databases were searched up to July 14th, 2018. Two authors screened the documents simultaneously. The Cochrane bias risk assessment tool was used to evaluate the quality of the documents, and the Reviewer Manager 5.3 software performs statistical processing on the data. **RESULTS:** Twenty-three eligible studies were included, involving 917 female subjects, including 483 in the single RT group (RTG) and 434 in the control group (CG). The results of Meta-analysis showed single RT significantly reduced females' FM (WMD: 1.17; 95% CI: 1.03, 1.30; $P < 0.00001$) and BF% (WMD: 0.54; 95% CI: 0.09, 0.98; $P=0.02$), and also significantly increased their FFM e (WMD: -0.81; 95% CI: -0.93, -0.69; $P < 0.00001$). But there was no statistically significant increase in their MM (WMD: -0.20; 95% CI: -0.59, 0.19; $P=0.32$). **CONCLUSIONS:** The results of this study confirm that single RT can effectively reduce females' FM and BF%, and increase their FFM significantly. But it does not help MM growth for all females. Therefore, single RT may not be suitable for females to increase MM. However, it can be recommended for females as a means of rationalizing body composition, including FM decrease and FFM growth. **Keywords:** Single Resistance Training; Female; Body composition; Meta-analysis

1675 Board #269 May 28 10:30 AM - 12:00 PM
Employees With Metabolic Syndrome And Increased Depression Severity Profit Most From Exercise For Work Ability.
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 (No relevant relationships reported)

PURPOSE: Major depressive disorder is associated with less productivity, earlier retirement, and more sick-days at the workplace. These associations also exist for patients with metabolic syndrome. For both, exercise is a generally recommended part of multimodal treatments. However, for individuals with metabolic syndrome, in which depression is more prevalent and severe, evidence for the efficacy of exercise interventions is limited. **METHODS:** Company employees with diagnosed metabolic syndrome ($n=314$, age: 48 ± 8 yrs) were randomized to a 6-month exercise intervention (150 min per week) or wait-list control. Participants received individual recommendations for exercise activities by personal meetings, telephone or via a smartphone app. Physical activities were supervised and adapted using activity monitor data transferred to a central database. Work ability (work ability index), depression severity (hospital anxiety and depression scale [HADS]), and health-related quality of life (short form 36 [SF-36]) were assessed. **RESULTS:** We included 314 subjects from which 287 finished the intervention. After baseline stratification for normal (HADS scores 0-7) and increased depression scores (HADS scores 8-21) individuals with increased severity scores had similar age, body composition, blood lipids, and cardiorespiratory fitness compared to those with normal scores, but lower total work ability (33.1 ± 5.4 vs. 38.2 ± 4.9 points, $p < 0.05$) and component sum scores of health-related quality of life. After 6 months total work ability increased in the exercise group compared to controls with the magnitude of the observed increase being significantly greater for subjects with increased depression severity at baseline (3.7 ± 3.4 points) compared to those with normal severity scores (1.2 ± 2.4 points) ($p=0.021$). **CONCLUSIONS:** A 6-month exercise intervention for company employees with metabolic syndrome showed strongest effects on self-perceived work ability in individuals with mild to severe depression severity. This suggests exercise programs offered to workers with metabolic syndrome not only reduces individual disease risk but may also reduce healthcare and employers costs arising from metabolic syndrome and mental disease conditions.

1676 Board #270 May 28 10:30 AM - 12:00 PM
Effects Of Hatha Yoga And HIIT On The Psychological Status Of Female University Students With High Risk Of Eating Disorder
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 (No relevant relationships reported)

PURPOSE: By using Hatha Yoga (Yoga) and High Intensity Interval Training (HIIT) to intervene the female university students at high risk of eating disorder (ED), this study was purposed to get better understanding of the effects of exercise on the reduction of ED risk and improvement of psychological status. **METHODS:** A total of 384 female university students (20.40 yrs) were involved in the EDI-3 estimate, and 92 of them were judged to have high risk of ED. Eventually

63 of the 92 students participated in the eight-week intervention study after filling the informed consent form. They were randomly divided into three groups: the Yoga group (Y), HIIT group (H) and control group (C) (n=21, per group). During the experiment, the subjects were asked to record their daily diet logs and wear accelerators to measure physical activities. The exercises were as follows. (1) Y: 60 min/bout (including 5 min of regulated breathing, 45 min of Yoga Asana training and 10 min of relax), 3 times/wk. (2) H: treadmill exercise, 5 min of warm-up, 4×(3min of 90% VO_{2max} exercise + 2min of 50% VO_{2max} exercise), 5 min of relax, 3 times/wk. (3) C: daily physical activity without extra exercise. At the end of 8-week experiment, EDI-3 was conducted again.

RESULTS: (1) In reducing the value of Drive for Thinness ($\Delta DT=-2.74$), Y was significantly better than H ($p<0.05$); however in reducing the value of BD ($\Delta BD=-5.3$), H was significantly better than Y ($p<0.05$). (2) In reducing the value of Bulimia(B), both Y ($\Delta B=-3.32$, $p<0.05$) and H ($\Delta B=-5.7$, $p<0.01$) were effective in contrast to C. (3) In reducing Perfectionism value ($\Delta P=-2.95$), Y was very significantly better than H ($p<0.01$). (4) The subscales of DT and B were positively correlated with the subscales of Interceptive Deficits (ID) and Emotional Dysregulation (EDy) ($p<0.05$).

CONCLUSIONS: (1) 23.96% of female university students were at high risk of ED. (2) Both Yoga and HIIT could effectively reduce the risk of ED. (3) Yoga were more effective in reducing the DT behavior and improving the mental status in terms of EDy and P. (4) HIIT were more effective in reducing the BD and B behaviors. (4) The risks of DT and B was correlated with the psychological status such as ID and EDy.

Acknowledgment: This study was supported by 2018 Education Reform Project of BSU.

1677 Board #271 May 28 10:30 AM - 12:00 PM

EXERCISE METHOD AND EFFECT EVALUATION OF HIGH INTENSITY INTERVAL EXERCISE INTERVENTION NAFLD IN EXERCISE AND MEDICAL INTEGRATION

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(No relevant relationships reported)

PURPOSE:

Based on the analysis of the detection rate of fatty liver in the physical examination of the faculty in Beijing Normal University from 2017 to 2018, this study designed and implemented a high-intensity interval centered on improving exercise intensity, imparting motor skills, comprehending sports value, and experiencing exercise effects.

METHODS:

① Intervention: The exercise mode is high-intensity intermittent exercise, and the specific exercise forms cover resistance and aerobic content. HIIT exercise intensity is 85%-95% HRmax, exercise time is 50 minutes each time, the number is 3 times a week for 12 weeks. ② Physical and medical routine monitoring indicators of comprehensive health response NAFLD population, including body shape, quality index, heart rate, blood pressure, maximal oxygen uptake, blood biochemical index.

RESULTS:

① The detection rate of fatty liver in faculty and staff was higher in males than in females ($P<0.01$); it was characterized by increasing age ($P<0.01$) and obesity being higher than normal ($P<0.01$). ② After 12 weeks of HIIT intervention, the body weight, waist circumference and waist-to-height ratio of the exercise group decreased significantly, which decreased by 1.9%, 0.9% and 1.9% ($P<0.01$), respectively. ③ In the exercise group, the four physical quality indicators increased significantly ($P<0.01$). ④ The HDL-C of the exercise group increased significantly ($P<0.05$), LDL-C increased slightly, FBG, TC, TG decreased slightly. ⑤ AST and ALT in the exercise group decreased significantly ($P<0.01$). ⑥ The effective rate of exercise on NAFLD was 57.7% in the exercise group, which was significantly higher than that in the control group ($P<0.05$). ⑦ The health skills acquisition scores of the exercise group were significantly higher than those of the control group ($P<0.01$).

CONCLUSIONS:

① From 2017 to 2018, the detection rates of fatty liver in physical examination of teachers were 32.2% and 25.3% respectively. ② 12-week HIIT can significantly reduce the body weight, waist circumference, AST and ALT of NAFLD subjects, and it can significantly improve the lung capacity, physical fitness indicators, HDL-C of NAFLD subjects. ③ 12-week HIIT can significantly improve the liver sonogram of NAFLD subjects, and it can effectively promote the improvement of motor skills of NAFLD subjects.

1678 Board #272 May 28 10:30 AM - 12:00 PM

Multicomponent Training For Dementia Patients: Body&Brain Project Primary Results On Functional Fitness

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PURPOSE: Evidence is necessary to attest the therapeutic role of physical exercise as a non-pharmacological adjuvant treatment for dementia. In addition to the intrinsic benefits of regular exercise on physical fitness, individual wellness and quality-of-life, it also may have a positive influence on cognitive function, daily functionality and minimizing the risk of falls. Multicomponent Training (MT) combines aerobic, strength, balance and postural exercises and has been suggested as an effective training modality for dementia individuals. This study aimed to examine the effects of a MT intervention on functional fitness in elders with dementia. **METHODS:** A 6-month MT exercise program was conducted twice a week with 50-minute group-based sessions. This intervention included 25 subjects clinically diagnosed with dementia, referred from hospitals, daycare centers and municipalities - conducted in 6 community-based settings. Sessions were divided in 3 main parts: warm-up, specific training at light-to-moderate intensity, and cool down. The *Short Performance Physical Battery* (SPPB), *Timed-up-and-Go* (TUG), and *One-Leg Balance* (OLB) tests were used before and after intervention. **RESULTS:** The sample comprised 18 women with medium age of 77 years [range 62-90], and a baseline medium score of 20.64 points on *Mini Mental State Examination*. Results from Paired-Samples Signed Test revealed a statistically significant positive effect on SPPB ($p=0.001$) from pre (9.04 ± 2.42) to post intervention (10.28 ± 1.97); and on TUG ($p<0.000$), emphasized by 22 individuals that performed the task quicker at post-test (9.35 ± 3.27). Results from OLB showed a slight improvement from baseline (4.40 ± 6.83) to post-intervention (6.00 ± 7.51), although not statistically significant ($p=0.307$). **CONCLUSIONS:** Data suggest that a 6-month MT intervention may be an important strategy to improve physical function on dementia patients and, therefore, it might have an impact on reducing the risk of falls. In addition, this intervention may positively influence dementia subjects on daily tasks by promoting their mobility, critical to decrease the progression of dependence on caregivers'. **FUNDING:** FCT - CIAFEL (UID/DTP/00617/2019), "Body&Brain" (POCI-01-0145-FEDER-031808), and Ph.D. Grant (SFRH/BD/136635/2018); & IPDJ.

1679 Board #273 May 28 10:30 AM - 12:00 PM

Physical Function Of Aged Population Is Predicted By Motor Competence And Physical Fitness

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Fitness and cognitive status on aging has been widely studied and well reported on literature. Independence and functioning are decisive in elders life quality. Motor competence has been associated to children physical activity levels and healthy weight status. Whether or not Motor Competence has additional value in promoting physical function on aging is not well established.

PURPOSE: to investigate the relationship and influence of motor competence, physical fitness and cognitive status on physical functioning, in aged population.

METHODS: institutionalized participants were recruited as a convenience sample in three day-care centers (N=283, women N=184, mean age = 82.05±7.70 years). Physical functioning was assessed through self-report using a composite physical function scale. Physical fitness was evaluated with the Senior Fitness Test. Motor competence was evaluated as the proficiency in overarm throw a tennis ball, measuring the ball velocity, and standing long jump. Cognitive performance was assessed with Mini-Mental State Examination test. T test was used to test the difference between women and men in all variables. Pearson correlation between physical functioning, physical fitness and motor competence was performed. Stepwise regression was used to identify the predictor variables of physical functioning. Significance was set at $p < 0.05$.

RESULTS: Men had significant better motor competence and physical fitness results than women. In women, the highest correlation were found between physical functioning and Chair stand ($r=0.25$), standing long jump ($r=0.19$) and 2-min step ($r=0.19$). In men, the highest correlation were found on 2-min step ($r=0.30$) and overarm throw ($r=0.27$). Stepwise regression retained the following variables: 2.44 m up-&-Go, standing long jump, and sex ($F_{(3,212)} = 33.73$; $p < 0.001$, $R^2 = 0.32$). Men has an estimate of more 2.162 points in physical functioning than women. Physical functioning is estimate to increased 1 point for every -0.151 s in 2.44 m Up-&-Go, and 1 point for every 0.051 cm in standing long jump.

CONCLUSION: Despite having found significant moderate to low correlations in both men and women, it seems that both Motor Competence and Fitness status has important influence on physical functioning.

1680 Board #274 May 28 10:30 AM - 12:00 PM
The Effect Of Traditional Chinese Exercise On Diabetic : A Non-randomized Controlled Trial

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Objective: Clinical practice recommendations issued by the American Diabetes Association in 2019 include the health status and quality of life of people with diabetes as part of their daily care, and believe that it's important to strengthen physical exercise for diabetic patients. Previous studies have shown that the Baduanjin, a traditional Chinese sport, can regulate blood glucose and blood lipids, weight loss and improve immunity. This study was aimed at investigating the effects and safety of Modified Baduanjin on patients with type 2 diabetes. **Methods:** Forty patients were divided into the Modified Baduanjin group (A group, n=22) and the control group (B group, n=18) for 12 weeks according to their individual motivation. On the basis of conventional hypoglycemic treatment, Group A practiced Baduanjin for 30 minutes per day, 4 times per week, while no exercise intervention was given in group B. The main study outcomes included changes in fasting blood glucose, blood lipids, glycosylated hemoglobin, Quality of Life score (QoL score, 100 in total), muscle endurance, and flexibility after 12 weeks. **Results:** There were no significant differences in patient characteristics between the two groups at baseline. Group A in glycosylated hemoglobin (pre 6.56±0.70 vs post 6.28±0.70), QoL score (pre 80.18±9.02 vs post 86.64±9.91), muscle endurance (pre 3.76±4.38 vs post 6.91±5.73) and flexibility (pre 2.86±9.69 vs post 5.88±9.75). All the above results were statistically significant (P<0.05). There were no statistical significance in group B (P>0.05). 2) Few changes were found in fasting blood glucose and lipid parameters both in two groups (P>0.05). 3) All patients completed the exercise programme with no adverse effects. **Conclusion:** Chinese traditional exercise is effective and safe in regulating and control the level of blood glucose, enhancing physical fitness and improving the quality of life.

1681 Board #275 May 28 10:30 AM - 12:00 PM
Peer-led Fall Prevention Program For People Aged 50+: Are We Attracting The Right People?

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Falls are established as the leading cause of hospitalization amongst older adults leading to institutionalization and premature mortality. Peer-led exercise has been recognized as a powerful intervention for reducing the risk of falls. However, it is unclear if current community programs are attracting individuals at risk of falling.

Purpose

To examine the characteristics of participants enrolled in a community-based peer-led fall prevention exercise program.

Methods

Between 2012-2018, 912 older adults participated in this program. The 12-week peer-led fall prevention exercise program was offered to older adults 50+ twice per week for a total duration of 120 minutes. The program consisted of endurance, strength and balance exercises. At baseline, sex, age, falls, injuries due to falls, balance, hospital visits and medications were self-reported. Five time sit-to-stand (S-S) tests and 8ft up and go (8UG) tests were also measured to assess lower extremity strength and dynamic balance in relation to risk of mobility loss and falls.

Results

A total of 87.5% were women with an average age of 68 years old. Sixteen percent of participants reported falling in the past year, 58% of which resulted in injury. One-third of the participants reported having issues with balance, 9% had been to hospital in the past year and were prescribed an average of three medications. On average, females completed the 8UG test in 9.18 seconds and the S-S test in 13.10 seconds while males completed the tests in 10.25 seconds and 14.35 seconds, respectively. According to norms, all test means classified participants as at risk for mobility loss and falls. Females performed significantly better than males in the 8UG test (p = 0.001) and S-S test (p = 0.040).

Conclusion

The peer-led fall prevention program is attracting mainly women participants with various physical capacities and risks of falls.

Funding: NBHRF and GNB-Wellness

1682 Board #276 May 28 10:30 AM - 12:00 PM
Impact Of Psychological Effects On Adolescent Physical Activity: An Intervention Study

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Adolescent physical health is associated with the behaviour of physical activity (PA). To date, the intervention studies on improving adolescent PA emerge in an endless stream, however, those put few emphasis on the generation process of PA, especially in the psychological effects of PA. **PURPOSE:** This current study is to examine the intervention impacts of psychological effects on adolescent PA behaviour based on the Theory of Planned Behaviour (TPB) and the Self-efficacy Theory (SET). **METHODS:** Participants (n=51, 12±0.3y) in seventh grade from a Chinese junior middle school were assigned to two groups: the intervention group (n=24) and the control group (n=27). Both groups were pre and post tested with the related psychological effects questionnaires which were selected according to the TPB and SET, and PA behaviour measured by PA Scale and ActiGraph accelerometer (Model: wGT3X-BT). The intervention group took part in 8 times 45-minutes classes during 8 weeks, including 5 courses related to health, nutrition and PA, and 3 outdoor interesting basketball matches. The control group was not asked to make any change to their normal school day. A 2×2 repeated measure ANOVA was mainly conducted. **RESULTS:** In terms of psychological effects of PA, the intervention group showed significant increases in perceived behavioral control (F=5.279, p=0.024), exercise intention (F=10.662, p=0.002) and self-efficacy (F=6.427, p=0.013) over the control group, but not in exercise attitude, subjective norms and outcome expectancy. Furthermore, with regard to PA behaviour, the intervention group presented significant improvement in the duration of PA per time (F=5.406, p=0.022) and percentage of light intensity in 7 days (F=6.443, p=0.013) as well as the reduction in percentage of sedentary behaviour in 7 days (F=3.934, p=0.048) compared to the control group. No significant change in the rest of PA behaviour parameters were found between two groups. Moreover, the chi-square test indicated that the number of intervention group students participating in MVPA significantly increased compared to the control group after the eight-week intervention (=6.621, p=0.036). **CONCLUSION:** It was concluded that the psychological effects intervention towards PA based on TPB and SET can improve adolescent PA over the eight-week specific courses.

1683 Board #277 May 28 10:30 AM - 12:00 PM
Pilot Study- Effects Of A Standardized Eight-week Exercise Program On Fundamental Physical Components

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PURPOSE: To understand the effects of an eight-week resistance training program on the fundamental physical components of muscular endurance, strength, gait speed, flexibility, and balance, as well as sleep habits, pain levels, and quality of life. **METHODS:** Six individuals, consisting of five females and one male (48-69 years of age) were tested on six tasks: 30 second chair stand, 30 second arm curl, two-minute step test, chair sit-and-reach, back scratch, and an eight-foot, timed up-and-go. Data was collected at baseline and following the completion of an eight-week resistance training program, in which participants performed eight exercises, twice a week for a total of eight weeks. The resistance training program aimed to provide a total body workout, at constant, slow speeds. Data was analyzed using paired-samples t-tests. Additionally, a questionnaire was administered at baseline, after four weeks, and after the eight-week program concluded to reflect on their sleep habits, pain levels, and overall quality of life. **RESULTS:** Significant improvements were observed between pre and post for the Chair Stand (10.7 ± 0.9; 16.0 ± 1.8; p=0.002), Up&Go Right Foot (5.4 ± 0.3; 4.7 ± 0.3; p=0.010), and Up&Go Left Foot (5.5 ± 0.3; 4.7 ± 0.3; p=0.037). Additionally, two participants reported improved sleep habits, while four participants stated a decrease in pain levels during exercise. **CONCLUSION:** Results of the present investigation suggest that an eight-week resistance training program may lead to increased leg strength, gait speed, dynamic balance, and physical function, indicated by improvements in Chair Stand and Eight-foot Up&Go performance. As these functional tests can be used to identify fall risk and replicate required activities of daily living, the findings highlight the need to implement training programs for the maintenance and/or improvement of locomotor function in older adults, as well as improve quality of life components such as sleep habits and perceived pain during daily activity.

1684 Board #278 May 28 10:30 AM - 12:00 PM
The Effects Of A Sit-to-stand Workstation On Body Composition Over 12 Months

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The nature of office work promotes a sedentary lifestyle associated with an increased risk of obesity. Many interventions have attempted to combat physical inactivity among sedentary office workers. The sit-to-stand (STS) workstation is a modality aimed at improving workers' physical health.

PURPOSE: Therefore, the purpose of this study is to evaluate the effects of using a STS workstation on body composition over the course of 12 months. **METHODS:** All participants were volunteer faculty and staff of the University of Central Oklahoma randomly assigned to a control ($n = 19$) or STS workstation intervention ($n = 13$) group. Participants of both groups consented to a pre-test, 6-month, and 12-month dual-energy X-ray absorptiometry (DXA) scan to assess variables of body composition including, but not limited to; body fat percentage (BF%), total fat mass, total lean mass, total bone mineral density (BMD), and the ratio of android to gynoid (A/G) fat. The STS intervention group was tasked with standing at least two hours per work day, while the control group was instructed to continue their day as normal without incorporating the use of a STS workstation.

RESULTS: Multiple 2 x 3 mixed-design ANOVA tests were conducted to examine the effects a STS workstation has on body composition over time (pre-, 6mos., and 12mos.). There were no significant interactions between time and group for total BF% ($F_{(2,60)} = .17, p > .05$), total fat mass ($F_{(2,60)} = .26, p > .05$), total lean mass ($F_{(2,60)} = .51, p > .05$), total BMD ($F_{(2,60)} = .15, p > .05$), and A/G ratio ($F_{(2,60)} = .37, p > .05$). Additionally, there was not a significant main effect found for groups among any of the five body composition variables. A significant main effect for time was found for total BMD ($F_{(2,60)} = 11.6, p < .001$) and A/G ratio ($F_{(2,60)} = 3.2, p = .046$), but not for BF%, total fat mass, and total lean mass.

CONCLUSIONS: The implementation of a STS workstation did not significantly improve body composition when compared to the control group. Future research is needed to determine if utilizing a STS workstation improves other body composition variables.

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1685 Board #279 May 28 10:30 AM - 12:00 PM
Hit Effects On Substrates Oxidation Rates Of Women In Different Phases Of Monthly Ovarian Cycle

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The metabolic inflexibility (limitation to respond or adapt to conditional changes in metabolic demand due to dietary patterns, energy availability, or circulating energy substrates) may be associated with variations in estrogen concentrations observed during the monthly ovarian cycle, whereas that apparently healthy women of childbearing age exhibit variation in substrates oxidation rates that may lead to overweight, type II diabetes and other associated conditions. **Purpose:** The aims of this study were to verify and compare the influence of eight treadmill high-intensity interval training (HIT) sessions on carbohydrate and lipid oxidation rates (CHOox and LIPox, respectively) and intensities of ventilatory anaerobic thresholds (VATs) of women in different phases of monthly ovarian cycle. **Methods:** Eleven irregularly active women performed incremental treadmill exercise testing followed by submaximal work-rate running for 45min to determine VATs, VO_{2peak} , peak velocity (V_{peak}), and substrate oxidation rates, before and after training period, in different phases of their monthly ovarian cycle ("Follicular" phase group, FPG, $n=6$; "Luteal" phase group, LPG, $n=5$). The training period consisted of eight HIT sessions, composed each one of eight sets of 60s running at 100% V_{peak} interspersed by 75s recovery, every 48h. **Results:** Our results showed no significant differences in VATs intensities between groups. The comparison between groups showed significant differences in relative energy derived from CHOox pre-post training of the -61.4% and -59.3% respectively, and LIPox pre-post training of the 27.5% and 34.4% respectively. The relative energy derived from CHOox after the training period were 18.9% and 25.5% higher to FPG and LPG, respectively; consequently, the relative energy derived from LIPox after the training period were 8.45% and 3.46% lower to FPG and LPG, respectively. Over the training period, V_{peak} was ~13.5 km/h, which produced the relative intensities of ~89% VO_{2peak} e ~93% HR_{peak} for both groups. **Conclusion:** The

monthly ovarian cycle phases promote significant changes on substrates oxidation rates leading to decrease of CHOox. High intensity interval training can minimize the differences observed and constitute an alternative intervention.

1686 Board #280 May 28 10:30 AM - 12:00 PM
Do The Health Benefits Of Different Physical Fitness Levels Of Young Adults Outweigh The Risks?

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PURPOSE: Air pollution has become a substantial environmental issue affecting human health and health related behavior. Physical activity is widely accepted as a method to promote health and well-being and is potentially influenced by air pollution. There is a paucity of research on the point at which exercise level in a polluted environment becomes more beneficial than harmful, thus limiting the capacity to effectively balance the risk and benefits of regular outdoor exercise. Therefore the purpose of the study was to determine whether long-term regular exercise could prevent the health damage among healthy young adults in air pollution conditions.

METHODS: In our study, we constructed a real-world crossover study with repeated measures of 25 healthy young adults. Linear mixed models were used to determine the impact of short-term exposure to air pollution environment on respiratory and inflammatory functions among 25 different physical fitness levels of health young adults after 2 hours moderate intensity physical activity. **RESULTS:** There were increased statistically significance ($p \leq 0.05$) in pulmonary function(forced expiratory volume in 1s (35 mL), forced vital capacity (25 mL), forced expiratory flow(FEF25-75%)(69 mL)) and number of lymphocytes among young adults with high physical fitness levels, while decreased statistically significant in lung inflammation(fraction of exhaled nitric oxide, FeNO). However, different outcomes were found in normal physical fitness levels' counterparts. Additionally, Studies have generally suggested that moderate-intensity physical activity can increase lymphocyte immune function and improve health by causing an increase in the secretion of neurotransmitter-catecholamines. **CONCLUSIONS:** Our findings suggest that: 1) the young adults with high levels of physical fitness may reduce the immediate adverse effects of air pollution, such as inflammatory responses and increase respiratory function, compared to normal physical fitness levels' counterparts; 2) the regulation of neurotransmitter-catecholamine secretion may be a potential mechanism for physical activity and air pollution to affect health by regulating lymphocytes. Further studies with larger sample size and longer exposure time are highly needed to duplicate the work.

1687 Board #281 May 28 10:30 AM - 12:00 PM
The Effect Of Yoga On Body Fat And Cardiorespiratory Fitness Of Sedentary Overweight Female Students

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PURPOSE: To observe the effects of 8-week yoga on body fat and cardiorespiratory fitness of sedentary overweight female students.

METHODS: 25 healthy overweight female students were recruited online or in classroom. They were randomly divided into the yoga($n=13$) and control ($n=12$) group. 8-week Hatha yoga, 4 times/week, 60 minutes/time. After each session, subjects were asked about their feelings to adjust the intensity. During the intervention, all subjects maintained their daily diet and physical activity. Control group can join our yoga practice if they wanted to after the experiment. Before the experiment, the height was measured twice with a height meter. Body composition was measured by DXA, cardiorespiratory fitness was tested with the Bruce Protocol in pre-and post-experiment, body weight, fat mass, Fat%, the fat mass in android and gynoid areas, absolute VO_{2max} and relative VO_{2max} were automatically identified by the computer. All operations were done by same person. All the data were compared between groups with independent sample t-test, and within groups with paired sample t-test, SPSS was used for statistics.

RESULTS: (1) In pre-experiment, there were no significant difference in age, height, weight, BMI, body Fat, Fat%, android and gynoid Fat mass, absolute and relative VO_{2max} between the two groups; (2) In post-experiment, the relative VO_{2max} (38.54 ± 4.01 VS $34.75 \pm 3.77, p < 0.05$) in the yoga but not the control group was significantly increased; (3) Compared with the pre-experiment, Fat% ($34.36\% \pm 2.41\%$ VS $33.63\% \pm 2.64\%, p < 0.05$) in yoga group decreased significantly, absolute VO_{2max} (1.95 ± 0.33 VS $2.19 \pm 0.27, p < 0.01$) and relative VO_{2max} (33.85 ± 3.41 VS $38.54 \pm 4.01, p < 0.01$) increased significantly in the post-experiment. All indicators in the control group showed no significant difference in pre- and post-experiment; (4) Significant differences in the changes of Fat% ($-0.73\% \pm 0.98\%$ VS $0.06\% \pm 0.68\%, p < 0.05$), absolute VO_{2max} (0.24 ± 0.21 VS $0.06 \pm 0.13, p < 0.05$) and relative VO_{2max} (4.69 ± 3.45 VS $1.17 \pm 1.90, p < 0.01$) existed between the two groups.

CONCLUSIONS: 8-week yoga can reduce the Fat% and improve cardiorespiratory fitness of sedentary overweight female students. **Acknowledgment:** this study was supported by 2018 Education Reform Project of BSU and The Laboratory of the Ministry of Education.

1688 Board #282 May 28 10:30 AM - 12:00 PM
IMPROVEMENT IN ELEMENTARY STUDENTS PREFERENCE FOR PHYSICAL ACTIVITY ENGAGEMENT FOLLOWING PHYSICAL LITERACY PROGRAMMING

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(No relevant relationships reported)

How children perceive their physical ability and body image can impact their involvement in physical activities. Teaching children basic mechanics and exposing them to new activities may increase the likelihood of selecting a physically active option versus a passive option. **Purpose:** The purpose of this research was to examine the relationship between body mass index (BMI) and self-perception of adequacy in and enjoyment of physical activity following implementation of a six-week physical literacy (PL) intervention. **Methods:** Students (n=82) in grades 2-5 completed the Children's Self-Perceptions of Adequacy and Predisposition for Physical Activity (CSAPPA) scale pre- and post- PL intervention. The PL intervention program consisted of a once weekly, 30-minute program conducted by trained individuals during the school day. This program was designed to focus on the mechanics of running, jumping, and throwing. Height and weight were measured pre- intervention to calculate BMI using the Center for Disease Control's Youth and Teen calculator. **Results:** A significant interaction between CSAPPA score and BMI category was found, ($F(1,82) = 4.948, p < 0.05$). Further evaluation of the interaction indicated that students in the unhealthy BMI category were more likely to choose an active over a passive physical activity option following the PL intervention. **Conclusion:** Based on the aforementioned results, PL programming seems favorable in improving self-perception of physical activity selection in children with abnormal BMIs. Previous research has shown that students who do not feel confident performing a task are less likely to participate. Following the trend of decreased exposure to physical activity during school, students with unhealthy BMIs are not getting proper exposure to the mechanics of movement. This may lead to less physical activity participation and increases in unhealthy BMI ranges. By teaching children that they can move proficiently, children are making more active choices possibly leading to improvements in self-perception.

1689 Board #283 May 28 10:30 AM - 12:00 PM
Effects Of Different Types Of Exercise Programs And/ or Nutritional Guidance On Body Fat And Muscle Mass Distribution In Overweight Adults: A Secondary Analysis Of A Randomized Controlled Trial

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(No relevant relationships reported)

PURPOSE: Both exercise training and diet are recommended to prevent muscle mass loss and excessive fat accumulation. The aim of the present study was to investigate whether 12 weeks of high-intensity interval training (HIIT), resistance training (RT), combination training (CT = HIIT+RT) or a nutritional guidance (NG) plan induced differential responses on body composition components, and to compare the responses between the four intervention groups.

METHODS: Subjects were 57 sedentary subjects with abdominal obesity or excess weight for body mass index > 26 wt./ht.2 (mean age, 40.7 ± 7.0 years) were allocated to a 12-week individualized programme intervention (HIIT, RT or CT) or NG (changing the quality of the diet with changing the total energy intake to encourage weight loss). The main outcomes were the change in total fat/muscle mass, percentage of body fat, percentage of body lean, trunk fat/muscle mass, leg fat/muscle mass, and fat/muscle android gynecoid distribution were measured by segmental dual-energy X-ray absorptiometry.

RESULTS: Two-way ANOVA revealed a significant group effect from HIIT and CT groups on trunk fat mass (%) [$F(5.3), p=0.024, \eta^2 p=0.058$], legs fat mass [$F(4.4), p=0.037, \eta^2 p=0.050$], android fat mass (%) [$F(5.8), p=0.023, \eta^2 p=0.123$] and total fat mass (%) [$F(5.2), p=0.025, \eta^2 p=0.057$]. Additionally, significant effect was observed for the group \times time interaction between RT and CT group for the muscle mass (g) in arms [$F(4.3), p=0.006, \eta^2 p=0.130$] and group \times time interaction between RT and NG group in total muscle mass (g) [$F(2.9), p=0.038, \eta^2 p=0.093$]. **CONCLUSIONS:** Physical exercise has beneficial effects on body composition distribution in sedentary

adults with excess weight. Further clinical trials are needed to investigate the underlying mechanisms related for physical exercise training and modification in body composition.

1690 Board #284 May 28 10:30 AM - 12:00 PM
A Short-term Longitudinal Study Of The Effectiveness Of Kids Get Fit Fitness And Nutrition Curriculum

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PURPOSE: This study investigated the effects of the Kids Get Fit (KGF) fitness (premised on integrative neuromuscular training) curriculum and nutritional education on measures of movement competence, muscular endurance, and dietary behavior in elementary school age children. **METHODS:** Participants were 4th graders at two local schools ($94 \pm 2\%$ Hispanic/Latino) in Corpus Christi, Texas, i.e., experimental (n = 69; 31 males) (8.5 ± 0.5 years; 132.6 ± 6.3 cm; 36.3 ± 10.7 kg) and control (n = 40; 14 males) (8.4 ± 1.2 years; 131.7 ± 17.1 cm; 35.7 ± 11.5 kg). KGF instructors delivered an engaging curriculum that included fitness, dance, yoga, and nutritional education to children at the intervention school, while the control school had traditional physical education class across 12 weeks. Movement competence (standing long jump), muscular endurance (90° push-up), and dietary behaviors (EFNEP 3rd-5th Grade Survey) were assessed at baseline and within a week of concluding the intervention. A series of factorial ANOVA and Mann-Whitney U Test was used to explore differences within and between groups. Statistical significance was set at $P < .05$. **RESULTS:** There was a significant interaction of time and intervention ($F(1,108) = 7.973, P = .006$); the control group had higher resting heart rate increase compared to the experimental group. There was a significant interaction of time and intervention ($F(1,96) = 8.579, P = .004$); the experimental group showed greater increase in standing long jump performance compared to the control group. There was a significant main effect of the intervention ($F(1,107) = 6.192, P = .014$); the experimental group showed increased 90o push-up performance compared to the control group. There were no significant differences in sugar-sweetened beverage (U = 1311.500, P = .505), vegetable (U = 1399.500, P = .924), and fruit (U = 1341.500, P = .629) consumption between groups after 12 weeks. **CONCLUSIONS:** Findings suggest the intervention improved muscular endurance and movement competence. Improved stability of resting heart rate suggests favorable cardiovascular effects attributed to enhanced fitness. Lack of differences in dietary behaviors further underscore the importance of involving entire families in nutritional education and addressing access to healthy foods in elementary school age children.

1691 Board #285 May 28 10:30 AM - 12:00 PM
Maternal Fitness And Physical Activity Levels Decrease Infant Adiposity Up To 1 Year Of Age

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Maternal obesity and excess gestational weight gain (GWG) are associated with increases in infant birth weight and childhood obesity. While greater levels of physical activity are associated with lower GWG and may contribute to reduced infant birthweight and infant adiposity, this remains to be substantiated. **Purpose:** The objective was to examine the relationships between aerobic physical activity during pregnancy, maternal cardiorespiratory fitness, GWG, and infant adiposity from birth to one year of age.

Methods: Nineteen pregnant mothers with singleton pregnancies were randomized into either aerobic intervention (N=9) or control (N=10) groups and followed for 12 months postpartum. At 12 \pm 2 weeks, 20 \pm 2 weeks and 36 \pm 2 weeks, maternal cardiorespiratory fitness (VO_{2peak} ml/kg/min) was assessed using cycle ergometry, percent body fat via skinfolds, and 5-day levels of physical activity with the BodyMedia Sensewear Armband. Infant skinfolds, length, weight, and waist circumference were obtained at birth, 6 months, and 12 months postpartum.

Results: Higher total energy expenditure, moderate to vigorous physical activity (MVPA), step count, and MET level were associated with lower maternal percent body fat (range $r = -.59$ to $-.82$; $p < 0.02$) and GWG (range $r = -.32$ to $-.40$; $p \leq 0.05$). Multiple linear regression analysis with energy expenditure, MVPA, step count and MET level included in the model showed that, MVPA independently predicted 43% of the variability in maternal percent body fat and that MET level independently predicted 22% of the variability in GWG. Total time spent in physical activity during pregnancy did not associate with infant adiposity at birth or during follow-up. However, women with higher cardiorespiratory fitness participated in greater MVPA throughout pregnancy compared to those who were less fit (67.1 ± 38.3 vs. $23.8 \pm$

23.6min, $p < 0.001$). At the 1 year time point, for every 1 unit increase in maternal cardiorespiratory fitness, infant waist circumference, biceps skinfolds and triceps skinfolds decreased by 1.4cm, 1.6mm, and 1.1mm, respectively ($p < 0.05$).

Conclusion: Our findings suggests that greater cardiorespiratory fitness is associated with reduced infant adiposity up to one year of age, possibly mediated by levels of moderate to vigorous physical activity throughout pregnancy.

1692 Board #286 May 28 10:30 AM - 12:00 PM
Sedentary Behavior, Physical Activity And Bone Mineral Density In Ckd Patients: An Isotemporal Substitution Approach

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[BACKGROUND] Both insufficient moderate- to vigorous-intensity physical activity and excessive amount of sedentary behavior may contribute to a declined bone mineral density, which is associated with an increased mortality in patients with chronic kidney disease (CKD). However, the benefits of behavior modification (e.g., replacing sedentary behavior with physical activity) on bone mineral density remains obscure. Isotemporal substitution approach is a statistical approach which estimates the associations when replacing time from one behavior to another, while keeping total time and other behavior fixed. [PURPOSE] The purpose of this study was to determine the associations of sedentary behavior and physical activity with bone mineral density in patients with CKD, using isotemporal substitution approach. [METHODS] A total of 108 middle-aged and older patients with CKD (65 ± 9 years) participated in this study. The time spent in sedentary behavior, light-intensity physical activity (LPA), and moderate- to vigorous-intensity physical activity (MVPA) were assessed using triaxial accelerometers. As indices of bone mineral density, speed of sound (SOS), broadband ultrasound attenuation (BUA) and stiffness index were used. SOS and BUA were measured using ultrasound bone-densitometer. Stiffness index was calculated from SOS and BUA. [RESULTS] The time spent in MVPA was significantly and positively associated with SOS ($B = 1.328$, 95%CI: 0.004, 2.652), BUA ($B = 0.827$, 95%CI: 0.046, 0.609) and stiffness index ($B = 0.926$, 95%CI: 0.091, 1.762) after adjusting for age, sex, body mass index and kidney function. However, the time spent in sedentary behavior and LPA were not significantly associated with bone mineral density measurements. Isotemporal substitution approach showed that replacement of 10 min/day of sedentary behavior with equivalent MVPA time was beneficially associated with SOS ($B = 1.455$, 95%CI: 0.224, 2.686), BUA ($B = 1.015$, 95%CI: 0.289, 1.742) and stiffness index ($B = 1.088$, 95%CI: 0.311, 1.864). [CONCLUSION] These cross-sectional findings suggest that replacing sedentary behavior with the same amount of MVPA may benefit bone health in middle-aged and older patients with CKD.

1693 Board #287 May 28 10:30 AM - 12:00 PM
Effects Of A Personalized Six-week Resistance Exercise Program On Senior Citizens' Cardiometabolic Health And Adherence

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 (No relevant relationships reported)

The cardiometabolic benefits of resistance training in senior populations are well documented however, adoption and adherence remain low. Rigidly structured resistance-training interventions and lack of quality, personalized instruction may be to blame. **PURPOSE:** We tested the hypothesis that a community-based, personalized, resistance-training program offered to senior citizens would improve cardiometabolic health and positively influence exercise adherence by accommodating a wide range of fitness levels. **METHODS:** Five senior citizens (2M/3F; 74 ± 5 years) completed a personalized resistance-training program that consisted of meeting with a trainer twice a week, for 60-minutes, over the course of six weeks. Pre and post exercise intervention, physical fitness and body composition were determined with the Senior Fitness Test and anthropometric measures, respectively. Metabolic health was assessed by measuring circulating plasma lipids (total cholesterol, high-density lipoprotein, low-density lipoprotein, and triglycerides) and glucose, and determination of blood pressure. Adherence was calculated as the percentage of resistance-training sessions attended. Semi-structured interviews were conducted on a weekly basis to grasp detailed approaches trainers utilized in each exercise session to promote adherence. **RESULTS:** In support of our hypothesis, a six week, community-based, resistance-training program improved performance in the Senior Fitness Test (chair stand test: 13 ± 3 vs 18 ± 4 repetitions, $p = 0.03$ and chair sit and reach test: -6 ± 12 vs 4 ± 6 centimeters, $p = 0.03$) and decreased waist circumference (91 ± 12 vs 88 ± 14 centimeters; $p = 0.04$). In contrast to our hypothesis, there were no changes in

circulating plasma lipids, glucose, or blood pressure. Adherence to exercise sessions was high at 86%. Qualitative analysis revealed that instructors provided physical and psychological assistance for their participants, while making accommodations to their fitness levels and welcoming feedback. **CONCLUSIONS:** These preliminary data indicate that a six-week, community-based, personalized, resistance-training program offered to senior citizens is an effective method to improve cardiometabolic health while encouraging adherence.

Support: Western New Mexico University Research Grant

C-45 Free Communication/Poster - Nutrition and Metabolism: Meta-Analyses

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

1694 Board #288 May 28 9:30 AM - 11:00 AM
Effects Of High-fat Diets On Physical Performance: A Meta-analysis

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 (No relevant relationships reported)

BACKGROUND: Use of high-fat diets to support physical performance has grown in popularity over recent years. While this strategy allows for enhanced fat oxidation and reduced reliance on carbohydrate for fuel during exercise, its ability to improve physical performance has not been consistently shown.

PURPOSE: Determine effect of high-fat diets (FAT) on physical performance compared to control carbohydrate diets (CHO).

METHODS: Meta-analysis was conducted on studies with healthy (BMI < 30) trained or untrained men or women consuming isocaloric FAT (> 50% total energy intake) compared to control CHO diets for > 2 days, followed by a physical performance test. Performance outcomes were grouped as endurance (time to exhaustion, time trial, and VO_{2max}) and power/strength. Data presented as effect size [ES (95% CI)] using Hedges' g with random effects. Analysis was conducted on crossover and parallel study designs separately.

RESULTS: A total of 31 studies (21 crossover, 10 parallel) containing 51 subgroups (31 crossover, 20 parallel) were identified. Overall, FAT had no effect on physical performance in crossover [-0.13 (-0.36, 0.11)] or parallel [-0.18 (-0.53, 0.17)] studies compared to CHO. Stratified by training status, FAT had no effect on trained individuals in crossover [-0.08 (-0.26, 0.09)] or parallel [0.05 (-0.17, 0.26)] studies compared to CHO. In untrained individuals, FAT had a negative effect [-1.14 (-2.01, -0.28), $P < 0.05$] in parallel studies compared to CHO, and no effect [-0.32 (-1.22, 0.57)] in crossover studies compared to CHO. Stratified by performance outcome, FAT had no effect on endurance performance in crossover [-0.10 (-0.26, 0.09)] or parallel [-0.27 (-0.80, 0.25)] studies compared to CHO. FAT had a negative effect on power/strength [-0.23 (-0.45, 0.00), $P < 0.05$] in crossover studies compared to CHO. FAT had no effect on power/strength [-0.08 (-0.44, 0.27), $P < 0.05$] in parallel studies compared to CHO.

CONCLUSION: Overall, these data indicate FAT does not have a positive effect on physical performance compared to control CHO.

This material is based on the work supported by MRDC; authors' views not official U.S. Army or DoD policy.

1695 Board #289 May 28 9:30 AM - 11:00 AM
Interval Training Versus Continuous Training On Glycemic Control In Prediabetes And Type 2 Diabetes: Meta-analysis

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 (No relevant relationships reported)

Several randomized controlled trials indicated that high-intensity interval training (HIIT) can improve the glycemic control and cardiorespiratory fitness in prediabetes or type 2 diabetes, but there is no consensus that HIIT is a superior model than moderate-intensity continuous training (MICT). **PURPOSE:** To compare the effects of HIIT versus MICT on glycemic control and cardiorespiratory fitness in prediabetes and type 2 diabetes (T2D) patients.

METHODS: This search was performed in PubMed, EBSCO, Web of Science and the Cochrane Library, and relevant randomized-controlled trials (RCTs) were included based on the including criteria: participants were prediabetes or type 2 diabetes; had both HIIT and MICT groups; had at least one of the outcomes of fasting glucose, HbA1c, fasting insulin, insulin resistance (HOMA), VO_{2peak} .

RESULTS: 1) Eighteen studies (122 prediabetes in four studies and 375 T2D patients in 14 studies) were included and meta-analyzed. 2) In T2D patients, HIIT showed a

great improvement in fasting insulin [mean difference: -0.59, 95%CI (-0.69—0.12), $P = 0.005$] and HbA_{1c} [mean difference: -0.15, 95%CI (-0.27—0.04), $P = 0.006$], compared with MICT. 3) Compared with MICT, HIIT improved significantly of 0.33 L/min [95%CI (0.26—0.41), $P < 0.0001$] of absolute $\dot{V}O_{2peak}$, 3.31 mL/min/kg [95%CI (-2.25—8.85), $P < 0.0001$] of relative $\dot{V}O_{2peak}$ in T2D patients, and 0.83 mL/min/kg [95%CI (0.03—1.63), $P = 0.04$] of relative $\dot{V}O_{2peak}$ in prediabetes. 4) Compared with MICT, HIIT significantly reduced BMI [-0.49, 95%CI (0.73—0.25), $P < 0.0001$] in T2D patients. 5) HIIT was more than MICT in lowering systolic blood pressure [-6.23, 95%CI (-8.48—3.98), $P < 0.0001$] in T2D patients. But there were no differences between two exercise models in diastolic blood pressure, total cholesterol, HDL, LDL, triglycerides in both prediabetes and T2D patients.

CONCLUSIONS: 1) HIIT induced more positive benefits in glycemic control and cardiorespiratory fitness than MICT in T2D patients. 2) In prediabetes, HIIT may induce similar cardiometabolic adaptation compared with MICT, and more benefits in cardiorespiratory fitness, which require more high-quality RCTs to prove. Supported by National Key Research and Development Program Major Prevention and Control Research on Chronic Non-communicable Diseases (2016YFC1300202).

1696 Board #290 May 28 9:30 AM - 11:00 AM
Effects Of Exogenous Testosterone Administration On Lean Body Mass And Physical Performance: A Meta-analysis

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Testosterone (T) administration (TA) increases serum T and lean body mass (LBM). Although TA-mediated increases LBM may enhance physical performance, the data are largely equivocal, which may be due to differences study populations, the magnitude change in serum T and LBM, or the performance metrics themselves.

PURPOSE: This meta-analysis explored the effects of TA on changes in serum T, LBM, and physical performance. The association between increases in serum T and LBM was assessed, and if changes in LBM, study population, or the performance metrics studied affected physical performance was determined. **METHODS:** A systematic review of double-blind randomized control/clinical trials comparing TA versus placebo on serum T, LBM, and physical performance was performed. Data were extracted from 20 eligible manuscripts. Effect sizes (ES) were assessed using Hedge's g and a random effects model. Data are presented as ES (95% CI). **RESULTS:** Compared to placebo, TA had a large effect on serum T [2.65 (1.35, 3.96), $p < 0.001$], a small effect on LBM [0.32 (0.18, 0.46), $p < 0.001$], and a trivial effect on overall performance [0.14 (0.08, 0.20), $p < 0.001$]. Changes in serum T in TA groups were not associated with the ES of TA on LBM compared to placebo ($p = 0.221$). However, when TA groups were dichotomized based on median increase in serum T, medium [0.50 (0.23, 0.76), $p < 0.05$] and small [0.22 (0.14, 0.29), $p < 0.05$] effects were observed for LBM in those with increases in serum T above and below 8.82 nmol/L, respectively. Overall, performance increased with TA in diseased [0.17 (0.06, 0.27), $p < 0.05$] and older (60+ years) [0.16 (0.08, 0.24), $p < 0.05$] males, but not in younger (18-55 years) males. TA increased lower body [0.09 (0.04, 0.14), $p < 0.05$], upper body [0.22 (0.03, 0.41), $p < 0.05$], and handgrip [0.14 (0.06, 0.22), $p < 0.05$] strength, and lower body muscular endurance [0.38 (0.09, 0.68), $p < 0.05$]. TA had no effect on lower body power, aerobic endurance, and functional performance. **CONCLUSIONS:** These data show that the effects of TA on: 1) LBM are mediated by the overall effect of TA on serum T concentrations, and 2) physical performance are observed in mainly tests of muscular strength and endurance in diseased and older males.

1697 Board #291 May 28 9:30 AM - 11:00 AM
Effects Of Intermittent Fasting On Exercise Performance And Body Composition: A Systematic Review And Meta-analysis

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(No relevant relationships reported)

Intermittent fasting (IF) has been mostly studied in athletes during Ramadan and in those willing to decrease adiposity while maintaining or increasing lean body mass.

PURPOSE: To estimate the effects of IF on performance outcomes, namely aerobic, anaerobic, muscle strength and body composition adaptations.

METHODS: We conducted a comprehensive search of peer-reviewed articles in 3 electronic databases: PubMed, Web of Science and Sport Discus (all articles published until March 2019). Studies were selected if they included samples of adults (≥ 18 years), had an experimental or observational design, investigated IF (Ramadan and non-Ramadan IF) and included performance or body composition outcomes. Meta-analyses were performed when feasible. Eighteen articles met eligibility criteria.

RESULTS: Overall, IF had a medium, negative effect on relative fat mass (SMD = -0.51, $p = 0.029$; $Q = 2.09$, $p = 0.554$; $I^2 = 0\%$; $k = 4$), and a small, but significant negative effect on maximum oxygen uptake ($\dot{V}O_{2max}$) (SMD = -0.45, $p = 0.023$; $Q = 12.09$, $p = 0.002$, $F = 83\%$; $k = 3$). Non-significant effects were observed on body mass (SMD = -0.45, $p = 0.137$; $k = 7$), vertical jump height (SMD = 0.01, $p = 0.945$; $k = 3$) and Wingate mean power output (SMD = 0.04, $p = 0.921$; $k = 3$).

CONCLUSIONS: We found that, while leading to small impairments in $\dot{V}O_{2max}$, IF is effective for inducing positive adaptations in body composition (i.e. decreased relative fat mass).

1698 Board #292 May 28 9:30 AM - 11:00 AM
 β -hydroxy- β -methylbutyrate (HMB) Does Not Improve Resistance Exercise-Induced Changes In Body Composition: A Systematic-review And Meta-analysis

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β -hydroxy- β -methylbutyrate (HMB) is a leucine metabolite used as a nutritional supplement purported to increase lean body mass and performance in response to resistance exercise training (RET). However, literature definitive evidence-based answer to the question of the efficacy of HMB is lacking.

Purpose: The aim of this systematic-review and meta-analysis was to determine the efficacy of HMB supplementation, in the calcium (HMB-Ca) or free acid (HMB-FA) form, to augment lean body mass and strength gains during RET.

Methods: A systematic search on Medline, Embase, CINAHL and SportDiscus, from 1996-Oct 2019 was conducted. Inclusion criteria for studies were: randomized controlled trial (RCT), RET ≥ 3 weeks (training sessions at least 2 x/week), male subjects < 50 y, and ingesting 3g/d of HMB-Ca or HMB-FA with or without protein or amino acids. Random-effects meta-analysis was performed in Review Manager V.5.3. Cochrane risk-of-bias tool for randomized trials (RoB 2) was applied. Studies with 3 domains judged as unknown risk or at least 1 domain judged as high risk of bias were excluded from the analysis. Industry-related sponsorship or authorship were considered high risk of bias. The following outcomes were investigated: total body mass (TBM), lean body mass (LBM), fat mass (FM), total 1 repetition maximum (RM), bench press (BP) 1RM, and lower body (LwB) 1RM.

Results: Fourteen studies fit the inclusion criteria. However, after removing studies according to RoB2 scoring, the number of analysed studies dropped to seven. A total of 291 male participants (18-45y) were included, and the mean study duration was 8 ± 3 weeks with a training frequency of 2-5 d/week. No significant effects were found on TBM (0.34kg [-0.09, 0.77], $p=0.12$), body composition (LBM: -0.06kg [-0.55, 0.42], $p=0.80$; FM: 0.11kg [-0.12, 0.34], $p=0.34$) or strength (total 1RM: 1.30kg [-3.12, 5.72], $p=0.56$; BP 1RM: 1.49kg [-1.33, 4.30], $p=0.30$ and LwB 1RM: 3.96kg [-1.09, 9.02], $p=0.12$).

Conclusion: This meta-analysis showed that HMB does not improve changes in body mass and composition caused by RET. In addition, effects on strength were not significant. Therefore, the claims for HMB consumption to optimize RET effects seem to be based on studies with considerable risk of bias. When such studies are not considered, there is no support for HMB ingestion.

1699 Board #293 May 28 9:30 AM - 11:00 AM
Effect Of Vitamin D3 Supplementation On Serum 1,25(OH)₂D Status Of Athletes: Systematic Review And Meta-analysis

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Vitamin D is an essential fat-soluble vitamin, which plays an important role in the maintaining of good health. Without sufficient vitamin D, people cannot absorb enough calcium, which is a primary component of the bone. In the past century, vitamin D deficiency is heavily studied and lots of scientists report that vitamin D deficiency is related to several health problems, such as osteoporosis, muscle aches and weakness. Vitamin D supplements and vitamin D fortified foods always have claims of bringing people health benefits including bone health and muscle function. **PURPOSE:** This study is designed to investigate the effects of vitamin D3 supplementation on serum 1,25(OH)₂D among athletes. **METHODS:** Literature search of PubMed, Embase and Cochrane Library databases from inception to Sept. 2019 was accomplished.

Duplicates were removed at the stage of title and abstract assessment with assistant from Mendeley tools and by notes from Cochrane library. **RESULTS:** 6 RCTs with 205 athletes (vitamin D3 = 107, placebo = 98) finally met inclusion criteria. 20 athletes were lost to follow-up and 185 athletes (vitamin D3 = 100, placebo = 85) were documented with complete result. The intervention of vitamin D3 significantly improved the level of serum 1,25(OH)₂D (SMD 3.77, 95% CI: 1.88 to 5.66, $P < 0.01$). Among athletes with insufficient baseline serum 1,25(OH)₂D, vitamin D3 daily dosage at 5000 IU for over 4 weeks led to serum 1,25(OH)₂D concentration of 31.7 ng/ml. Athletes with sufficient serum 1,25(OH)₂D level at baseline were recruited in only one study, and the participants were assigned to either vitamin D3 at a daily dosage of 3570 IU or placebo for 12 weeks, their serum 1,25(OH)₂D sufficiency (VD: 37.2 ± 7.6 vs 45.6 ± 7.6 ; PL 38 ± 6.8 vs 32 ± 8.4) was well maintained above the cut-off boundary with improved serum 1,25(OH)₂D status in supplementation group. **CONCLUSIONS:** Serum 1,25(OH)₂D concentration was improved after supplementation in this meta-analysis. Additional well-designed RCTs with large number of participants from a variety of sports that examined the effect of vitamin D3 supplementation on serum 1,25(OH)₂D concentrations are needed.

1700 Board #294 May 28 9:30 AM - 11:00 AM
Acute And Chronic Effects Of Branched-chain Amino Acid Supplementation: A Systematic Review And Meta-analysis

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 (No relevant relationships reported)

Branched-chain amino acids (BCAA) influence muscle protein turnover through the mTOR signaling pathway and phosphorylation of translation initiation factors. It has been suggested that BCAA supplementation may decrease muscle damage, attenuate soreness, promote recovery, and improve strength and hypertrophic adaptations to resistance exercise; however, the findings are inconsistent and thus the question of efficacy of BCAA supplementation is uncertain.

PURPOSE: We performed a systematic review and meta-analysis to determine the influence of acute BCAA supplementation on perceived soreness and performance recovery following a bout of resistance exercise. Additionally, we analyzed the effect of 6+ weeks of resistance training with BCAA on fat free mass and strength.

METHODS: A systematic search was conducted in Medline, Embase, CINAHL and SportDiscus. Fifteen studies with 348 participants were eligible for inclusion. Random-effects meta-analyses were performed in RevMan (Review Manager (RevMan), V.5.3. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014). Acute outcomes included isometric knee extension, vertical jump, and perceived muscular soreness. Chronic outcomes included changes in fat free mass, upper- and lower-body strength.

RESULTS: Acutely, BCAA supplementation following an acute bout of resistance exercise did not attenuate perceived soreness (SMD: -0.42, CI: (-0.95, 0.12), $p=0.13$) or attenuate performance decrements in the vertical jump (MD: 0.54, CI: (-1.05, 2.12), $p=0.51$) or reductions in isometric knee extension torque (SMD: 0.11, CI: (-0.39, 0.61), $p=0.66$). Chronic BCAA supplementation during resistance training did not influence resistance exercise induced changes in fat free mass (MD: 0.01, CI: (-0.70, 0.73), $p=0.97$), upper body strength (SMD: 0.08, CI (-0.63, 0.79), $p=0.83$) or lower body strength (SMD: 0.10, CI: (-1.15, 1.34), $p=0.88$).

CONCLUSIONS: BCAA supplementation does not effectively reduce soreness, attenuate subsequent performance decrements, or influence muscular adaptations to resistance training.

1701 Board #295 May 28 9:30 AM - 11:00 AM
Regenerative Changes in Resting Energy Balance Demonstrating Metabolic Efficiency and Body Composition Normalization

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 (No relevant relationships reported)

Resting metabolism plays a critical role in healthy weight management. Metabolic adaptations in response to lifestyle cues induce acclimatization of factors involved in resting state energy homeostasis.

PURPOSE: To determine the effects of dietary modification and exercise intensity on resting energy metabolism and body composition in sedentary female cohort.

METHODS: Subjects ($n=46$) with $>25\%$ fat mass participated in 10-weeks of 200 kcal·24 h⁻¹ caloric deficit, adherence to whole-foods, plant-based diet, and randomization into three exercise groups. Exercise intensity levels were set by respiratory exchange ratio (RER) ranges determined through submaximal VO₂ uptake treadmill test; *Low:* RER=0.75 ($n=16$), *Moderate:* RER=0.85 ($n=16$), *High* RER=0.95 ($n=14$). Resting metabolic rate (RMR) variables—respiratory quotient (RQ), VO₂,

VO₂, resting energy expenditure (REE), and macronutrient substrate oxidation rates (KCHO, KFAT)—were measured using indirect calorimetry at *pre* and *post* treatment stages with whole-body air displacement plethysmography to obtain body composition profiles. One-way ANOVA was performed to evaluate mean changes in resting energy metabolism and body composition. **RESULTS:** Significant differences in RQ and VO₂ were noted between groups (F 1.46=7.88, $p=.001$; F 1.46=3.51, $p=.039$, respectively). Significant differences in KCHO and KFAT substrate oxidation rates were noted between groups likewise (F 1.46=5.74, $p=.006$; F 1.46=5.05, $p=.011$, respectively). Changes in total body mass showed significant differences (F 1.46=6.39, $p=.004$). The most positive improvements in metabolic efficiency variables were appreciated in the low and moderate intensity groups in post hoc analysis. **CONCLUSION:** The combination of modest caloric adjustment, adherence to plant-based diet, and participating in a low or moderate intensity exercise program confers positive changes in metabolic status and corrective energy homeostasis that promotes effective body composition normalization.

C-46 Free Communication/Poster - Mental Health

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

1702 Board #296 May 28 9:30 AM - 11:00 AM
Combined Exercise Training Improves Work-Related Burnout Symptoms And Psychological Stress: A Randomized Controlled Study

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 (No relevant relationships reported)

Burnout syndrome is an important public health problem due to the negative effects on workers and workplace wellbeing with consequent social and economic repercussions. Physical activity is recognized as a useful treatment to reduce burnout and psychological stress among the workers, however, there are few rigorous studies on treatment efficacy. **PURPOSE:** This randomized controlled study aimed to evaluate the effects of a Combined Exercise Training on burnout symptoms and perceived stress among workers in the helping professions. **METHODS:** Forty-two men (46.3 ± 8.1 years), scoring medium to high on the Maslach Burnout Inventory (MBI) emotional exhaustion and depersonalization subscales, were allocated into an intervention ($n = 21$) or waitlist control ($n = 21$) group. The intervention group performed a combined 8-week circuit resistance training and agility training (60 min, 3d·wk⁻¹) at a local fitness center, whereas the control group did not participate in an exercise program. At baseline and after the intervention, the MBI and Perceived Stress Scale were administered. **RESULTS:** Significant interaction effects group-by-time ($p < 0.001$; $\eta^2_p > 0.35$) showed improvements for the intervention group that reduced emotional exhaustion (-9.2 ± 2.7 , $p < 0.001$, $d = 1.21$), depersonalization (-4.7 ± 2.8 , $p < 0.001$, $d = 1.00$) and perceived stress (-6.0 ± 2.5 , $p < 0.001$, $d = 1.16$), and increased personal accomplishment (4.3 ± 1.9 , $p < 0.001$, $d = 0.81$). The magnitude of the effects was large, revealing changes of crucial practical relevance. Adherence (90.4%) and satisfaction (3.71 \pm 0.56; rating 1-4) with the intervention were high. No significant changes were found in the control group ($p > 0.05$). **CONCLUSION:** The findings support the evidence that Combined Exercise Training may reduce burnout symptoms and perceived stress among workers in the helping professions. We recommend participation in exercise in the leisure time or workplace because it may likely improve work performance, wellbeing and life quality.

1703 Board #297 May 28 9:30 AM - 11:00 AM
Prevalence And Associated Factors Of Depressive Symptoms In Chinese Elderly Women

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 (No relevant relationships reported)

Purpose To explore the prevalence and associated factors of depressive symptoms among Chinese elderly women. **Methods** The public data of China Health and Retirement Longitudinal Study collected in 2015 was adopted, and 2575 female participants aged 60 years and above were included in this study. Part of observed variables of demographics, family transfer, health status and functioning portions were used. Depressive symptoms was measured using the 10-item version of the Center for Epidemiologic Studies Depression Scale. Analysis of variance and Pearson's χ^2 test were adopted to compare the differences among subgroups, and univariate and multivariate logistic regression models were applied to explore associations between different factors and depressive symptoms. **Results** The mean age of the participants was 69.16 \pm 7.22 years old, the mean score of CED-10 scale was 10.23 \pm 7.05, about 46.45% participants had depressive symptoms last month. Multiple regression analysis

revealed that higher odd ratio of depressive symptoms appeared in the following subgroups: older age ($OR = 1.98, 95\% CI = 1.41-2.79$), not living with spouse ($OR = 1.31, 95\% CI = 1.07-1.60$), living in further area from main city zone ($OR = 1.49, 95\% CI = 1.17-1.90$), providing more economic supports to children last year ($OR = 2.93, 95\% CI = 1.45-5.92$), lower parent-child relationship satisfaction ($OR = 3.42, 95\% CI = 1.86-6.32$), poorer self-reported health status ($OR = 3.24, 95\% CI = 1.77-5.96$), lower score of instrumental activities of daily living scale ($OR = 2.75, 95\% CI = 1.97-3.85$), lower health status satisfaction ($OR = 3.06, 95\% CI = 1.53-6.10$) and shorter sleep duration at night last month ($OR = 2.09, 95\% CI = 1.64-2.65$). **Conclusions** There was a high prevalence of depressive symptoms among Chinese elderly women, and it was significantly related to demographics, interaction with children and health status. Targeting these issues might be helpful in screening and reducing depression among Chinese elderly women.

1704 Board #298 May 28 9:30 AM - 11:00 AM
Esport Athletes' Quality Of Life Over A Professional Season

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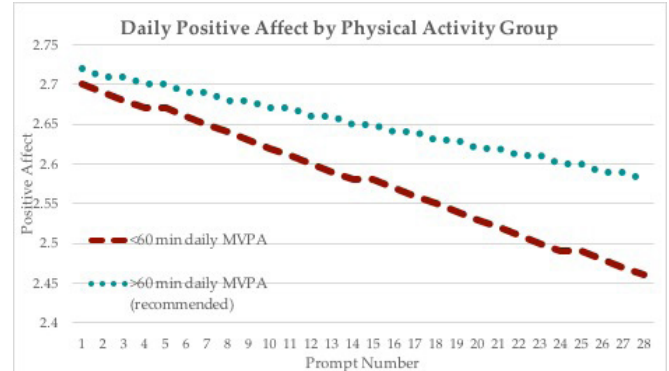
PURPOSE: Worldwide, video games have stormed into mainstream culture, creating a wave of opportunity for a new kind of athlete. In 2019, the global esports audience is expected to reach 453.8 million, while over 164 million adults in the United States now play video games and three-quarters of American households are home to at least one gamer. Few studies exist that address the unique set of health concerns in this growing population. Our objective was to monitor changes in health status over the 5-month competitive season among professional videogamers (n=6) from an esports team. **METHODS:** Data collection included Brief Michigan Hand Questionnaire (BMHQ), Patient Rated Outcomes Measurement Information System (PROMIS) measures, and physical exam measures. These measures were collected during the pre-participation physical exam in March and post-season August 2019. **RESULTS:** The mean age was 24 (range: 21-28 years); BMI was 28.8 kg/m²(range: 22.9-34 kg/m²); systolic blood pressure was 130 mmHg (range: 114-156 mmHg); diastolic blood pressure was 75 mmHg (range: 74-78 mmHg); pulse 92.5 bpm (range: 66-123 bpm), waist circumference was 91.75 cm (range: 77-106 cm). The mean post-season Quality of Life score (0.73) was lower than the mean pre-season score (0.80, p-value = 0.05). Global mental health, global physical health, physical function, upper extremity, and Brief Michigan Hand Questionnaire scores trended lower post-season, but did not reach statistical significance. Pain interference and pain intensity scores were higher post-season than the mean pre-season scores, but these differences were not statistically significant. **CONCLUSIONS:** This study identifies potential quality of life concerns associated with professional eAthletes. Further study is needed with a larger study population of professional eAthletes to confirm the physical and mental health changes over the course of a professional season. Findings may facilitate the development of injury prevention and treatment protocols to enhance the mental and physical health and wellness of eAthletes.

1705 Board #299 May 28 9:30 AM - 11:00 AM
Daily Physical Activity And Affect In Preschoolers

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PURPOSE: Physical activity is vital to mental health yet relatively little is known about the temporal dynamics of this relation, particularly in young children. This study examined whether one marker of mental health, daily positive affect was higher among preschoolers meeting recommended guidelines for physical activity. **METHODS:** Participants included 72 preschoolers (3-5 yrs) enrolled in a study of physical activity and mental health recruited from the general community. Preschoolers wore an accelerometer (ActiGraph wGT3X-BT) for one week, obtaining objective counts of moderate-to-vigorous physical activity (MVPA). Preschoolers engaged in >60 minutes of daily MVPA were compared to those who did not. Caregivers completed a week-long cell-phone based ecological momentary assessment protocol. Caregivers responded to four prompts each day (28 total) about their child's affect and behavior. **RESULTS:** The dataset consisted 2,016 observations. 38% (n=27) of the sample failed to meet the minimum recommended guidelines (<60 minutes) for MVPA. Linear growth models for positive affect allowed each preschooler to have his/her own initial level of positive affect and rate of change in positive affect. Models also accounted for child age, sex, and psychopathology. Initial positive affect was higher among preschoolers meeting MVPA guidelines (Est= 0.37, SE= 0.15, t=2.51, p=.01). Across

the week, active preschoolers maintained positive affect (Figure 1), whereas less-active preschoolers reported a significant decrease in positive affect (Est= -0.01, SE= 0.01, t=-2.10, p=.04). **CONCLUSION:** Initial levels of positive affect and the maintenance of positive affect were higher among children meeting MVPA guidelines. Although only small changes were evident across the week, this finding indicates that physical activity may sustain positive affect in young children and over time, potentially buffer against the onset of psychological disorders such as depression.



1706 Board #300 May 28 9:30 AM - 11:00 AM

Association Between Sport Specialization, Athlete Burnout, And Past Injury In High School Athletes

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With the rise in early sport specialization, understanding its psychological impacts on young athletes is increasingly important. **PURPOSE:** To determine whether sport specialization level, past injuries, or other demographic factors are associated with burnout symptoms among high school (HS) athletes. We hypothesized that athletes with high specialization level or a history of prior injuries would report increased burnout compared to peers with lower specialization level and those without past injuries. **METHODS:** We conducted a cross-sectional assessment of HS athletes who completed questionnaires during pre-participation physicals. The survey included the Athlete Burnout Questionnaire (ABQ) and Jayanthi sport specialization scale, as well as questions on injury history (stress fracture, concussion, time-loss orthopedic injuries), competition level (varsity or non-varsity) and weekly training hours. The primary dependent variable was total ABQ score. Our independent variables were low, medium, or high specialization level and history of time-loss orthopedic injury, stress fracture or concussion. **RESULTS:** 186 athletes completed the survey: 49% were categorized as low specialization (mean age=15.3±2.0 yrs; 50% female), 35% medium specialization (mean age=15.3±1.3 yrs; 47% female), and 16% high specialization (mean age=15.7±1.1 yrs; 57% female). The specialization groups did not significantly differ on their total ABQ scores (mean scores: low=29±7.6, medium=28.3±6.5, high=29.9±8.8; p=0.64). Athletes with prior orthopedic injuries had significantly higher ABQ scores than those without such history (30.6±6.8 vs 27.8±7.7; p=0.01). There were no differences in ABQ scores based on history of stress fractures (31.8±7.8 vs 28.7±7.4; p=0.17) or concussion (28.8±7.2 vs 28.9±7.2; p=0.94), or whether an athlete was currently ailing from an injury (29.1±7.5 vs 28.9±7.5; p=0.91). After covariate adjustment, history of orthopedic injury was significantly associated with higher ABQ scores (β=2.81; 95% CI 0.44 - 5.18; p=0.02). **CONCLUSION:** Prior history of time-loss orthopedic injuries, but not a HS athlete's level of sport specialization, was associated with higher burnout symptoms.

1707 Board #301 May 28 9:30 AM - 11:00 AM

Adherence To A Six-Month Walking Intervention For Individuals With Schizophrenia Spectrum Disorder: Preliminary Results

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PURPOSE: Schizophrenia spectrum disorder (SSD) is one of the most debilitating mental illnesses and often results in negative lifestyle alterations, such as increased

sedentary behavior, that increases the likelihood for the development of comorbidities, such as cardiovascular disease, leading to a decline in quality of life and decreased life expectancy of up to 25 years. Increasing physical activity in healthy populations is known to decrease risk factors and improve quality of life, along with life expectancy. The purpose of the study was to evaluate the adherence of a 6-month group-walking program at the clinic in people diagnosed with SSD. The secondary purpose was to evaluate selected health and physical function outcomes. **METHODS:** Individuals diagnosed with SSD were enrolled in a group-based, six-month, progressive walking intervention meeting biweekly. Participants were given a Fitbit Charge HR to be worn for the duration of the intervention. They were expected to attend as many groups as possible to complete the 30-minute walking session at individualized intensities determined to create an exercise dose-response. Group leaders recorded attendance for each participant for the evaluation of adherence to the intervention. Health and physical function outcomes were evaluated using dependent samples *t*-tests from baseline and post-intervention assessments. **RESULTS:** Twelve individuals (6 males, 6 females) between the ages of 18-65 were included in analyses. Overall attendance was 43%. There was a significant improvement ($p < 0.05$) in distance covered during the 6-minute walk test, increasing from 367 ± 81.8 m to 476 ± 99.9 m. There was no significant difference in resting heart rate, mean arterial pressure, weight, hip or waist circumferences ($p > 0.05$). **CONCLUSIONS:** Adherence to the group walk intervention was relatively low compared to previous studies. Change in group walking leaders during the study and the extremely hot summer may have contributed to the lower than expected adherence rates. However, the 6-month walking intervention promoted improvements in 6MWT distances which is very encouraging. Further studies are warranted to continue to explore the effects of increasing physical activity in people with SSD with the goal of improving their health and consequently improve life expectancy.

1708 Board #302 May 28 9:30 AM - 11:00 AM
The Association Between Physical Activity And Eudaimonic Well-being In College Students

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Previous studies on physical activity (PA) and psychological well-being have predominantly investigated the impact of PA on mental disorders and hedonic well-being. In contrast, relatively few studies have examined the association between PA and eudaimonic well-being (EWB), a key dimension of positive psychology focusing on actualizing one's human potentials and formulating positive human functioning. **PURPOSE:** To examine the associations between PA and the six components of EWB in college students while controlling for gender and age. **METHODS:** 1346 college students (685 males and 661 females, mean age = 20.33 years) voluntarily completed a set of questionnaires measuring PA and EWB. PA was assessed using the International Physical Activity Questionnaires. The metabolic equivalent (MET)-minutes per week were calculated to indicate the level of PA. EWB was operationalized as consisting of six components, including autonomy (AU), environmental mastery (EM), personal growth (PG), positive relations with others (PR), purpose in life (PL), and self-acceptance (SA). EWB was assessed using the 42-item Psychological Well-Being Scale (PWBS) on a 6-point Likert scale. The PWBS consists of six 7-item subscales, each assessing a unique component of EWB. Six multiple regressions were conducted with AU, EM, PG, PR, PL, and SA as the outcomes, respectively. In all models, PA was the predictor and age and gender were controlled as covariates. **RESULTS:** The regression models significantly explained the variances of AU ($R^2 = 3.54\%$, $p < 0.001$), EM ($R^2 = 4.34\%$, $p < 0.001$), PG ($R^2 = 5.59\%$, $p < 0.001$), PR ($R^2 = 5.28\%$, $p < 0.001$), PL ($R^2 = 3.93\%$, $p < 0.001$), and SA ($R^2 = 4.15\%$, $p < 0.001$) in college students. PA was significant in all models with higher levels of PA associated with higher levels of AU ($\beta = 0.13$, $p < 0.001$), EM ($\beta = 0.19$, $p < 0.001$), PG ($\beta = 0.09$, $p < 0.001$), PR ($\beta = 0.15$, $p < 0.001$), PL ($\beta = 0.13$, $p < 0.001$), and SA ($\beta = 0.17$, $p < 0.001$). The results indicated positive associations between PA and all components of EWB. **CONCLUSIONS:** For college students, regular PA is positively associated with all components of EWB. The strength of the positive association is strongest between PA and environmental mastery. Universities may consider creating more opportunities for PA participation to improve positive psychological well-being for college students.

1709 Board #303 May 28 9:30 AM - 11:00 AM
Does Age Influence The Effects Of Exercise On Anxiety Levels Of Children With ASD?

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Anxiety is a common comorbidity among children with Autism Spectrum Disorder (ASD), with approximately 40% of youths with ASD meeting the criteria for at least

one anxiety disorder (van Steensel *et al.*, 2011). Furthermore, anxiety has been shown to be more likely in adolescents with ASD (Mayes *et al.*, 2011; Vasa *et al.*, 2013). Only one study has shown that exercise has potential benefits for anxiety in 13-27 year olds with mainly mild ASD, following an eight week programme (Hillier *et al.*, 2011). Further research is needed to examine the effects of exercise on anxiety in children with more severe symptoms of ASD and to establish if age is a factor on the effects of exercise on anxiety.

PURPOSE: To determine whether age influences the effects of exercise on anxiety levels of children with moderate to severe ASD.

METHODS: Twenty children (5-18 years) with moderate to severe ASD, were included in the study. A 16-week school-based exercise programme was implemented for 60 minutes, three days a week. Anxiety was measured using the Anxiety Scale for Children with ASD (ASC-ASD), which was given to the children's teacher, before and at the end of the programme. A Spearman's rank-order correlation was run to measure the relationship between age and the responsiveness of the intervention.

RESULTS: There was a significant, strong negative correlation between age and the effectiveness of the intervention on total ASC-ASD scores, $r_s(14) = -0.77$, $p = 0.001$, and on performance anxiety, $r_s(14) = -0.73$, $p = 0.003$. There was a significant, moderate negative correlation between age and the effectiveness of the intervention on anxious arousal, $r_s(14) = -0.65$, $p = 0.012$, and on uncertainty, $r_s(14) = -0.58$, $p = 0.028$. There was an insignificant, weak negative correlation between age and the effectiveness of the intervention on separation anxiety.

CONCLUSION: Age is associated with the effectiveness of exercise on anxiety levels of children with moderate to severe ASD. The older the age of the child, the greater improvement was seen in anxiety levels at school following the exercise programme. This research was funded by the Institute of Technology Carlow, President's research fellowship award.

1710 Board #304 May 28 9:30 AM - 11:00 AM
Associations Between Physical Activity, Generalized Anxiety Disorder, And Social Physique Anxiety Among Young Adults

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Social Physique Anxiety (SPA) has been associated with physical activity (PA) behaviors and anxiety disorder symptoms. However, little is known about the potential influence of SPA on associations between PA and Generalized Anxiety Disorder (GAD).

PURPOSE: This study quantified associations between PA, GAD and SPA among young adults ($N=470$, 23.2±4.8y; 63.4% female) and explored SPA as a mediator of the association between PA and GAD.

METHODS: Seven-day PA Recall determined estimated expenditure (kcal/wk) and classified inactive, moderately active, and highly active PA dose categories. The Psychiatric Diagnostic Screening Questionnaire GAD subscale assessed GAD symptom severity; a score of ≥ 6 indicated analogue GAD (AGAD) status. The Social Physique Anxiety Scale assessed SPA. Independent *t*-tests examined baseline differences based on gender and AGAD status. Cohen's *d* quantified the magnitude of difference. Logistic regression quantified odds of AGAD based on PA dose, adjusting for age, gender, and smoking status. Simple mediation analyses examined mediation of the continuous PA-GAD symptom association by SPA.

RESULTS: Females reported less PA ($p \leq 0.002$, $d=0.31$) and greater SPA ($p \leq 0.001$, $d=0.63$) and GAD symptom severity ($p \leq 0.001$, $d=0.51$). AGAD reported greater SPA ($p \leq 0.001$, $d=0.92$). Compared to inactive, odds of AGAD were 28.3% ($OR=0.72$, 95%CI: [0.43, 1.20], $p \geq 0.21$) and 42.5% ($OR=0.58$, [0.35, 0.94], $p \leq 0.03$) lower among moderately active and highly active, respectively. In adjusted models, compared to inactive, odds were 29.3% ($OR=0.71$, [0.42, 1.20], $p \geq 0.21$) and 36.9% ($OR=0.63$, [0.38, 1.06], $p \geq 0.08$) lower among moderately active and highly active, respectively. Regression models of PA on GAD symptoms ($\beta=-0.01$, $p \leq 0.04$), SPA on PA ($\beta=-0.02$, $p \leq 0.03$), and SPA on GAD symptoms ($\beta=0.14$, $p \leq 0.001$) were significant. When regressed together, SPA was ($\beta=0.14$, $p \leq 0.001$), but PA was not ($\beta=-0.003$, $p \leq 0.27$), statistically significant, supporting mediation.

CONCLUSION: PA may lower odds of GAD, but findings were not significant after adjusting for covariates. SPA, a modifiable factor that was higher among females and those with AGAD, mediated the association between PA and GAD. Future research should examine these relationships longitudinally and explore SPA experimentally.

1711 Board #305 May 28 9:30 AM - 11:00 AM
Mental Health, Cardiovascular Risk Factors, And The College Student

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College is a time when many health habits, both physical and behavioral, start to form that will remain throughout one's adult life (Kemper & Welsh, 2010). It has been estimated that between 12-50% of college students have one or more of the common mental health disorders (Hunt & Eisenburg, 2010). Mental health disorders in early adulthood have been associated with long-term physical health issues (cancer, cardiovascular disease, diabetes, hypertension, asthma, etc.) that appear throughout adulthood (Scott et al., 2016). The earlier these physical health issues can be identified, the earlier various treatments (such as lifestyle modification) could be started. **PURPOSE:** To analyze the relationship between mental health status and cardiovascular risk factors in college freshmen. **METHODS:** 45 college freshmen (27 females and 18 males) were recruited from a small, liberal arts college in the Midwest. Cardiovascular risk factors (blood pressure (BP) and body composition) were measured, physical activity was self-reported, and sleep was evaluated by use of the Pittsburgh Sleep Quality Index. Mental health was evaluated by the Depression, Anxiety, and Stress Survey. The cohort was divided into three categories based on their individual mental health scores: those who scored high in all three (depression, anxiety, and stress) (n=7), those who scored low in all three (n=14), and those who had some combination of high and low (mixed) (n=24). **RESULTS:** Participants in the mixed group had significantly higher systolic BP (110.8±0.1mmHg) than those in the high (102.7±5.7mmHg) or low groups (104.9±7.9mmHg) (p=0.033). No significant differences in days/week of physical activity, hours of nightly sleep, diastolic BP, fat-free mass, fat mass, skeletal mass, or visceral adipose tissue were seen between groups. **CONCLUSION:** These differences in BP could be a result of medication (such as beta blockers), which could be the cause of the reduced BP in the group with high scores on all three mental health scales. Data on medication use was not collected in this study, but should be added to future studies. Additional research should investigate this relationship in a larger cohort so additional relationships could be explored.

1712 Board #306 May 28 9:30 AM - 11:00 AM
Relationships Between Adolescents' Physical Activity And Mental Health In Urban And Rural Areas Of China

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 (No relevant relationships reported)

The relationship between physical activity (PA) and mental health has been documented, but the relationships between PA and different dimensions of mental health problems in rural and urban areas of China need to be explored. **PURPOSE:** To examine differences in the relationship of PA and mental health problems and these problems between rural and urban areas of China. **METHODS:** Data were collected over 2 months in 2018. Four representative regions of China were selected: Beijing, Shanghai, Nanchang, and Urumchi. 9629 adolescents completed questionnaires assessing mental health, PA and individual characteristics. The Diagnostic Test of Anxiety Tendency Scale was used to assess mental problems including eight subscales. PA was measured by Physical Activity Questionnaire for Adolescents. Height and weight were measured by portable stadiometers and digital scales, and BMI (kg/m²) was converted to BMI z-score. Chi-square tests were used to compare mental health problems in rural and urban areas. Multilevel logistic regressions were performed to examine the relationship between PA and different mental health problems, and other individual variables were controlled as covariates. **RESULTS:** The detection rates of overall mental health problems among urban (5.27%) and rural areas (7.28%) differed (μ²=9.23, p<.01). Seven of eight subscales differed in urban and rural areas: learning anxiety (53.64% vs. 59.44%), anxiety with people (9.29% vs. 11.32%), solitude tendency (5.05% vs. 6.21%), self-accusation tendency (19.52% vs. 24.46%), sensitivity tendency (21.66% vs. 26.61%), physical symptoms (24.09% vs. 30.44%), and terror tendency (7.60% vs. 10.81%). Every SD increase of PA (all p<.01) related to a decrease of learning anxiety by 33%, anxiety with people by 24%, solitude tendency by 34%, sensitivity tendency by 23%, and physical symptoms by 29%. Compared with urban areas, rural areas have greater odds of learning anxiety by 23% (p<.01), solitude tendency by 27% (p<.001), and physical symptoms by 37% (p<.05). **CONCLUSIONS:** People in urban areas have fewer mental health problems than those in rural areas. More PA correlates with decreased odds of mental health problems, including learning anxiety, anxiety with people, solitude tendency, sensitive tendency, and physical symptom. Supported by THU 2016THZWLJ12

1713 Board #307 May 28 9:30 AM - 11:00 AM
Sitting Time Predicts Cortisol Levels In Women, Independent Of Cardiorespiratory Fitness Level

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PURPOSE: Research suggests that sitting time may be an independent predictor of negative health outcomes, even after accounting for physical activity (PA) participation. There is limited investigation of the association between sitting time and mental health outcomes, and the mechanisms by which sitting time may increase the risk for mental health disorders are not completely understood. Considering that cortisol [an index of hypothalamic pituitary adrenal axis regulation] has been shown to be a robust predictive biomarker for depression and anxiety disorder risk, this study aimed to investigate whether sitting time was associated with salivary cortisol levels in women, and whether this relationship remained significant after controlling for indices of physical fitness. **METHODS:** Twenty-one healthy women [18-45y, mean age: 23.9 +/- 6.3y; mean body mass index (BMI): 23.9 +/- 4.6] who were medication-free and had regular menstrual cycles completed (1) self-report of weekly PA and weekly sitting time; (2) assessment of cardiorespiratory fitness (CRF) via maximal oxygen consumption during exercise; (3) one-week recording of sleep and activity patterns by wrist actigraphy; and (4) measurement of salivary cortisol levels (collected during the follicular phase of the ovarian cycle in order to control for the influence of ovarian cycle hormone fluctuations on salivary cortisol). **RESULTS:** Regression analysis revealed that greater total sitting time/week significantly predicted higher cortisol levels in women ($\beta = 0.71, p < 0.001$), and this relationship remained significant after controlling for age, BMI, and CRF level ($\beta = 0.67, p < 0.01$). Additionally, greater total sitting time/week was significantly associated with lower actigraph-measured PA (activity counts/min; $r = -.57, p < 0.01$). **CONCLUSIONS:** Results suggest that, although greater total sitting time was associated with a reduced amount of daily PA, greater total sitting time may still predict higher salivary cortisol levels, independent of indices of fitness (BMI and CRF). It is possible that the stress-related mechanisms underlying the relationship between sitting time and depression and anxiety risk may be related to sitting time itself, and not a simply a product of reduced daily PA. Further investigation is needed to explore these associations.

1714 Board #308 May 28 9:30 AM - 11:00 AM
Home-based Pilates For Symptoms Of Anxiety, Depression, And Fatigue Among Women With Ms

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 (No relevant relationships reported)

Exercise supports positive effects of exercise on mental health outcomes among people with Multiple Sclerosis (PwMS). However, non-traditional exercise modes like Pilates remain understudied. **PURPOSE:** This randomized controlled trial investigated the effects of eight weeks of twice weekly home-based Pilates training compared to delayed-start wait-list condition on symptoms of anxiety, depression, and fatigue among 54 females (46.7±9.6 y) with physician diagnosed MS (Patient Determined Disease Steps score <3), no previous Pilates experience, and no other significant physical or psychiatric condition. **METHODS:** After providing informed consent, participants were randomised to twice weekly home-based Pilates sessions guided by a DVD or delayed-start wait-list. Well-validated questionnaires assessed symptoms of anxiety, depression, and fatigue at baseline, and weeks two, four, six and eight of the intervention. Compliance was documented in weekly exercise diaries and followed-up by a phone call from the first author. RM-ANOVA examined between-group differences across time. Hedges' *d* quantified the magnitude of differences in outcome change for home-based Pilates compared to delayed-start wait-list. **RESULTS:** Group X time interactions were significant for depressive symptoms ($F_{(4,50)} = 3.21, p \leq 0.02$), physical symptoms of fatigue ($F_{(4,50)} = 3.45, p \leq 0.01$), cognitive symptoms of fatigue ($F_{(4,50)} = 3.08, p \leq 0.02$), psychosocial symptoms of fatigue ($F_{(4,50)} = 3.51, p \leq 0.009$), and total fatigue ($F_{(4,50)} = 3.82, p \leq 0.007$). Compared to wait-list, home-based Pilates significantly reduced (all $p \leq 0.041$) depressive symptoms at weeks 6 ($d = 0.39$), and 8 ($d = 0.69$), physical symptoms of fatigue at weeks 2 ($d = 0.41$), 4 ($d = 0.24$), 6 ($d = 0.57$), and 8 ($d = 0.87$), cognitive symptoms of fatigue at weeks 4 ($d = 0.39$), 6 ($d = 0.32$), and 8 ($d = 0.60$), psychosocial symptoms of fatigue at weeks 2 ($d = 0.51$), 4 ($d = 0.48$), 6 ($d = 0.58$), and 8 ($d = 0.69$), and total fatigue at weeks 2 ($d = 0.23$), 4 ($d = 0.37$), 6 ($d = 0.53$), and 8 ($d = 0.84$). **CONCLUSION:** Home-based Pilates improved mental health outcomes among females with MS, including moderate magnitude reductions in depressive and fatigue symptoms. These findings support the potential of home-based Pilates to improve several mental health symptoms prevalent among PwMS.

1715 Board #309 May 28 9:30 AM - 11:00 AM

Mental Toughness, Self-compassion, And Mental Health In Esports: A Meditation Analysis

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(No relevant relationships reported)

Promotion of mental health (MH) issues has been lately a priority in several sport organizations in the US (e.g., NCAA, NFL, NBA). Self-compassion (SC) and mental toughness (MT) have been proven successful against stressors associated with sports. Preliminary evidence have shown a positive relationship between MT and MH, SC and MH, and MT and SC. These constructs have never been investigated in eSports, an industry that has grown considerably in the recent years. **PURPOSE:** To confirm the three aforementioned relationships and explore the mechanism underlying these relationships in eSports. Hypotheses: (1) MT will correlate positively with MH, (2) SC will correlate positively with MH, (3) MT will correlate positively with SC, and (4) SC will mediate the MT-MH relationship. **METHODS:** In total, 16 recreational gamers (>6hours per week) agreed to participate (Mage = 22, SD = 2.69). Three inventories were administered via Qualtrics: Mental Toughness Index, Self-Compassion Scale, and Mental Health Continuum – Short Form. The analysis consisted of Pearson correlations and mediation analysis in R. **RESULTS:** The estimated correlations between MT and MH was .55, MT and SC was .71, and MH and SC was .61. In the preliminary mediation model, the estimated standardized regression coefficient of MH on MT was 0.55. The same estimate after adding SC was 0.23. **CONCLUSION:** The results indicate that (a) all three variables are positively correlated to each other and (b) SC reduced, or mediated, the relationship between MT and MH by 0.32 units. Therefore, evidence to support all four hypotheses was found. The correlations are in accordance with findings from Gucciardi, Hanton, and Fleming (2017), Neff, Rude, and Kirkpatrick (2007), and Wilson, Bennett, Mosewich, Faulkner, and Crocker (2019). The mediation analysis findings suggest that the relationship between MT and MH is partially explained by SC and confirm outcomes from Padgett, Forsse, Papadakis, Deal, and Stamatis (2019). The above could have important implications for eSports Psychological Skill Training (PST) practice in the effort of general prevention/early intervention of MH: not only these three variables are positively correlated but a better understanding of the relationship between MT and MH is now offered for this unique sporting environment.

1716 Board #310 May 28 9:30 AM - 11:00 AM

Associations Between Daily Steps And Prolonged Sitting And Suicidal Ideation In Depressed Adults

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(No relevant relationships reported)

Suicide is a national public health concern with rates increasing 33% between 1999 and 2017. Suicidal ideation (SI) or thinking of or planning suicide, typically precedes suicide attempts. Thus, recognizing risk factors for SI in populations that are at suicide risk, such as those with Major Depressive Disorder (MDD) is key for prevention. Low physical activity (PA) and high sedentary time (ST) are associated with SI in the general population, though research has not explored these in MDD. **Purpose:** This study examined whether PA and prolonged sitting in adults with MDD are associated with SI severity. **Methods:** SI over the past month was assessed using the Mini International Neuropsychiatric Interview in 47 adults (72% female) with MDD, with SI scored as None (n=16), Low (n=14), Moderate (n=4) or High (n=13). Thigh-worn accelerometers assessed PA and ST continuously for 7 days. A multinomial logistic regression analysis compared differences in average steps per day and daily average prolonged ST, defined as ST in bouts of >60 minutes, among SI severity groups. **Results:** The logistic regression demonstrated no significant difference in either behavior among groups (p>0.05). There were medium effect sizes for prolonged ST between None and High (Hedges' g=0.57) and between None and Low/Moderate (g=0.77). For steps per day, small effect sizes were found between None and High (g=0.29) and None and Low/Moderate (g=0.42). **Conclusion:** Although non-significant, the medium effects suggest promoting decreases in prolonged ST may aid in suicide prevention in adults with MDD, in conjunction with other efforts. Future studies with larger and more diverse samples will be key for understanding the utility of reducing prolonged ST to combat suicidal ideation and attempts.

Suicidal Ideation	Steps Per Day	Prolonged ST (minutes in>60-minute bouts)
None (n=16)	8,207±3,487	262±109
Low/Moderate (n=18)	6,993±2,209	362±145
High (n=13)	7,272±2,872	347±184

1717 Board #311 May 28 9:30 AM - 11:00 AM

Burnout Syndrome As A Predictor Of Low Individual Attractions To The Group-social In Mexican Athletes

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(No relevant relationships reported)

PURPOSE: To identify the relationship between Burnout Syndrome and the Individual Attractions to the Group-Task (ATG-S) factor in college athletes. **METHODS:** 224 college athletes from 11 team sports (134 men and 90 women in an age range between 19 and 24 years old) of a high-performance program were evaluated with a psychometrical battery that included the Sport Burnout Inventory - Reviewed conformed by 3 subscales: Emotional Exhaustion (EE), Depersonalization (D), and Reduced Personal Realization (RPR); it brings four possible categories: "Low Risk", "Moderated Risk", "High Risk" and "With Burnout". Also, these athletes answered The Group Environment Questionnaire (GEQ), which evaluates the cohesion in sports teams in four group and individual factors; Individual Attractions to the Group-Social (ATG-S) was the only factor analyzed, the results were summarized in quartiles, the higher quartile the worst the score. Multinomial logistic regression was performed to associate the categories of burnout syndrome by component and the results of the ATG-S factor. **RESULTS:** Statistically significant associations were observed between moderate risk of Burnout Syndrome in EE and D and scoring in the second quartile in ATG-S. On the other hand, moderate risk in EE and the three risk dimensions in RPR were significantly associated with the fourth quartile in ATG-S. **CONCLUSIONS:** Individuals who got a moderate risk of suffering Burnout Syndrome in the EE and D factors had more chances of getting a worse score in the ATG-S factor. However, RPR was more consistently associated with worse ATG-S scores. These results allow us to relate some of the Burnout Syndrome signs with a low perceived social cohesion in college team sports.

Table 1. Association between Burnout Syndrome dimensions and ATG-S scores.

		ATG-S		
		Q2	Q3	Q4
EE	With BO	-†	-†	-†
	High risk	0.73 (0.15-3.67)	0.50 (0.10-2.48)	1.81 (0.45-7.24)
	Moderate risk	3.12* (1.29-7.55)	2.25 (0.97-5.24)	2.93* (1.18-7.28)
D	With BO	1.59 (0.19-13.36)	2.24 (0.38-15.55)	1.10 (0.13-9.50)
	High risk	2.25 (0.56-9.03)	1.18 (0.28-4.98)	2.40 (0.61-9.51)
	Moderate risk	2.92* (1.09-7.77)	1.48 (0.55-3.96)	2.04 (0.73-5.67)
RPR	With BO	6.14 (0.63-60.39)	3.94 (0.38-40.44)	15.35* (1.72-137.42)
	High risk	2.29 (0.68-7.71)	2.64 (0.87-8.05)	3.69* (1.15-11.90)
	Moderate risk	2.19 (0.74-6.49)	2.23 (0.78-6.39)	3.06* (1.03-9.07)

Data expressed as OR (95% CI).
* p<0.05. † The sample was too small to perform the analysis. ATG-S: Attraction to the Group-Social. BO: Burnout. D: Depersonalization. EE: Emotional exhaustion. Q: Quartile number. RPR: Reduced personal realization.

THURSDAY, MAY 28, 2020

1718 Board #312 May 28 9:30 AM - 11:00 AM
Anxiety And Depression As Predictor Agents Of Low Group Integration Task In Mexican College Athletes.

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 (No relevant relationships reported)

PURPOSE: To identify the relationship between depression and anxiety indicators and Group Integration Task (GI-T) in college athletes.

METHODS: 224 college athletes from 11 team sports (134 men and 90 women with an age range between 19 and 24 years old) of a high-performance program were evaluated with a psychometrical battery that included the Goldberg's anxiety and depression scale (two subscales with 9 questions each, that results in "With/Without anxiety" and "With/Without depression") and; the Group Environment Questionnaire (GEQ) which evaluates the cohesion in team sports in four group and individual factors; Group Integration Task (GI-T) was the only one analyzed, the results were summarized in quartiles, the higher the quartile, the worst the score. Multinomial logistic regression was performed to analyze the association between Goldberg's and GI-T scores.

RESULTS: Statistically significant associations were found between for presenting depression and the presence of third (p=0.01) and fourth (p=0.01) quartiles. On the other hand, showing anxiety was significantly associated with presenting scores on the fourth quartile only (p=0.03).

CONCLUSIONS: Those athletes that scored with probable depression or anxiety are associated with higher quartile punctuations in GI-T factor. Evaluating anxiety and depression in athletes of team sports could be a way to identify probable cohesiveness problems between their members. Similar studies are suggested to corroborate this result.

	GI-T		
	Q2	Q3	Q4
With depression	1.47 (0.68 - 3.15)	2.75* (1.34 - 5.68)	2.72* (1.27 - 5.83)
With anxiety	2.07 (0.82 - 5.23)	1.61 (0.53 - 3.96)	2.78* (1.14 - 6.80)

Data expressed in OR (95% CI).
 GI-T: Group integration task. Q: Quartile number. * p<0.05

1719 Board #313 May 28 9:30 AM - 11:00 AM
Heart Rate Variability As Psychophysiological Stress Indicator In Mexican College Volleyball Players

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 (No relevant relationships reported)

PURPOSE: To compare the response of Heart Rate Variability (HRV) during induced stress as a psychophysiological stress indicator in Mexican college volleyball players.

METHODS: We evaluated 16 male college volleyball players (18 to 26 y). Psychophysiological assessment of stress consisted of 7 stages lasting 2 min each (baseline, exposed to a physiological stressor [unpleasant sounds], 1st rest, exposed to a cognitive stressor [mathematical task], 2nd rest, exposed to stressor emotional [talk about a stressful memory] and 3rd rest). It was done by a ProCompTM Infniti Biofeedback System. Short-term HRV was obtained by a Blood Volume Pulse (BVP) Sensor and analyzed using time-domain: SDRR (standard deviation of RR intervals) and pNN50 (percentage of successive RR intervals that differ by more than 50 ms); and frequency-domain: HRV peak frequency, Very Low Frequency (VLF) total power, Low Frequency (LF) total power, High Frequency (HF) total power, VLF % power, LF % power and HF % power measurements. Statistical analysis was performed by repeated measures ANOVA and non-parametric Friedman test.

RESULTS: Significant differences in HRV were observed when we compared the seven stages of the assessment (with stress stimulus and without stress stimulus). During the COGNITIVE stage there was a difference with the BASELINE (p= .01) and EMOTIONAL (p= .004) stage in HRV peak frequency; in VLF% between PHYSIOLOGICAL and 1st REST (p= .01) stage; among the BASELINE and the EMOTIONAL (p= .04) stage on SDRR; and with pNN50 on COGNITIVE and 3rd REST (p= .02) stage. (Table 1).

CONCLUSIONS: The results show significant changes in the variables associated with sympathetic activity in stages that had stressors compared to baseline and rests, which may indicate psychophysiological response to stress. These results support the idea of HRV is a useful psychophysiological stress indicator and maybe a helpful tool to identify and have better stress management in Mexican college athletes.

	Baseline	Physiological	1st Rest	Cognitive	2nd Rest	Emotional	3rd Rest
SDRR ¹	78.4 (58.3 - 92.4) a	76.3 (67.5 - 110.5)	91.6 (70.5 - 117.4)	80.7 (62.4 - 114.6)	89.9 (72.8 - 114.6)	112.2 (62.9 - 155.5) a	90.1 (68.8 - 115.5)
pNN50 ²	20.4 (2.4)	20.9 (2.6)	19.2 (2.5)	15.2 (2.2) b	22.1 (2.2)	17.4 (2.5)	22.1 (2.5) b
HRV _{PF} ²	0.12 (0.01) c	0.13 (0.01) d	0.09 (0.01)	0.07 (0.01) c,d	0.13 (0.02)	0.10 (0.01)	0.11 (0.02)
VLFTP ¹	227 (86 - 444)	130 (64 - 310)	409 (198 - 608)	254 (171 - 373)	319 (140 - 555)	399 (112 - 742)	417 (122 - 651)
LFTP ¹	480 (308 - 1015)	604 (330 - 1160)	609 (267 - 1490)	850 (394 - 1673)	508 (400 - 1439)	924 (597 - 2735)	506 (321 - 1442)
HFTP ¹	628 (378 - 1094)	641 (273 - 935)	681 (278 - 1055)	473 (194 - 927)	723 (210 - 1564)	656 (321 - 2389)	746 (304 - 1324)
VLF% ¹	16.8 (10.1 - 23.9)	11.9 (4.1 - 17.7) e	22.4 (12.2 - 27.8) e	21.7 (11.3 - 29.4)	15.6 (10.3 - 25.2)	11.4 (6.1 - 18.9)	18.9 (10.6 - 26.9)
LF% ¹	36.7 (24.7 - 51.6)	41.8 (29.4 - 51.6)	31.9 (26.5 - 55.9)	48.6 (33.6 - 58.0)	36.9 (27.1 - 56.0)	47.9 (37.0 - 64.7)	33.5 (25.1 - 49.9)
HF% ²	43.9 (17.0)	43.1 (20.4)	37.9 (16.5)	30.0 (12.8)	40.7 (20.8)	34.1 (16.2)	40.2 (18.5)

¹ Non-normal distribution is expressed with Median (P₂₅ - P₇₅).
² Normal distribution is expressed with Mean (SD). Same letters denote significant differences between the indicator of HRV during each stage (p<0.05).

1720 Board #314 May 28 9:30 AM - 11:00 AM
Relationship Between Time Practicing A Sport And Risk Of Burnout In Mexican College Athletes.

Ethel Nayeli Moreno-Lopez, Victo Hugo Montejó-Lambaren, Sara Ramirez-Hernandez, Alejandro Gaytan-Gonzalez, Juan Ricardo Lopez-Taylor. *Universidad de Guadalajara, Guadalajara, Mexico.*
 (No relevant relationships reported)

PURPOSE: To determine the association between the experience of practicing a sport and the risk of suffering Emotional Exhaustion and Depersonalization.

METHODS: 307 college athletes from a high-performance program in Guadalajara, Mexico, were evaluated. Trained psychologists applied the Sport Burnout Inventory - Reviewed (18 questions and 3 subscales: Emotional Exhaustion (EE), Depersonalization (D) and Reduced Personal Realization (RPR); it brings four possible conclusions: "Low Risk", "Moderated Risk", "High Risk" and "With Burnout") to identify Burnout problems. The years of experience practicing their sport were obtained through an interview with the athletes before the questionnaire was answered. A logistic regression analysis was performed to predict the presence of Depersonalization and Emotional Exhaustion depending on the years practicing the sport.

RESULTS: EE was not related to the years practicing a sport. On the other hand, D showed a relationship with the time of experience in the moderated risk of suffering Burnout Syndrome when an athlete mentioned have been practicing their sport for 7-9 years (p=0.02), 4-6 years (p=0.01) and 1-3 years (p=0.01).

CONCLUSIONS: Burnout Syndrome seems to be a time practicing an activity related problem. In our sample, nonetheless, the time was not directly related to a high risk of suffering burnout scores in the analyzed factors. Those who have most time practicing neither showed statistically significant association with the Burnout inventory scores. We recommend continuing making this kind of investigation, which may give us better information about the time-related etiology of Burnout Syndrome.

Table 1. Association between experience, emotional exhaustion, and depersonalization.

		Emotional exhaustion		Depersonalization		
		Moderate risk	High risk	Moderate risk	High risk	With BO
Experience practicing the sport	>10 years	0.80 (0.36 - 1.76)	0.63 (0.10 - 4.10)	2.91 (0.78 - 10.88)	4.98 (0.60 - 41.66)	3.11 (0.35 - 27.83)
	7 to 9 years	0.80 (0.33 - 1.91)	1.36 (0.23 - 8.17)	4.77* (1.24 - 18.37)	7.70 (0.89 - 66.29)	2.20 (0.19 - 25.52)
	4 to 6 years	0.81 (0.35 - 1.84)	1.32 (0.23 - 7.45)	5.50* (1.49 - 20.26)	6.08 (0.71 - 52.01)	2.61 (0.26 - 26.27)
	1 to 3 years	1.12 (0.49 - 2.53)	1.78 (0.33 - 9.73)	5.34* (1.43 - 19.93)	10.37* (1.27 - 84.83)	6.60 (0.77 - 56.58)

Data expressed as OR (95% CI).
* p<0.05. BO: Burnout.

1721 Board #315 May 28 9:30 AM - 11:00 AM
A Qualitative Investigation Of Comorbid Psychological And Physical Health Conditions With Low Energy Availability In Current And Former NCAA Female Distance Runners Of Reproductive Age
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 (No relevant relationships reported)

PURPOSE: It is widely accepted that low caloric energy intake, with or without disordered eating, is associated with health consequences in female athletes. Female distance runners are subject to the societal "thin ideal" in addition to sport-specific body ideals and performance pressures, that may result in low energy intake and over exercise to control body weight. There is a gap in the literature regarding the structural and environmental predictors of low energy intake and the pursuit of weight loss in collegiate distance runners, as well as specific health consequences experienced by this population. The purpose of this study is to address this gap in the literature through a qualitative investigation of collegiate distance runners with low energy intake, with or without disordered eating.

METHODS: Motivated by feminist theory, we conducted semi-structured, in-depth interviews. Interviews were transcribed and coded for major themes.

RESULTS: Participants (n=30) represented 19 Universities and had a mean age of 25. Four major themes emerged, including the pursuit of the "ideal of the runner body," coaches encouraging athletes lose weight, as well as both severe injury and performance burnout following a period of restrictive eating and overtraining.

CONCLUSION: These findings will serve to better understand prevention, early intervention, and tertiary care in the population of female distance runners.

1722 Board #316 May 28 9:30 AM - 11:00 AM
Cardiorespiratory Fitness And Incident Use Of Sedative-hypnotics: A Longitudinal Population-based Study
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Purpose: Population-based and clinical studies suggest that higher cardiorespiratory fitness (CRF) is associated with better mental health and less sleep complaints. However, in these studies mental health and sleep are assessed through questionnaires. The increased use of sedatives and hypnotics coupled with their known adverse health associations raises potential public health concerns. So far no studies have assessed if CRF is associated with incident use of sedative-hypnotics in the general population.
Methods: This prospective study included 30,481 participants (52.2% women, mean age 51.0 years) from the third survey of the Norwegian Nord-Trøndelag Health

Study in 2006-08. Data on psychotropic drugs were retrieved from the Norwegian Prescription Database and incident sedative-hypnotics was measured as first registered prescription with code N05C in the Anatomical Therapeutic Chemical Classification System. Participants using any psychotropic drugs three months prior to participation and three months after participation were excluded. The participants were followed from three months after participation until incident use of sedative-hypnotics, emigration, death or study end 1st of January 2018. Baseline CRF (ml/kg/min) was determined using non-exercise algorithms based on sex, age, waist circumference, physical activity, and resting heart rate (eCRF). Baseline eCRF was further grouped into age- and sex-specific tertiles. Cox regression models were used to calculate hazard ratios (HRs) and 95% confidence intervals (CIs) for the association between baseline eCRF and incident use of sedative-hypnotics. The multivariable analyses were adjusted for age, sex, education, symptoms of anxiety and depression, limiting-longstanding illness, and sleep problems. **Results:** During follow-up, 4,632 (15.2%) of the participants used sedative-hypnotics. In fully adjusted models comparing with the lowest tertile of eCRF, those in the middle and upper eCRF tertiles had 8% (HR: 0.92, 95% CI: 0.84-1.00) and 24% (HR: 0.86, 95% CI: 0.77, 0.62-0.94) lower risk of incident use of sedative-hypnotics. **Conclusion:** Higher CRF is associated with less prescribed sedative-hypnotics in the general population. This effect seems to be more pronounced for those with highest CRF.
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1723 Board #317 May 28 9:30 AM - 11:00 AM
Severe Intensity Exercise Promote Greater Reduction In Anxiety Scores Than Moderate In Adults
 Cyro G. Borges¹, Marcos Mónico-Neto¹, Sergio Tufik², Hanna Karen Moreira Antunes¹. ¹UNIFESP, Santos, Brazil. ²UNIFESP, São Paulo, Brazil.
 (No relevant relationships reported)

It is well known that moderate exercise can modulate anxiety state; however, few studies have shown the effects of severe intensity exercise over anxiety. **Purpose:** Compare the impact of moderate and severe exercise on anxiety state answers in healthy adults. **Methods:** Twenty four male subjects (30.45±5.3yrs; 74.78±8.9kg; 174.12±4.1cm; 24.69±2.4kg/m²; 18.04±5.5%Fat mass; 27.33±4.5 Trait Anxiety Score), were submitted to two tests at intensities based on Vpeak percentage of a treadmill maximal graded test separated by 7 days: 1) 60% Vpeak for 30 minutes (moderate intensity); 2) 85% Vpeak until volitional exhaustion (severe intensity). For these conditions, the subjects answered de state subscale of the State-Trait Anxiety Inventory in the following time-courses: baseline (B), immediately after (IA) and 30 minutes after (R) the end of exercise. The results were compared using GLM (General linear models with Duncan post-hoc, with significance p≤0.05. The protocol was approved by Unifesp Ethics Committed (#2.381.537). **Results:** A significant reduction in anxiety scores was found immediately after (p = 0.03) and 30 minutes after (p = 0.02) moderate exercise (60% Vpeak) when compared to pre-exercise moment. Similar pattern was observed in the severe exercise (85% Vpeak) with lower scores 30 minutes after (p = 0.01) when compared to the other time-courses. At this intensity the scores came from a moderate anxiety immediately after to low level 30 minutes after the end of exercise. Comparing the variation between IA-B and IA-R, it was observed that the reduction in anxiety scores was even greater in the severe exercise (p <0.001). **Conclusion:** The comparison between the exercise intensities showed that both intensities can reduce state anxiety scores but severe intensity reduced scores in a greater amplitude than the moderate exercise in adults.
Financial Support: AFIP, CAPES (001 code), and CNPq

1724 Board #318 May 28 9:30 AM - 11:00 AM
Examination Of Pathogenic Behaviors And Weight Perceptions Among Female Collegiate Athletes And Dancers
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 (No relevant relationships reported)

Engaging in pathogenic behaviors (PB; e.g., dieting, purging, etc.) to control weight (WT) is often seen in athletics. Female athletes, especially those in aesthetic sports, have a higher risk of disordered eating, eating disorders and body image dissatisfaction.

Purpose: To examine PB and WT perceptions [current: CWT, ideal: IWT, mental weight: MWT (perceived WT if they didn't control their WT)] in collegiate athletes/dancers.

Methods: A convenient sample of female athletes/dancers (n=125; age: 19.8 ± 2.0; height: 163.9 ± 28.8 cm; WT: 63.6 ± 9.2 kg) across 6 sports and dance (i.e., equestrian (EQ), volleyball, beach volleyball, softball, soccer, ballet) from an NCAA Division I institution participated in a larger cross-sectional study. Participants were measured for height, WT, and body composition and completed a demographic survey (included

self-reporting IWT and MWT) and the Eating Disorder Inventory-Symptoms Checklist (for PB). Basic descriptive statistics assessed demographic information. Cross-tabulations assessed the proportion of participants classified as "at risk" for PB across sport. A repeated measures ANOVA examined perceptions of WT (CWT vs. IWT vs. MWT) across sport.

Results: Significant differences were found for use of PB across sport [61.4%: $X^2(5, N=125) = 16.5, P=0.006$]. EQ (8.9%) and ballet had the highest risk (13.4%). Significant differences were found between dieting and sport type [$X^2(5, N=125) = 12.2, P=0.033$] for an overall risk of 52.8% with highest risk for EQ (13.6%) and ballet (16%). Significant differences were found between excessive exercise and sport type [$X^2(5, N=125) = 32.7, P\leq 0.01$] for an overall risk of 13.6% with highest risk for EQ (10.4%). No significant differences were found for binge eating, purging, laxatives, diet pills, and diuretics. A significant main effect was revealed for WT perceptions across sport ($F_{1,115}=1625, P\leq 0.01, \eta^2=.988$), with significant interactions for WT type ($F_{2,115}=40.3, P\leq 0.01, \eta^2=.260$) and WT type and sport ($F_{10,115}=3.3, P=0.001, \eta^2=.124$). **Conclusion:** Overall athletes report engaging in PB, especially dieting and excessive exercise to control their WT, with aesthetic sports at higher percentages. Athletes WT perceptions are of concern, as all sports want to be smaller and assume their WT would be higher if they didn't control their WT.

1725 Board #319 May 28 9:30 AM - 11:00 AM
Relationship Of Internalized Weight Stigma To Sleep Quality And Physical Activity Among College Students
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PURPOSE: Studies suggest weight stigma may be associated with negative health consequences, including a reduced ability to lose weight, reduced physical activity, and poor mental health outcomes. Less is known about the prevalence of weight stigma among college students and how this relates to behavioral health.

METHODS: Students at a large Midwestern university completed an anonymous, online cross-sectional survey. Participants self-reported height and weight to determine BMI and weight status. Participants self-reported time spent in moderate, vigorous, and resistance-based physical activity. Participants completed to Pittsburgh Sleep Quality Index (PSQI) to determine sleep quality.

RESULTS: A total of 328 students provided complete data and are included in this analysis. The majority of participants were female ($n=256, 81\%$), and Caucasian ($n=292, 89\%$). Eighty-nine participants (28.1%) had obesity based on BMI classification with no difference in prevalence between genders. Mean reported sleep time was 7.0 ± 1.3 hours for all participants. Female participants reported lower overall sleep quality (7.1 ± 3.4) compared to males (6.3 ± 3.6). Mann-Whitney U group comparisons demonstrated that participants reporting higher sleep quality had lower degrees of internalized weight stigma; this relationship was seen among females ($md=7.0; P<0.001$) and males ($md=6.5; P<0.05$). The majority of both male (77.9%) and female (73.0%) participants did not meet national physical activity recommendations. Mann-Whitney U groups comparisons demonstrated that participants with higher Participants meeting physical activity recommendations reported lower degrees of internalized weight stigma ($md=4.20, P<0.01$).

CONCLUSIONS: There is evidence that higher internalized weight stigma is related to reduced sleep quality and lack of achievement of physical activity recommendations among college students. Further research should explore this relationship to improve lifestyle counseling within this population.

1726 Board #320 May 28 9:30 AM - 11:00 AM
The Psychological And Academic Impact Of Athletic Injury
 Jessie Juenemann, Ben Resnick, Jennifer Dysterheft Robb.
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(No relevant relationships reported)

PURPOSE: Awareness and research on the mental health of student athletes has been rapidly increasing and recently become a primary focus of the National Collegiate Athletic Association (NCAA) and National Athletic Trainers' Association. Although many see athletes as individuals who have grit and strength, the impact of injury and sport can have drastic effects on an athlete's mental health, as well as academic performance and social participation. Without proper support, critical negative secondary effects could occur during and after the rehabilitation process. Therefore, the purpose of this study was to examine the psychological and academic impact of athletic injury, specifically NCAA Division III athletes.

METHODS: A total of 34 collegiate student-athletes participated in the study (19 male, 15 female) from the Minnesota Intercollegiate Athletic Conference. Participants completed a mixed-methods questionnaire on the perceived mental impact of previous or current sport injuries. The questions required short answer and likert scale rating

responses. A seven layer thematic analysis using three coders and triangulation to control for bias was used to analyze short answer responses and develop primary and subthemes. Quantitative data was analyzed using descriptive statistics.

RESULTS: Thematic analysis revealed major changes occurred in: Mental Health, Physical Health, Daily Habits, and Perceived Social Support following sport injury. Critical findings included: 38% of participants perceived negative social interactions from coaches, 35% had symptoms of depression, 74% had some type of emotional disruption, and 29% had a reduction in academic motivation.

CONCLUSIONS: High reports of depressive feelings, overall disruption to emotions and habits, and lack of social support alongside these mental health changes are a cause for great concern for collegiate athletes and their institutions. It is recommended that NCAA institutions utilize sports psychologists or mental health professionals to allow athletes to have a larger support system and work through mental health and academic issues they may face.

1727 Board #321 May 28 9:30 AM - 11:00 AM
The Acute Effects Of Exercise Intensity On Positive And Negative Affect
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(No relevant relationships reported)

College students commonly rate stress as the number one health problem with which they deal with on a daily basis. Aerobic exercise is often promoted as an effective tool for stress management and overall improved mental health. Less understood is the utility of exercise intensity as a means to reduce perceived levels of stress and subsequently improve mood. **PURPOSE:** to investigate the acute effects that the intensity of aerobic exercise has on positive and negative affect. **METHODS:** College students ($n=28$) were assessed for affect via the Positive and Negative Affect Schedule (PANAS) questionnaire. In a crossover study, students performed two cycle ergometer protocols 48 hours apart - 1) moderate-intensity at 65% of peak power output for 20-min and 2) vigorous-intensity at 85% of peak power output, performed in a 1-min-on, 1-min-off interval format for 20-min. After the conclusion of the exercise session, the students were assessed via the PANAS a second time, allowing for pre/post analysis.

RESULTS: Initial analyses indicated no interaction effect (time x condition) for either positive affect ($p=0.065$) or negative affect ($p=0.064$). Positive affect scores increased from pre to post in both conditions (65%: $p<0.001, d=1.2$; 85%: $p<0.001, d=1.2$). Negative affect scores decreased from pre to post in both conditions (65%: $p<0.001, d=0.92$; 85%: $p<0.001, d=0.89$). **CONCLUSIONS:** The results of this study found that an acute 20-min bout of cycling at both 65% and 85% of peak power led to large improvements in positive affect (18.8%, 27.4%) and large decreases in negative affect (23.5%, 17.6%). Moderate and vigorous-intensity aerobic exercise were equally effective in improving mood in this college population.

C-47 Free Communication/Poster - Genetics, Immunology and Endocrinology with Exercise

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

1728 Board #322 May 28 9:30 AM - 11:00 AM
A Comparison Of Tnfr1 And Tnfr2 Expression On Monocyte Subsets Following Continuous And Interval Exercise
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Purpose: To examine the tumor necrosis factor receptor (TNFR) 1 and 2 response on monocyte subsets to interval and continuous aerobic exercise. **Methods:** Six men (22.5 ± 3.9 yrs; 180.8 ± 5.0 cm; 80.5 ± 6.6 kg; 11.8 ± 4.3 %BF; 44.2 ± 2.4 ml·kg⁻¹·min⁻¹) completed three cycling protocols: moderate continuous (MCT), sprint-interval (SIT), and high-intensity-interval (HIIT), in a randomized order. Visit 1 consisted of a maximal graded exercise test (VO_{2max}) on a cycle ergometer. HIIT consisted of 15 90-sec bouts at 85% VO_{2max} and 90-sec active recovery periods. SIT consisted of 15 20-sec bouts at 130% max wattage and 160-sec active recovery periods. MCT was a continuous bout at 65% VO_{2max}. Each trial duration was 53 min, including a 5-min warm-up and a 3-min recovery. Blood was collected before (PRE), immediately (IP), 30 minutes (30M), 2 hours (2H), 6 hours (6H) and 24 hours (24H) post-exercise.

Changes in surface expression, as measured by median fluorescent intensity (MFI) of TNFR1 and 2 on monocyte subsets (classical: CD14⁺CD16⁻; intermediate: CD14⁺CD16⁺; and non-classical: CD14⁻CD16⁺) were analyzed via flow cytometry. Changes in TNFR1 and 2 expression were determined using a mixed model regression with fixed effects on time and condition. **Results:** Analysis indicated a time effect for TNFR1 expression on classical ($F=4.450, p=0.001$) and intermediate ($F=3.517, p=0.006$) monocytes. TNFR1 expression on classical monocytes decreased ($p < 0.05$) from PRE (6637 ± 704 MFI), IP (6538 ± 522 MFI), 30M (6836 ± 661 MFI), and 2H (6600 ± 564 MFI) at 6H (5934 ± 814 MFI) and 24H (6156 ± 516 MFI). TNFR1 expression on intermediate monocytes decreased ($p < 0.05$) from PRE (6391 ± 649 MFI), 30M (6618 ± 655 MFI) and 2H (6418 ± 569 MFI) at 6H (5912 ± 814 MFI) and 24H (5936 ± 443 MFI). A time effect ($F=4.079, p=0.002$) was observed for TNFR2 expression on intermediate monocytes, with a decrease ($p < 0.05$) from PRE (25528 ± 3188 MFI) at 30M (22327 ± 4067 MFI), 2H (21008 ± 5113 MFI), and 6H (20515 ± 5918 MFI). TNFR2 expression on intermediate monocytes recovered by 24H (25483 ± 3189 MFI). **Conclusion:** Changes in TNFR1 and TNFR2 expression were observed across time, with no differences observed between conditions. Therefore, TNFR1 and TNFR2 expression on monocytes may not be dependent on intensity, but more investigation is necessary.

Partially supported by the NSCA Foundation

1729 Board #323 May 28 9:30 AM - 11:00 AM
Diurnal Regulation Of Exercise-induced Interleukin-6 Signaling

Charli D. Aguilar, Elias M. Malek, Caitlin K. Reynolds, Graham R. McGinnis. *University of Nevada Las Vegas, Las Vegas, NV.* (Sponsor: James Navalta PhD., FACSM)

(No relevant relationships reported)

BACKGROUND: Exercise induced production of specific myokines, namely Interleukin-6 (IL-6), is essential in protecting the heart against cardiac ischemia-reperfusion (IR) injury in mice. Interestingly, IL-6 production in skeletal muscle has been shown to have a circadian rhythm in vitro, which also influences the magnitude of exercise-induced IL-6 in the blood in humans. However, how the circadian rhythm affects the exercise-mediated IL-6 signaling pathways in the heart is not currently known. **PURPOSE:** It was the purpose of this study to investigate how time-of-day affects exercise induced IL-6 signaling in the heart. **METHODS:** We assessed activation of the IL-6 signaling pathway in cardiac muscle following exercise at two times of day; Zeitgeber time (ZT) 0 (beginning of light/rest phase) and ZT12 (beginning of dark/active phase). 21-week-old male C57/BL6 mice ($n=38$) were habituated to treadmill exercise for 5 days under red light during the active phase and allowed to recover for 2 days. Following a single 60-minute bout of treadmill exercise at 10 m/min, mice were sacrificed at 3 time points; pre-exercise (SED), immediately post-exercise (POST), and 1-hour post-exercise (1HR). Hearts were cleared of blood and rapidly snap frozen in LN2. IL-6 signaling was assessed via western blotting of phosphorylated Signal Transducer and Activator of Transcription 3 (pSTAT3). Statistical analyses was performed using SPSS 25 (SPSS Inc., Chicago, IL, USA). Differences in p-STAT3 at the various time points was analyzed using 2x3 factorial ANOVA and significance accepted at $p < 0.05$.

RESULTS: Values are presented as (Mean ± SD), fold change from sedentary mice at ZT0. No difference was observed in p-STAT3 (Tyr705) between sedentary mice at ZT0 and ZT12 (1.00 ± 0.35 vs 0.95 ± 0.60). A significant interaction effect revealed that p-STAT3 (Tyr705) levels were significantly increased following exercise performed at ZT0 (POST; 4.45 ± 1.30, and 1HR; 2.70 ± 1.35, $p < 0.05$), while exercise at ZT12 had no effect on IL-6 (POST; 1.42 ± 0.52), and 1HR; 1.32 ± 0.56, $p < 0.05$).

CONCLUSIONS: Exercise-induced myocardial IL-6-signaling was strongly activated at ZT0 compared to exercise at ZT12. Induction of IL-6 activation in cardiac tissue by exercise is time-of-day dependent.

Funding: Work was supported by NV INBRE Pilot Grant to Dr. McGinnis

1730 Board #324 May 28 9:30 AM - 11:00 AM
Pituitary-thyroid Hormone Responses Following Resistance Exercise Performed At Submaximal Movement Velocity

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(No relevant relationships reported)

Acute hormonal changes can be elicited by mechanical overloading of skeletal muscle, which are potentially involved in muscle adaptation following resistance exercise. In particular, previous studies have shown that resistance exercise at maximal velocity induces acute changes in circulating levels of pituitary-thyroid (P-T) hormones.

PURPOSE: This study investigated the responses of thyrotropin (TSH), free thyroxine (fT4) and prolactin (PRL) in young volunteers after a bout of resistance exercise performed at 70% of the maximal velocity of movement. **METHODS:** Nine healthy males (age: 22.5 ± 3.3 years, height: 181 ± 5 cm, body mass: 81.6 ± 5.6 kg) underwent a protocol of resistance exercise of the knee extensors of both legs (4 sets squat and 4 sets leg press, 8 repetitions/set, with a load corresponding to that of 10-repetition maximum). A recovery period of 3 minutes was allowed between sets. Blood samples were collected before, immediately after and at 20 and 40 min post-exercise. Plasma levels of TSH, fT4 and PRL were measured by ELISA. One-way ANOVA was used for statistics and data are presented as mean±SE. **RESULTS:** TSH showed a slight gradual increase up to 12% at 40 min post exercise, which failed to reach significance ($p > 0.05$) due to a large variability shown between the subjects' responses (3.63±0.89 ng/dl, 3.53±0.71 ng/dl, and 3.70±0.88 ng/dl, immediately after, at 20 and 40 min after exercise, respectively, compared to 3.26±0.65 ng/dl at baseline). Plasma fT4 levels exhibited also a no significant increase post exercise (1.33±0.09 ng/dl, 1.18±0.10 ng/dl, and 1.33±0.15 ng/dl, immediately after, 20 and 40 min after exercise, respectively, compared to 1.23±0.10 ng/dl at baseline; $p > 0.05$). PRL levels showed a significant decrease up to 17% 20 min after exercise (18.39±1.23 ng/ml, 17.3±1.24 ng/ml and 17.46±1.10 ng/ml, immediately after, at 20 and 40 min post-exercise, respectively, compared to 21.59±2.29 ng/ml at baseline; $p < 0.05$). **CONCLUSION:** Our findings suggest that resistance exercise at a submaximal velocity induces mild acute pituitary-thyroid hormone responses. Further studies are needed to characterize the mechanisms by which those responses are triggered and regulated during recovery after resistance exercise.

1731 Board #325 May 28 9:30 AM - 11:00 AM
Relationships Of Serum And Plasma BDNF To TNF- α , IL-10, And IL-1ra During Aerobic Exercise

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(No relevant relationships reported)

PURPOSE: To examine the relationship of Brain Derived Neurotrophic Factor (BDNF) in serum and plasma to serum TNF- α , IL-10, and IL-1ra in response to aerobic exercise. **METHODS:** Six recreationally active men (26.0 ± 2.6 yrs, 180.3 ± 5.3 cm, 85.3 ± 7.6 kg, 48.64 ± 5.2 mL·kg⁻¹·min⁻¹) completed three exercise trials under different conditions: low temperature (5°C), moderate temperature (22°C), and high temperature (35°C). Each protocol consisted of a 60-min cycling trial at 60% VO_{max}, a 15-min rest, and a time-to-exhaustion trial at 90% VO_{max} (TTE). Blood was sampled before (PRE) and after the 60-min time trial (60), immediately following the TTE (90), and one hr post-TTE (REC). Serum concentrations of TNF- α , IL-10, IL-1ra, BDNF(-S), and plasma concentrations of BDNF(-P) were analyzed via ELISA. Data were combined across different conditions and analyzed by calculating change scores between PRE and other time points – presented as 60, 90, REC. Relationships between analytes were determined using Pearson Product Moment Correlations, with $\alpha \leq 0.05$. Correlation coefficients were described as weak ($r: 0.30 - 0.49$), moderate ($r: 0.50 - 0.69$), or strong ($r: 0.70 - 0.89$). **RESULTS:** Correlation coefficients between changes in BDNF-S and changes in IL-1ra indicated moderate to strong positive relationships between BDNF-S at 60 with IL-1ra at 60 and 90 BDNF-S at 90 with IL-1ra at 90, and BDNF-S at REC with IL-1ra at 90 and REC ($r \geq 0.568, p \leq 0.043$). Correlation coefficients between BDNF-P and TNF- α indicated a moderate positive relationship between BDNF-P at 60 with TNF- α at 90 ($r = 0.513, p = 0.035$). Changes in BDNF-S and IL-1ra demonstrated weak to moderate, non-significant correlation coefficients between BDNF-S at 90 and REC with IL-1ra at 60 ($r = 0.456, p = 0.087; r = 0.508, p = 0.064$; respectively). Similarly, correlation coefficients between changes in BDNF-S and IL-10 presented weak to moderate, non-significant relationships BDNF at 60 and 90 with IL-10 at 60 ($r = 0.544, p = 0.068; r = 0.498, p = 0.070$; respectively). No other relationships were observed. **CONCLUSION:** There appears to be a strong relationship between BDNF-S and IL-1ra throughout the trial, suggesting BDNF may be linked to the anti-inflammatory cascade, though not corroborated in BDNF-P.

1732 Board #326 May 28 9:30 AM - 11:00 AM
Sex Dimorphism In Muscle Damage-Induced Inflammation

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Evidence suggests that estrogen can provide a protective effect against muscle damage-induced inflammation. However, to date, no study has directly compared the muscle damage-induced intramuscular cytokines gene expression between men and women. **Purpose:** The purpose was to determine the intramuscular cytokine response to a bout of unaccustomed eccentric exercise in men and women. **Methods:**

Untrained men ($n=8, 22 \pm 3$ y) and women ($n=8, 20 \pm 1$ y) completed a session of 80 unilateral maximal eccentric knee extensions. Vastus lateralis samples were collected and analyzed for gene expression of Interleukin (IL)-6, IL-10, IL-15, tumor necrosis factor (TNF)- α , and transforming growth factor (TGF)- β before exercise (BL), and 12 (12h) and 24 hours (24h) after exercise. Data were **Results:** A significant ($p<0.05$) time \times gender effect was found for IL-10 and TNF- α expression. IL-10 was increased at 12h (13.64 ± 4.22 -fold) and 24h (29.34 ± 8.42 -fold) compared to at BL for men, but there was no change for women. At 24h, IL-10 was greater for men than for women. Additionally, TNF- α was increased at 24h (7.78 ± 2.17 -fold) compared to 12h (3.64 ± 1.36 -fold) for men; no change was found for women. A significant time effect was found for IL-6 with an increased at 12h (3.23 ± 0.7 -fold) and 24h (4.80 ± 1.57 -fold) compared to BL. No changes were observed for IL-15 and TGF- β expressions. **Conclusion:** In response to exercise-induced muscle damage, TNF- α and IL-10 gene expression increased in men but not in women. These results suggest that there is a sex dimorphic response in muscle damage-induced intramuscular pro-inflammatory and anti-inflammatory cytokines.

1733 Board #327 May 28 9:30 AM - 11:00 AM
Monitoring Of Exhaustion And Recovery - Biomarkers From The Earlobe?

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 (No relevant relationships reported)

Venous blood samples are widely used to monitor an athlete's health and training status. However, due to practicability reasons, the use of micro-sampling methods might be a more applicable solution to monitor training burden and recovery on a regular basis. **PURPOSE:** As changes in the immune system may define the susceptibility to infection, the aim of the current study was to assess test-retest reliability as well as validity of leukocyte subpopulation determination from capillary blood.

METHODS: Twenty young (25.1 ± 3.5 years, 10 males, 10 females) and healthy subjects were enrolled into the study. After performing an all-out test on a treadmill (45 min at 75% of VO_{2max} followed by a graded increase of velocity until maximum exhaustion), venous and capillary blood samples were taken at five time points (before, immediately after, 1 h, 3 h and 24 h after the test), respectively. Additionally, a second resting blood sample was drawn on a different day with at least one week apart to assess test-retest reliability. Leukocyte subpopulations were determined on a flow cytometer (Cytotoflex, Beckman Coulter) in comparison to the reference method (XE-2100, Sysmex Austria).

RESULTS: When comparing to the reference method ICC (95% CI) for leukocyte subpopulations ranged from 0.63 (0.27-0.83) for lymphocytes to 0.76 (0.49-0.90) for monocytes with typical errors of 0.23 (0.18-0.23) and 0.06 (0.05-0.09), respectively. However, test-retest reliability was rather low ranging from 0.19 (-0.26-0.58) for monocytes and 0.55 (0.16-0.80) for lymphocytes. Nevertheless, the micro-sampling method was similarly effective to detect the exercise-induced changes in leukocytes, lymphocytes, monocytes and granulocytes.

CONCLUSION: Capillary blood samples seem to be an interesting alternative to venous blood samples when measuring post-exercise alterations of leukocyte subpopulation counts. Future studies will focus on enhancing test-retest reliability and expanding the methods to intracellular markers to further enhance the informative value for athletes, coaches and sports physicians.

1734 Board #328 May 28 9:30 AM - 11:00 AM
Acute Effects Of Maximal Exercise On Inflammatory Markers And Heart Rate Variability

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BACKGROUND: It has been suggested that vagal input may influence inflammatory responses on a millisecond timescale akin to heart rate. This study aimed to investigate the relations between vagally mediated markers of heart rate variability (HRV) and inflammatory profiles in response to maximal aerobic exercise. **METHODS:** Eight recreationally active males (26 ± 3 yrs, 9.7 ± 3.2 %BF) completed two trials separated by a minimum of eight weeks. Resting HRV was assessed during a 5-min seated period at both trials; the root mean square of successive differences (rMSSD) was used to assess vagal input. Maximal oxygen uptake (VO_{2max}) was assessed via ramp protocol on the cycle ergometer (100W + 25W per minute) until volitional fatigue. A blood draw was collected immediately pre-, and immediately post-maximal oxygen uptake testing. Inflammatory markers were quantified in serum using a high sensitivity T-Cell multiplex (IFN γ , IL-10, IL-2, IL-4, IL-6, and TNF- α). Principal component analysis (PCA) was used to form three components and a repeated measures multivariate analysis of covariance (MANCOVA) was used to examine differences in these

components between the two trials and across time (pre vs post). **RESULTS:** After controlling for the difference in baseline rMSSD, inflammation between the two trials approached significance ($p=.095$). However, none of the 3 components were significantly different in response to maximal exercise ($p=.824$). **CONCLUSIONS:** Vagal input was assessed by seated resting HRV (rMSSD) which influenced baseline resting inflammatory status but did not influence the exercise-induced inflammatory response. This data suggests that when investigating inflammatory responses, resting vagal input should be considered.

1735 Board #329 May 28 9:30 AM - 11:00 AM
A Twist2 Expressing Progenitor Cell Type Population Exists In Human Skeletal Muscle

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 (No relevant relationships reported)

INTRODUCTION. Satellite cells are muscle stem cells that function to support long-term muscle homeostasis, repair and exercise adaptations. Recent evidence in rodents has revealed the existence of an additional muscle progenitor cell population with the capacity to specifically regulate the repair and maintenance of type-II skeletal muscle fibres. These cells are typified by the expression of the transcription factor Twist2 (Tw2) and represent a distinct, non-satellite cell population found within the myofibre interstitium. However, the presence and function of Tw2-positive cells within human skeletal muscle is currently unknown. Therefore, the **PURPOSE** of this investigation was to identify and characterize Tw2-positive cells within skeletal muscle under basal conditions. **METHODS:** Muscle biopsy samples were obtained from the hamstrings muscle of young healthy males and females undergoing anterior cruciate ligament repair ($n=8, 3$ male, 4 female, mean age ~ 25 years), for immunohistochemical (IHC) analysis of muscle cross-sections and immunocytochemical (ICC) analysis of cytospin mononuclear cells enzymatically digested from muscle biopsy samples. **RESULTS:** ICC staining revealed numerous Tw2-positive cells in the isolated mononuclear cell fraction suggesting they originated from the myofibre interstitium. This was confirmed through IHC staining for Tw2 and laminin in tissue cross-sections which revealed that Tw2 expression was localized to a population of cells outside the myofibre membrane at a density of 0.014/mm². In agreement with previous reports, Tw2 protein expression was localized within both the cytosol and the nucleus of Tw2-positive cells. Importantly, IHC analysis of the satellite cell marker pax7 and Tw2 demonstrated that cells expressing these markers were mutually exclusive demonstrated that Tw2-positive cells represent a unique cell type, independent of satellite cells. Ongoing analysis is examining the response to Tw2-positive cells to acute and chronic exercise stimuli. **CONCLUSION:** These findings identify a novel non-satellite cell population typified by Twist-2 expression in human skeletal muscle, the function of which currently remains unknown.

1736 Board #330 May 28 9:30 AM - 11:00 AM
Changes In Brain-Derived Neurotrophic Factor Are Correlated With Changes In Il-6 During Aerobic Exercise.

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 (No relevant relationships reported)

The effects of exercise on inflammation are complex. Literature suggests a reduction of chronic inflammation following exercise training, however, following acute bouts of exercise, both pro- and anti-inflammatory responses have been demonstrated. Brain-derived neurotrophic factor (BDNF) has been suggested to have an intermediary role during the inflammatory response to exercise. Therefore, observing the role of BDNF in the post-exercise inflammatory response may allow for a greater understanding of the intricacies of the inflammatory response. **Purpose:** The purpose of this study was to observe the relationship between BDNF and interleukin-6 (IL-6) during aerobic exercise in different environmental conditions. **Methods:** Six college aged men (26 ± 3 yrs) completed a VO_{2max} test (48.6 ± 5.7 mL/kg¹/min¹) along with three separate trials in 5°C (LT), 22°C (MT), and 35°C (HT). Each trial consisted of cycling for 60 minutes at 60% VO_{2max} , a time to exhaustion trial at 90% VO_{2max} (TTE), and passive recovery for 60 min in the same condition. Blood was obtained before exercise (PRE), after 60 min of cycling (60), after the TTE (90), and after recovery (REC). Blood was analyzed via ELISA for serum and plasma BDNF concentrations and serum IL-6 concentrations. Change scores were calculated as percentages (Δ PRE to 60; Δ PRE to 90; Δ PRE to REC) and analyzed using a Pearson Correlation, with significance defined as $\alpha \geq 0.05$. **Results:** Changes in serum IL-6 (Δ PRE to 60) were significantly ($r = .566, p = 0.018$) correlated to changes in plasma BDNF (Δ PRE to 60). Changes in serum

IL-6 (Δ PRE to 90) were significantly ($r = 0.511, p = 0.043$) correlated to changes in serum BDNF (Δ PRE to 90). Changes in serum BDNF were not significantly correlated to changes in plasma BDNF. No other significant correlations were observed.

Conclusion: This study suggests there is a relationship between IL-6 and BDNF. This could lead to better understanding of the mechanism for both IL-6 and BDNF responses due to aerobic exercise. The insignificant correlation between serum and plasma BDNF give evidence that each may represent different pools of BDNF that respond independently to aerobic exercise.

This study was partially funded by the Kent State University Research Council

1737 Board #331 May 28 9:30 AM - 11:00 AM

Differentially Expressed Genes In Cd8+ T-cells Following A Dual-stress Challenge

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine differentially expressed genes (DEG) in CD8+ T-Cells in response to a dual stress challenge (DSC) in resistance trained (RT) men. **METHODS:** RT men ($n = 6$; age = 21.7 ± 2.8 years; height = 176.0 ± 4.9 cm; weight = 79.8 ± 9.6 kg) volunteered to participate in this study. Each volunteer underwent a DSC, which consisted of three exercise stages (ES) lasting 15-20 minutes each. After each ES a cognitive assessment lasting 5 minutes each (15 minutes total) was conducted, for a total DSC of roughly 65 minutes. Blood draws were collected prior to the DSC and 20 minutes after completion of the DSC. T-cells were isolated using the Negative Selection EasySep Human CD8+ T-Cell Isolation Kit and T-cells were resuspended in TRI Reagent and total RNA was isolated with a Direct-zol RNA MicroPrep Kit. The NEBNext Ultra II Directional RNA Library Prep Kit for Illumina was then used to construct RNA sequencing libraries. An Illumina NextSeq 550 sequencing system at the University of Kansas's Genome Sequencing Core was used to generate paired-end, 50-base pair sequence reads. Gene expression values were normalized using the TMM-method (weighted trimmed mean of M-values) using R statistical programming language and EdgeR, followed by differential gene expression analyses per EdgeR protocol. Finally, pathways affected by the differentially expressed genes were investigated using Ingenuity Pathway Analysis (IPA). **RESULTS:** Forty DEG were identified ($p < 0.001$), with 35 of those being upregulated and five being downregulated. Further analysis with IPA showed these genes are involved in the regulation of 5 pathways ($p < 0.001$) including the JAK/STAT pathway, Th1 pathway and IL-6 signaling pathway. The affected pathways are involved in the inflammatory response as well as cell growth, proliferation, development, signaling, and cell survival. **CONCLUSION:** Thirty-five upregulated genes and five downregulated genes were observed in in response to a dual-stress challenge. These genes play a role not only in growth, proliferation, development and survival of CD8+ T-Cells but also to other immune cells via various signaling pathways. Further research is warranted to help better understand the roles these genes play in the immune response to exercise.

C-48 Free Communication/Poster - Cardiovascular

Thursday, May 28, 2020, 9:30 AM - 12:00 PM

Room: CC-Exhibit Hall

1738 Board #332 May 28 9:30 AM - 11:00 AM

Results From The Fifa Sudden Death In Football Registry (FIFA-SDR) — Sport-specific Data Of 5 Years

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(No relevant relationships reported)

PURPOSE: Large population-based studies about sudden cardiac deaths (SCD) and survived sudden cardiac arrests (SCA) in athletes from the USA and Europe indicate regional differences in the underlying causes. A different ethnic and genetic mix

between these regions may lead to such a heterogeneous distribution. It is of great relevance to investigate these regional patterns to possibly optimize existing screening and prevention procedures and reduce fatalities. This registry aims to investigate SCD and SCA in football (soccer) players worldwide, both at professional and recreational level.

METHODS: From 2014 to 2018 cases of SCDs and SCAs were mainly recorded by media monitoring (Meltwater®), a confidential web-based data platform and data synchronization with existing national SCD registries ($n=16$). Inclusion criteria were met when SCD or SCA occurred during football-specific activity or up to one hour afterwards. Death during other activities was excluded.

RESULTS: A total of 632 players (mean age 34 ± 16 years, 96% males) was reported from 70 countries; 150 players (24%) survived. Elite players represented a small portion (6%). A diagnosis by autopsy or definite medical reports could be established in 219 cases (35%). The leading causes over the age of 35 years were coronary artery disease (CAD, 74%) and ≤ 35 years sudden unexplained death (22%), cardiomyopathy (CM, 17%) and CAD (11%). Hypertrophic CM and coronary artery anomalies showed the highest fraction in North America with 15% and 36%, respectively. Myocarditis was most frequently reported from Europe (7%). CAD ≤ 35 years prevailed in Africa (38%) and CM (42%) in South America. Commotio cordis occurred infrequently (3%). In North America and Australia survival rates were the highest (53% and 47%, respectively). Early use of an automated external defibrillator was associated with a higher survival rate (86%) compared to manual cardiopulmonary resuscitation (35%).

CONCLUSIONS: Differences between countries in the underlying cardiac diseases for SCA and SCD have to be taken into account to possibly improve and modify primary and secondary prevention measures in football players. The percentage of autopsied cases is difficult to increase because this reflects the law in most countries. Therefore, an expansion of national SCD registries is urgently needed.

1739 Board #333 May 28 9:30 AM - 11:00 AM

Arterial Blood Pressure And Vascular Stiffness In Young And Masters Road Cyclists Matched For Performance

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(No relevant relationships reported)

Advancing age is associated with reductions in athletic performance as well as declines in vascular functions in masters athletes. Regular vigorous exercise can prevent or attenuate decreases in both athletic performance and vascular functions in master athletes. Currently, it is not known if vascular functions of masters athletes are not different from younger counterparts when their athletic performance was matched. **PURPOSE:** The present study was conducted to compare arterial pressure and vascular function between younger and masters road cyclists who were matched for cycling performance. To avoid the potential issue of sampling less competitive younger cyclists, we recruited younger and developing cyclists. **METHODS:** Young (16 ± 1 years; $n=25$) and masters (40 ± 4 years; $n=23$) apparently healthy road cyclists who had been cycling vigorously >720 min/week (or >200 km/week) were studied. A 20-km time trial time and cycling time to exhaustion during graded exercise tests were used to determine cycling performance. Arterial blood pressure, brachial-ankle pulse wave velocity (baPWV), and carotid artery intima-media thickness (IMT) were measured. **RESULTS:** Mean 20-km time trial, time to exhaustion, and maximum oxygen consumption were not significantly different between young and master road cyclists. Peak power output was higher in masters road cyclists than in young cyclists ($p < 0.05$). Young road cyclists had higher ($p < 0.05$) heart rate at rest, maximum heart rate, and submaximal heart rate during the 20-km time trial than masters cyclists. Systolic and diastolic blood pressure was greater ($p < 0.05$) in masters cyclists ($127 \pm 12 / 77 \pm 11$ mmHg) than in young cyclists ($119 \pm 7 / 63 \pm 7$ mmHg). Both baPWV (1237 ± 117 vs. 993 ± 105 cm/s) and carotid IMT (0.49 ± 0.07 vs. 0.43 ± 0.02 mm) were significantly higher in masters road cyclists than in young cyclists ($p < 0.05$). **CONCLUSION:** Masters road cyclists demonstrated greater arterial blood pressure and vascular stiffness compared with younger and developing cyclists who were matched for cycling performance.

1740 Board #334 May 28 9:30 AM - 11:00 AM

New Conditioning Evaluation Method Using Heart Autonomic Function In Competitive Archery Athletes

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PURPOSE: Archery is mainly an outdoor sport that involves shooting arrows from a standing position at a target 70 meters away. It is a relatively static sport that requires less physical activity than most other sports, but extremely fine control over movements. In the present study we investigated a new method of evaluating the condition of athletes in target sports, such as archery, for improving performance from the perspective of autonomic function, i.e., heart rate and heart rate variability (HRV) and respiratory sinus arrhythmia (RSA). **METHODS:** The participants were members of the Japanese women's national archery team (athlete A: age, 30 years, height, 180.0 cm, weight, 69.0 kg; athlete B: age, 18 years, height, 157.5 cm, weight, 50.0 kg). HRV was measured 1) at rest in the supine position for 5-min, 2) at rest in the supine position for 3-min, after having five deep breaths, then, 3) in the standing position for 3-min and finished the measurement with five deep breaths. The ECG data were derived from the chest II leads using the Biopac MP36 data acquisition system (Santa Barbara, CA, USA) and input at a sampling frequency of 1 kHz, and heart rate and HRV were measured from the R-R interval. **RESULTS:** The HRV results for athletes A and B are shown in Table 1. In the present study, athletes A and B were both asked about their subjective feelings of fatigue and their archery performance (scores) at the time of the HRV measurements. Athlete A reported subjective feelings of fatigue at the time of the measurement. Athlete B had no subjective feelings of fatigue, but the inability to achieve high scores.

CONCLUSION: The results suggest that even when there are no subjective feelings of fatigue, but the heart rate is high, LF/HF is high, HF is low, or RSA is low, in that case, cardiac sympathetic nervous function will be predominant, and poorer performance may be expected.

Athlete A	Supine 5min	Max HR	Min HR	Difference HR	Supine 3min	Standing 3min	Max HR	Min HR	Difference HR
HR (bpm)	98.8	104.2	90.6	13.6	100.3	106.0	111.1	100	11.1
HF, ms ²	20.4				5.1	1.7			
LF / HF	0.3				0.4	7.1			

Athlete B	Supine 5min	Max HR	Min HR	Difference HR	Supine 3min	Standing 3min	Max HR	Min HR	Difference HR
HR (bpm)	62.6	87.0	51.1	35.9	62.3	77.9	99.7	67.6	32.1
HF, ms ²	366.4				821.0	7.2			
LF / HF	0.1				0.5	9.8			

1741 Board #335 May 28 9:30 AM - 11:00 AM

Time And Dose Of Blood Pressure Medication Improves Hidden Hypertension Risk In A Firefighter

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Most firefighters (FF) are unaware of their BP levels, which increases their risk of undiagnosed hypertension. According to a recent study, BP medication taken at bedtime lowers levels more effectively and leads to a 66% decrease in the risk of fatal cardiac incidents. Using ambulatory BP (ABP) monitoring to measure BP over time is a recommended way to assess risk. **PURPOSE:** To provide evidence that time and dosage of BP medication can improve hypertension risk in FF. **METHODS:** We included 43 FF in an ongoing clinical trial. FF wore an ABP cuff for a period, and the overall average BP, daytime BP and nighttime BP levels were examined. FF also came to the lab for a clinical fasted visit including BP, body fat, and vascular health measures. For this sub-analysis, we report data from 1 FF who was found to have nocturnal hypertension and morning BP surge. **RESULTS:** Overall the entire group of FF were hypertensive with clinic BP of 128.7 ± 1.7/ 81.8 ± 1.2 mmHg, had high central BP measured by SphygmoCor® XCEL (121.8 ± 2.7/ 84 ± 1.5 mmHg), and had high average SBP measured by ABP (130.9 ± 1.5 mmHg). We identified several FF with nocturnal hypertension and high morning BP surge levels, and here we report on data on one. He was 53 yr old, weighed 226 lbs, had 36.1% body fat, was an uncontrolled hypertensive (140.5/84.5 mmHg), and had high central BP levels (134/81 mmHg). During the initial ABP monitoring, his daytime BP was 160.2/86.9 and nighttime BP was 178.9/87.1 mmHg. His BP rose in the morning to 203/104 mmHg and remained that level for 2hrs. The FF self-reported feeling headaches and

a 'rushing sensation' during fire calls, so he took his ABP data to a clinician. Initially, he was prescribed BP med in AM. The doctor increased dosage and switched to nighttime medication. During follow-up ABP monitoring, the FF's BP was much more controlled. His average daytime BP was 145.1/82.6, nighttime BP was 114.8/66.2, and morning BP was only 125/69 mmHg. **CONCLUSION:** With this case-study data from one FF in a larger clinical trial, we confirmed that timing and dosage of medication leads to improved BP levels. This further confirms that overall health awareness in FF is important. Fire chiefs and the firehouse medical director should encourage and increase BP monitoring. This one example proves to be a valuable anecdote when we enter firehouses and discuss our clinical trial.

1742 Board #336 May 28 9:30 AM - 11:00 AM

Differential Gut Scfa Microbial Taxa Correlated With Blood Pressure Status In African American Collegiate Athletes

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Introduction: The gut microbiome and reduced short-chain fatty acid (SCFA) producing microbes have been related to hypertension status in sedentary individuals. Hypertension is common amongst athletes and epidemiologic data reports that cardiovascular sudden death is more common in African Americans (AA) (5-fold), compared to whites, and is related to the elevated prevalence of hypertension independently in athletes and in AA. Exercise is generally known to reduce blood pressure (BP) and stimulates beneficial changes in the gut microbiome to promote gut health (increasing gut SCFA), but it is unknown whether there are differential gut microbial characteristics related to BP status in athletes. **Purpose:** To determine gut microbial characteristics related to gut SCFA in AA collegiate athletes with and without hypertension and identify specific microbial taxa related to BP status. **Methods:** The present work included 30 AA collegiate athletes stratified by normal BP (systolic BP (SBP) ≤129 mmHg; n=15) and high BP (SBP ≥130 mmHg; n=15) and we performed 16S rRNA gene sequencing on fecal samples. **Results:** Relative to BP status, we did not observe any significant differences in alpha or beta diversity, or operational taxonomic units (OTUs). However, we observed that SCFA producing microbes were differentially abundant between the 2 groups and the relative abundance of some microbes were significantly correlated with systolic BP (g_Lactococcus, R=0.5 p=0.0074; g_Aldercruetzia, R=0.59 p=0.001; g_Paraprevotella, R=-0.38 p=0.044; g_cc_115, R=0.41 p=0.29). **Conclusion:** We report that SCFA producing microbes were differentially abundant in AA collegiate athletes stratified by BP status. Although exercise training broadly increases SCFA microbes in the gut, identification of microbial community characteristics and specific taxa will provide insight into gut microbial functional profiles related to greater BP in AA collegiate athletes.

1743 Board #337 May 28 9:30 AM - 11:00 AM

Masters Athlete Screening Study: Four-Year Cardiovascular Disease and Event Incidence

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Background: Masters athletes (≥35 yrs) are not immune to elevated cardiovascular risk and cardiac events. In the first year of Masters Athlete Screening Study, 798 masters athletes were screened; 91 (11.4%) of the cohort were found to have cardiovascular disease (CVD). Coronary artery disease (CAD) was the most common diagnosis (7.9%). **Purpose:** To evaluate the incidence of CVD and adverse cardiovascular events over four years of the screening study. **Methods:** Masters athletes (≥35yrs) from a variety of sports without previous history of CAD underwent yearly cardiovascular screening for four years. The screen consisted of anthropometrics, resting blood pressure, resting electrocardiogram, modified American Heart Association 14-element recommendations, cardiovascular event questionnaire, physical examination (year one), and Framingham Risk Score. Participants with an abnormal screen according to the European Association of Cardiovascular Prevention and Canadian Cardiology Society Guidelines underwent further evaluations. **Results:** During the following three years of study an additional 45 cases of CVD were detected, with an incidence rate of 1.9/100 (64.7±7.3yr; 79%M), 3.0/100 (65.1±7.3yr; 62%M), and 1.5/100 (65.0±5.8yr; 80%M), for years two, three, and four, respectively. Twelve participants had a new CVD diagnoses or progression of a diagnoses. The

most common diagnoses over the three years was CAD (n=15; 33.3%) and atrial arrhythmias (n=14; 31.1%). An additional 9 participants were diagnosed CVD outside of the study (atrial fibrillation n=2; moderate CAD n=2; mild CAD n=4; genotype positive hypertrophic cardiomyopathy n=1). Five out of 798 (0.6%) participants had a myocardial infarction. A single CV death occurred. Three of the individuals who had a cardiac event demonstrated a negative exercise treadmill test (ETT) (mean time 15±2.9 min) and three had a positive ETT (mean time 12±1.2 min); two of which initiated cholesterol-lowering medication after confirmation of CAD via CCTA, and one declined medication after a negative MIBI.

Conclusion: Yearly cardiovascular screening of masters athletes identified ~2 new diagnoses per 100 athletes per year (primarily CAD and atrial fibrillation). Despite yearly cardiovascular screening and high fitness, myocardial infarctions still occur.

1744 Board #338 May 28 9:30 AM - 11:00 AM
Cardiovascular And Respiratory Responses During Aquatic Rehabilitation At Different Depths Of Supine Immersion

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Aquatic Rehabilitation (AR), is used in the treatment of athletic injuries, initially in a supported supine aquatic position, before progressing to an independent vertical position. In water entry, cardiovascular and respiratory shifts are affected by, the hydrostatic pressure, the diving reflex responses, the water temperature, and vary at different positions and levels of immersion.

PURPOSE: The purpose of this study was to investigate how the depth of submersion during AR at 32°C in a supine position, affects cardiovascular and respiratory function.

METHODS: Seven participants (35±10 years), were subjected to two 15-min trials of AR aquatic bodywork manipulations (MKS). Subjects were supported in a supine position by the provider's elbow under the head, and the trunk and lower legs, a) were either kept in alignment to the surface (SI) of the water with a lumbar curve support, or b) allowed to diagonally submerge to a deeper level (DI) during movements. An underwater video camera (FinepixGPS) was used for recording, and via 2-dimensional (2-D) kinematic analysis, the depth of submersion (LOGGERPRO 3.8) and hydrostatic pressure, were evaluated. During the trials, respiratory rate (RR), heart rate (HR), and oxygen saturation (SO₂) were measured (ApneaLink 1_218). Before and after the trials, arterial blood was drawn for gas analyses (Abbott-I-Stat) in addition to blood pressure determination. Trials were conducted in a randomized cross-over design and analyzed for dependent measures (p<0.05). **RESULTS:** The depth of submersion of the trunk and legs with the SI was 0.022±0.036 m versus 0.575±0.06 m with the DI. Significant differences were observed for RR, 14.42±2.29 breaths/min vs 11.34±2.42 breaths/min (p=0.03), and systolic blood pressure, 124.85±6.52 mmHg vs 109±7.00 (p=0.008), for SI and DI respectively. No significant differences were observed for oxygen saturation or any other arterial gas variables measured. **CONCLUSIONS:** The increase of the depth of submersion during AR significantly impacted select cardiorespiratory parameters, i.e. breathing frequency and systolic blood pressure, consistent with an increase in parasympathetic and/or decrease in sympathetic activity. Depending on pre-existing conditions this may affect the quality of clinical care during rehabilitation of the athlete.

1745 Board #339 May 28 9:30 AM - 11:00 AM
Cardiac Remodeling In Child And Adolescent Athletes In Association With Sport Discipline And Sex.

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 (No relevant relationships reported)

Continuous high training loads are associated with structural cardiac adaptations and development of an athletic heart in adult athletes, especially in sport disciplines with high dynamic training components. In child and adolescent athletes these effects are increasingly reported. However, study populations are still very small. **PURPOSE:** To determine cardiac dimensions indicating cardiac remodeling in child and adolescent athletes.

METHODS: M Mode echocardiographs of 1021 athletes (m 575, f 446; 8-18 yrs; body surface area (BSA) 0.88-2.0 m²) from 19 sport disciplines were analyzed retrospectively. Sport disciplines were clustered into 9 groups according to Mitchell, categorizing sports by components of dynamic and static training loads. Groups were analyzed separately. Previous organized sporting experience (at least 3-13 yrs) was a requirement for inclusion. Left ventricular diameter (LVEDD), interventricular septal (IVS) and posterior wall (PW) thickness at end-diastole were analyzed and compared to cardiac z Scores (zS) for central European children. Deviations from normal mean

(zS = 0) were defined as difference. Data was analyzed descriptively (median ± SD), Bland-Altman analysis was performed. **RESULTS:** For all analyzed parameters, athletic children and adolescents showed higher median zS though large deviations from the normal mean (zS>1.88) were only seen in single cases. Differences in sport discipline and sex were discovered. Throughout all disciplines, boys showed higher zS compared to girls (LVEDD 0.48±0.96 vs 0.22±0.92; IVS 0.47±0.99 vs 0.29±1.05; PW 0.53±0.76 vs 0.08±0.76), especially in disciplines with high dynamic training loads (Mitchel C I-III). Additionally, high zS were observed in the group of athletes with the highest static and low dynamic training load (Mitchell A III). **CONCLUSIONS:** Cardiac remodeling in response to athletic training starts at a young age, especially in boys exposed to high dynamic as well as static training loads. The development of zS for young athletes is essential to determine whether zS above the mean in this group are physiological adaptations or the beginning of pathologies. Differences between boys and girls and the high zS in boys with high static training loads indicate an association between fat free mass and cardiac dimensions stronger than BSA.

1746 Board #340 May 28 9:30 AM - 11:00 AM
Benign And Pathological Electrocardiographic Changes In Basketball Athletes Of Brasilia - Brazil

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PURPOSE: Basketball has evolved a lot and the level of competition has increased considerably. Athlete's Heart Syndrome comprises a set of clinical, electrocardiographic (ECG) and echocardiographic (ECHO) changes, such as sinus bradycardia, myocardial hypertrophy or enlargement of the cardiac cavities. Thus, it is important to distinguish potentially fatal pathological changes from normal physiological adaptations. The aim of this study was to describe the clinical, ECG and ECHO characteristics of Brazilian basketball players and evaluate the presence of benign and pathological changes.

METHODS: Fifteen male basketball athletes (23 ± 3.74 years) competing in the National Brazilian Basketball Gold League were evaluated during the last week of preparatory training for the competition. The athletes performed clinical evaluation (cardiovascular risk factors, medication use, sleep quality, and application of the Physical Activity Readiness Questionnaire - PAR-Q), anthropometric (body mass index - BMI, kg.m-2 muscle mass - MM, Kg; fat percentage - FP,%), resting ECG, and transthoracic doppler ECHO (left ventricular ejection fraction - LVEF,%; left ventricular diastolic diameter - LVDD, cm; left ventricular mass index - LVMI, g.m-2). ECG changes were classified as benign or malignant according to the Seattle Criteria. **RESULTS:** The athletes did not report cardiovascular risk factors, medication use and presented negative PAR-Q. Most athletes (90%) complained of poor sleep quality. The anthropometric variables were BMI 24.13 ± 2.05 Kg.m-2, MM 47.6 ± 5.01 Kg; FP 8.89 ± 4.79%. All individuals presented sinus rhythm (100%). The main benign ECG alteration was early repolarization alteration (10 - 66.7%). The malignant ECG change was LV hypertrophy with negative T-wave (3 - 100%). On ECHO we found LVEF 65.76 ± 2.35%, LVDD 53.15 ± 3.57 cm and LVMI 81.46 ± 11.72 g.m-2, within the normal range for age and body surface. **CONCLUSIONS:** The presence of ECG criteria for LV overload was not associated with the presence of hypertrophy or ventricular remodeling on echocardiography. Evidence supports the use of ECG in screening, coupled with a cost-effective interpretation algorithm to assist abnormal or borderline changes to identify possible cardiovascular causes and prevent sudden death in athletes.

1747 Board #341 May 28 9:30 AM - 11:00 AM
Distribution Of Cardiorespiratory Fitness Among Children In The Hearts And Parks Study

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One-third of children in the U.S. have an unhealthy body mass index (BMI). Vigorous activity improves BMI and reduces cardiovascular risk in children. Additionally, greater cardiorespiratory fitness (CRF) in youth may confer lower risks of poor cardiovascular and metabolic health in adulthood. The Hearts and Parks study utilizes a novel clinic-community intervention exploring how various types of physical activity, nutrition education and behavioral support affect the health of children (5-17 y) with a BMI ≥ the 95th percentile. **PURPOSE:** To explore 1-min post-exercise heart rate (HR) recovery following a physical fitness test and the distribution of CRF in children with obesity at baseline of enrollment in the Hearts and Parks study. **METHODS:**

Participants aged 6-12 [n=109, Non-Hispanic: 59.1%, Boys: 47.8%] came to Duke's Children Primary Care Clinic for anthropometric measures and an assessment of physical fitness. Physical fitness was assessed via the 3-min YMCA Bench Stepping Test, adapted for children 5-18. Heart rate recovery was measured via pulse-oximetry 1 minute after the test. RESULTS: The mean HR (bpm) for all age groups in this study showed a "very good" CRF [younger boys: 99.5, older boys: 98.2, younger girls: 109.0, older girls: 114.2]. Boys had a greater CRF with 39% at an "excellent" CRF compared to 24% for girls. Overall, girls tended to have a lower CRF compared to boys with 10% of girls in the "poor" category compared to the 4% for boys. CONCLUSION: Compared to normative values of children and considering their BMI, the participants of this study showed greater CRF values than expected. Irrespective of CRF levels, this study suggests children who are obese, in school and engage in some physical activity may still have a healthy level of CRF. Future studies should employ another measure such as VO_{2peak} to examine CRF in children with obesity and how this may be related to the adiposity and health of the child. Funded by 17SFRN33700117

Cardiorespiratory Fitness	Younger Boys (6-9y)			Older Boys (10-12y)			Younger Girls (6-9y)			Older Girls (10-12y)		
	Ref Range	n	% of total	Ref Range	n	% of total	Ref Range	n	% of total	Ref Range	n	% of total
Excellent (HR _{mean post-ex} < 5 th %tile)	<95	11	10.1%	<93	9	8.3%	<100	8	7.3%	<102	6	5.5%
Very Good (HR _{mean post-ex} ≤ 25 th %tile)	95-106	8	7.3%	93-105	4	3.7%	100-113	12	11.0%	102-116	8	7.3%
Good (HR _{mean post-ex} ≤ 50 th %tile)	107-115	7	6.4%	106-116	5	4.6%	114-123	11	10.1%	117-128	3	2.8%
Sufficient (HR _{mean post-ex} ≤ 75 th %tile)	116-126	2	1.8%	117-128	3	2.8%	124-134	3	2.8%	129-141	1	0.9%
Poor (HR _{mean post-ex} ≤ 95 th %tile)	127-142	1	0.9%	129-147	1	0.9%	135-52	2	1.8%	142-157	4	3.7%
Very Poor (HR _{mean post-ex} > 95 th %tile)	>142	0	0.0%	>147	0	0.0%	>152	0	0.0%	>157	0	0.0%

C-49 Free Communication/Poster - Musculoskeletal/Neuromuscular Diseases

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

1748 Board #342 May 28 9:30 AM - 11:00 AM High Intensity Shoulder Exercise Improves Function, Pain And Tendinous Blood Flow In Subacromial Pain Syndrome.

Ole Kristian Berg¹, Fredrik Paulsberg², Clara Brabant³, Keyvan Arabsolghar³, Sigrid Ronglan³, Nina Oliinn Aasen Bjørnsen³, Tom Tørhaug³, Fredrik Granviken³, Sigmund Østgård Gismervik³, Jan Hoff³. ¹Molde University College, Molde, Norway. ²Rosenborg Clinic of Physiotherapy, Trondheim, Norway. ³Norwegian University of Science and Technology, Trondheim, Norway. (No relevant relationships reported)

Subacromial pain syndrome (SAPS) defined as pain of non-traumatic origin localized around the acromion, is a debilitating, common and often chronic condition. Among many proposed underlying causes of SAPS, hypoperfusion and hypoxic conditions in and around the tendons may be an intrinsic cause of SAPS. Exercise therapy with low load is the advocated treatment of choice for SAPS. PURPOSE: To determine if high intensity aerobic interval training (HIIT) of the rotator cuff was feasible, more effective in improving endurance and reducing pain compared to low intensity exercises. Additionally, to examine the response of tendinous microcirculation following the exercise therapy. METHODS: 21 subjects with chronic SAPS randomized to two groups: HIIT (n=13) and control group (CG) (n=8) was tested before and after 8 weeks of exercise therapy. Endurance performance was assessed by an incremental abduction adduction exercise of the arm to exhaustion (TTE). Contrast enhanced ultrasound (CEUS) of the m. supraspinatus and tendon was utilized to indicate tendon blood flow. Limitations in daily life was assessed by the shoulder pain and disability index (SPADI). RESULTS: Endurance in the TTE-test improved by an estimated 233 seconds more on average in HIIT than in CG (p=0.001, 95%CI: 102 to 363), the change was significant in HIIT (p<0.001), no change was seen in CG. The SPADI score was reduced 22 points more on average in HIIT (p=0.017, 95%CI: -40 to -5). The change from pre to post-test was significant in HIIT(p<0.001), but not in the CG. HIIT also experienced less pain during exercise after the intervention compared to CG (p<0.001). CEUS indicated an increase in tendinous blood flow in the HIIT group (p=0.019), no change was observed in CG. CONCLUSIONS: HIIT rotator cuff exercise appear to be a feasible intervention in SAPS, reducing pain and increasing endurance performance more than exercise with low load. CEUS indicate that HIIT may increase tendon microcirculation, thus abating a potential hypoperfused/ hypoxic state underlying the condition.

1749 Board #343 May 28 9:30 AM - 11:00 AM Effect Of Whole-body Vibration Training On Muscle Strength In Individuals With Knee Osteoarthritis
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Knee osteoarthritis (KOA) is one of the most common osteoarthritis diseases which affects physical function. As a new modality in strength training, whole-body vibration (WBV) training is considered as an efficient treatment for KOA. However, the inconsistent results of previous studies dampened enthusiasm for clinical application. PURPOSE: To investigate the effect of WBV on physical function and muscle strength of KOA. METHODS: After diagnosed by orthopedic surgeon, eligible participants were randomly allocated to WBV and control groups. The supervised 8-week intervention was performed three times per week with the intensity and duration increased gradually. The participants performed static squat training on the vibration platform under the frequency of 20 Hz and amplitude of 2 mm. The participants in the control group were asked to maintain their previous lifestyle and to avoid participating in any other regular rehabilitation programs. The isokinetic muscle strength measurements were performed at baseline and post-intervention at angular velocity of 90°/s and 180°/s. Two-way repeated measures ANOVA was used to determine the difference in outcomes between the two groups. RESULTS: 40 participants completed the intervention and measurements (Control; n=20, age=62.80±4.43 years; WBV; n=20, age=64.10±4.95 years). At an angular velocity of 90°/s, only significance was found at interaction in the peak power of flexors (p = 0.025). However, the peak torque (PT) of the flexors at 180°/s increased significantly in WBV group compared with control group (p = 0.023, partial eta-square = 0.132). Additionally, the significances were found at the interaction in the peak torque and peak power of extensors as well as the peak power of flexors at 180°/s. CONCLUSIONS: This study found that WBV training offered positive effects on muscle strength gain in patients with KOA.

1750 Board #344 May 28 9:30 AM - 11:00 AM Abstract Withdrawn

1751 Board #345 May 28 9:30 AM - 11:00 AM Sarcopenic Obesity Among Adults With Facioscapulohumeral Muscular Dystrophy
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BACKGROUND: Sarcopenic obesity has been observed in people with neuromuscular impairment and is linked to adverse health outcomes; it is unclear, however, if adults with facioscapulohumeral muscular dystrophy (FSHD) develop this condition. PURPOSE: Determine if adults with FSHD meet criteria for sarcopenic obesity (appendicular lean mass index (ALMI) scores of <7.26 kg/m² or 5.45 kg/m²; % body fat of ≥27% or 38% in men/women). METHODS: Ten FSHD patients (50±11.4 years, 2 females) and ten age/sex-matched controls (47±13.6 years, 2 females) completed one visit, which included a full-body DXA scan. Regional and whole body total mass (g), fat mass (FM, (g, %)), and lean mass (LM, (g, %)) were collected; body mass index (BMI, kg/m²) and sarcopenia measures (appendicular lean mass (sum of arm/leg lean mass, ALM (kg)) and ALM index (ALMI, kg/m²)) were computed. RESULTS: Whole body total mass was similar between cohorts (FSHD: 84.5±12.9 vs. control: 81.8±13.5 kg; p=0.65). A decrease in ALM volume was found in the FSHD group (FSHD: 20.5±4.4 vs. control: 26.5±5.9 kg; p=0.02); similarly, ALMI scores were different between FSHD and controls (FSHD: 6.3±1.2 vs. control: 8.6±1.4 kg/m²; p=0.001). An increase in the proportion of whole body FM to whole body total mass (% body fat) in the FSHD group was observed (FSHD: 40.8±7.0 vs. control: 27.9±7.5%; p=0.001). While mean alterations in ALMI (6.3±1.3 kg/m²) and % body fat (40.0±6.4%) among men with FSHD met diagnostic criteria for sarcopenic obesity, this finding was not mirrored among female FSHD counterparts (ALMI: 6.2±1.0 kg/m², % body fat: 44.1±11.4%). Whole body LM was 15% lower in FSHD (p=0.05), furthermore, the FSHD group had a reduced proportion of whole body LM to whole body total mass vs. controls (p=0.001), along with lower total arm (p<0.01) and total leg lean mass (p=0.03). Study participants with FSHD did exhibit an increase in total body FM (p<0.01), along with greater total leg fat mass (p<0.001) but not total arm fat mass (p=0.09). CONCLUSIONS: A loss in ALM and increase in FM may lead to sarcopenic obesity in men with FSHD, resulting in a reduced quality of life and longevity.

1752 Board #346 May 28 9:30 AM - 11:00 AM

Effects Of Aerobic Training On Pentraxin 3/Toll-like Receptor 4 And Oxidative Status In Elderly Adults

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(No relevant relationships reported)

PURPOSE: The consequence of reactive oxygen and nitrogen species (ROS/RNS)-mediated cellular aging has been linked to various diseases, such as atherosclerosis and cancer. One of the possible mechanisms for these ROS-mediated diseases is through the activation of intracellular pattern recognition receptors (PRR), thereby contributing to a chronic low-grade pro-inflammatory systemic state in aging. Pentraxin 3 (PTX3) is a soluble PRR mainly released from endothelial cells and immune cells and utilizes its counter-regulatory function in promoting the anti-inflammatory response via the inhibition of toll-like receptor 4 (TLR4). Although increased level of PTX3 has been shown following stimulation of oxidative stress and is also associated with aging-related diseases, the relationship between PTX3 and oxidative stress in aging remains to be elucidated. However, exercise has been proposed as the key intervention for the maintenance of health in the elderly. Therefore, this study was to examine whether or not the level of PTX3 on TLR4-dependent inflammation would be associated with changes in oxidative stress in both plasma and peripheral blood mononuclear cells (PBMCs) following 8 weeks of aerobic training in the elderly.

METHODS: Fourteen elderly subjects (9 trained and 5 controls) were recruited to participate in an 8-week aerobic training. The ELISA and western blot analyses were used to determine the levels of PTX3 and biomarkers of oxidative stress in both plasma and PBMCs prior to and following training.

RESULTS: No changes in plasma levels of PTX3 and oxidative stress markers (GSH, TEAC, and ROS/RNS) were observed in trained vs. control groups. However, our analyses showed a downregulation of PTX3 expression in PBMCs ($P = 0.017$) following aerobic training, along with decreased ratio of PTX3/TLR4 ($P = 0.047$). Furthermore, the tendency of oxidative stress response in PBMCs remained unchanged as shown in plasma levels. Finally, no correlation was observed between PTX3 and any oxidative stress biomarkers following training protocol.

CONCLUSIONS: These findings demonstrate the downregulation of PTX3 and PTX3/TLR4 ratio in PBMCs of elderly subjects, irrespective of changes in oxidative stress following 8 weeks of aerobic training.

1753 Board #347 May 28 9:30 AM - 11:00 AM

Skeletal Muscle Size Is An Important Factor For Racerunning Performance In Individuals With Cerebral Palsy

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(No relevant relationships reported)

PURPOSE: The RaceRunner, a three-wheeled running bike, enables individuals with cerebral palsy (CP) to propel themselves forward in a running-like motion with enough intensity to promote training adaptations. The influence of physiological parameters on RaceRunning (RR) performance is currently not well understood. The purpose of the study was to investigate correlations between physical parameters and RaceRunning performance.

METHODS: Sixty-two individuals (mean age 22, range 9-45, 32 males/30 females) with CP (Gross Motor Function Classification System, GMFCS I-V; 2-28-12-23-2) completed a 6-min RaceRunning test. Before the test, selective motor control (SMC) of ankle dorsi-flexion, passive range of motion and spasticity of hip, knee and ankle were assessed. Thickness of thigh and calf muscles were measured with ultrasound. Heart rate was monitored throughout the test and blood lactate was measured before and directly after the test.

RESULTS: Performance on the 6-min RR test was influenced by GMFCS but was independent of age. Strong correlations ($r \geq 0.500$, $p < 0.01$) were detected between the 6-min RR test performance and spasticity in extensor muscles of hip and knee, SMC of ankle dorsi-flexion, muscle thickness of thigh and calf muscles of the less affected limb. Average and maximum heart rate, as well as lactate correlated positively to performance on the 6-min RR test.

CONCLUSIONS: Spasticity in extensor-muscles of hip and knee and poor selective motor control in ankle effects RaceRunning performance negatively. Skeletal muscle

mass is an important factor for RaceRunning performance. Our findings stress the need for optimization of physical exercise regimes for individuals with CP in order to stimulate maintenance of skeletal muscle mass and function enabling full performance.

Pearson correlation between physical parameters and distance on the 6-min RR test			
Physical parameter	Side	Pearson r	p-value
GMFCS	N/A	0.6	<0.01
Spasticity (Hip-extensor)	Most affected	-0.7	<0.01
Spasticity (Hip-extensor)	Least affected	-0.6	<0.01
Spasticity (Knee-extensor)	Most affected	-0.5	<0.01
Spasticity (Knee-extensor)	Least affected	-0.6	<0.01
SMC (Ankle dorsi-flexion)	Most affected	0.6	<0.01
SMC (Ankle dorsi-flexion)	Least affected	0.6	<0.01
Muscle thickness (VL+VI)	Most affected	0.6	<0.01
Muscle thickness (VL+VI)	Least affected	0.5	<0.01
Muscle thickness (Med. Gastrocnemius)	Most affected	0.4	<0.01
Muscle thickness (Med. Gastrocnemius)	Least affected	0.5	<0.01

1754 Board #348 May 28 9:30 AM - 11:00 AM

Deficits In Performance Fatigability And Contractile Function Of The Plantar Flexor Muscles In Achilles Tendinopathy

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(No relevant relationships reported)

Achilles tendinopathy (AT) is an overuse condition resulting in pain and stiffness of the Achilles tendon. While experts agree that strength and endurance deficits persist in AT, this claim lacks empirical evidence. **PURPOSE:** To determine whether individuals with AT present with deficits in strength and fatigability compared to healthy controls (CON) during a single-leg heel raise (SLHR) performed to task failure. **METHODS:** 6 people with AT (3 male, 26.8±8.9 yrs) and 6 controls (CON, 3 male, 21.9±1.8 yrs) performed maximal voluntary isometric contraction (MVIC) of the plantar flexor muscles before and immediately after SLHR repetitions performed to task failure (test of fatigability). Electrical stimulation of the tibial nerve was used to evoke twitch contractions of the plantar flexor muscles before and after the fatigability test at rest and during MVICs to determine contractile properties and voluntary activation, respectively. **RESULTS:** At baseline, the AT and CON groups exhibited similar plantar flexor strength (MVIC), voluntary activation and resting twitch amplitude. However, the AT group performed fewer SLHR repetitions than CON (33 vs 59, $p = 0.009$). At task failure of the SLHR task, the reduction in plantar flexor MVIC (17.3% AT vs 23.7% CON, $p = 0.32$) and voluntary activation (5.8% AT vs 7.5% CON, $p = 0.78$) was similar for the two groups. However, persons with AT demonstrated larger reductions in resting twitch amplitude (34.4 Nm to 31.5 Nm, 8.4% reduction, $p = 0.047$), while CON demonstrated no change ($p = 0.23$). **CONCLUSION:** The plantar flexor muscles of persons with AT were more fatigable for a SLHR task compared with strength-matched controls. Deficits in contractile function rather than the ability to centrally drive the muscle appear to be responsible for deficits in endurance in people with AT. *This work was supported by a Promotion of Doctoral Studies Level I Scholarship from the Foundation for Physical Therapy and by Marquette University's Exercise and Rehabilitation Sciences Graduate Program.

1755 Board #349 May 28 9:30 AM - 11:00 AM

Cardiovascular Dynamics Response To Functional Electrical Stimulated Rowing In An Individual With Leukodystrophy: A Case Study

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Leukodystrophy (LD) encompasses an array of rare and progressive diseases that affect the brain, spinal cord, and peripheral nerves. LD presents from a gene abnormality causing destruction of the myelin sheath rendering this individual paraplegic. FES utilizes epidermal electrodes to artificially activate muscle tissue. This allows a paralyzed individual to engage in physical activity with upper and lower extremity muscle mass. **PURPOSE:** The purpose of this investigation was to assess exercise the cardiovascular response to functional electrical stimulation rowing (FES). Findings from the case study may provide important information to support further investigation of the benefits of FES in paraplegics. **METHODS:** One participant with LD participated in FES for 28 sessions over 4 months; with assessments done before

(PRE) and after (POST) intervention. The participant completed one of two training protocols during each training session. The PRE protocol consisted of FES for 10, two-minute bouts. The POST session was four, 10-minute bouts. **RESULTS:** $\dot{V}O_2$ was significantly increased ($t = 2.81, p = 0.048$) from PRE (795.82 mL/min) to POST (973.14 mL/min). Heart Rate (HR) was significantly different from PRE to POST ($t = 6.44, p = 0.003$). Heart rate increased from 64 (PRE) to 82 beats per minute (POST). There was no significant difference in the respiratory exchange ratio (RER) from PRE to POST ($t = 1.05, p = 0.354$). **CONCLUSIONS:** These data indicate that FES can be utilized as a mode of physical activity for individuals with LD and shows potential use for other diseases that cause paralysis of the lower limbs. Furthermore, FES has shown to increase the functional capacity of the participant demonstrated by the increase in $\dot{V}O_2$ and HR during the FES sessions. Therefore, leading to greater calories expended per session and potentially driving further beneficial cardiovascular adaptation.

1756 Board #350 May 28 9:30 AM - 11:00 AM
Body Composition In Persons With Multiple Sclerosis Vs. Healthy Controls

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Multiple Sclerosis (MS) is an autoimmune disease that attacks the myelin sheath and impedes proper conduction of action potentials through the central nervous system. As a result, persons with MS (PwMS) can experience symptoms of fatigue, muscular weakness, spasticity, and balance or gait issues. Such symptoms may reduce physical activity, negatively affecting body composition and predisposing PwMS to obesity, sarcopenia and osteoporosis. **PURPOSE:** The aim of the current study was to compare the body composition of PwMS and controls using DXA. **Methods:** Six males and 13 females with relapsing-remitting MS and 19 Age/Sex/BMI matched healthy controls were recruited for this study. Extended disability status score (EDSS) in PwMS ranged 0 to 6 ($\bar{x} = 3.1 \pm 2.2$). DXA scans were used to assess whole body and limb specific contents of fat, muscle and mineral content. Two-way ANOVAs (Group x Sex) with post hoc comparisons were run to assess differences across group and sex. **RESULTS:** Compared to male controls, MS males had a reduced whole body % lean mass ($\%LM_{WB}$) ($60.9 \pm 6.3\%$ vs. $74.0 \pm 11.0\%$, $p = 0.02$), $\%LM_{ARMS}$ (66.7 ± 8.5 vs. $79.0 \pm 8.6\%$, $p = 0.03$), $\%LM_{LEGS}$ (61.8 ± 6.2 vs. $75.2 \pm 9.9\%$, $p = 0.02$), % appendicular lean mass (aLM) (28.1 ± 5.1 vs. $35.3 \pm 5.8\%$, $p = 0.03$), and aLM/BMI (90.0 ± 21.10 vs. 115.8 ± 21.9 , $p = 0.04$). Similarly, the % body fat (%BF) was higher in MS males ($36.7 \pm 7.0\%$) compared to male controls ($23.1 \pm 11.7\%$ and $p = 0.02$). No between group differences were found for bone mineral content ($p > 0.05$). When collapsed across sex, group differences disappeared in all measures except android fat mass, which was higher in PwMS (35.0 ± 16.0 kg) than controls (23.8 ± 16.3 kg, $p = 0.04$). Interestingly, the Pearson's r correlation between BMI and BF% was significant for the MS group ($r = -0.715, p < 0.01$) but not for the control group ($r = 0.347, p = 0.15$). EDSS scores in PwMS did not significantly correlate with any variables ($p > 0.05$). **CONCLUSIONS:** Expected sex differences in body composition occurred regardless of group. MS males tended to have lower LM and higher %BF than controls, which was not seen in MS females. Significance in MS males may be explained by differences in sample size ($n = 6$) or sex differences in MS symptom or disease progression. It is furthermore unclear to what extent individual differences in physical activity or medication may influence results.

1757 Board #351 May 28 9:30 AM - 11:00 AM
Overground Locomotor Training In Parkinson's Disease: Effects On Walking Economy And Performance Fatigability

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Walking economy (WE) is a measure of metabolic energy expenditure relative to walking speed, and, when elevated, may contribute to decreased capacity and performance relative to sustained walking in people with Parkinson's Disease (PD). Coupled with performance fatigability (PF), these factors may increase disability in this population. Although sustained walking underlies many daily activities and impacts physical activity for many people with PD, responses to walking-specific interventions to develop optimal training methods have not been fully investigated in this population.

PURPOSE: Determine changes in WE, PF, and physiologic response during sustained walking following a task-specific, performance-based overground locomotor training program (OLT) in people with mild/moderate PD.

METHODS: 7 males and 2 females (68.9 ± 7.1 years old, H&Y scores 1-3) completed a 12-week program of 24 OLT sessions lasting 45 - 60 minutes each. Subjects were coached through multiplanar movement drills based on components of the gait cycle emphasizing power, stability and stepping under aerobically challenging conditions (ClinicalTrials.gov. - NCT03864393). Walking performance was measured during an overground 10-minute walk test (10MWT) by total distance (TD) and PF (Δ speed/total distance). During the final 5 minutes of the 10MWT, average heart rate (HR), oxygen consumption ($\dot{V}O_2$), and carbon dioxide production ($\dot{V}CO_2$) were recorded using a portable metabolic system. These values were divided by the average speed in the final 5 minutes of the 10MWT to assess WE and physiologic response.

RESULTS: There were moderate to large, significant effects for TD (925.77 ± 175.67 vs 1018.37 ± 133.83 , $p = 0.019$, $d = 0.59$), PFS (1.11 ± 0.19 vs 0.98 ± 0.13 , $p = 0.013$, $d = 0.79$) and HR/speed (76.46 ± 7.69 vs 71.49 ± 6.71 bpm/m/s, $p = 0.05$, $d = 0.69$). There were small, non-significant effects for $\dot{V}O_2$ /speed (12.14 ± 1.99 vs 11.47 ± 2.89 mL/min/kg/m/s, $d = 0.34$) and $\dot{V}CO_2$ /speed (790.56 ± 196.8 vs 778.93 ± 197.94 mL/min/m/s, $d = 0.06$).

CONCLUSIONS: OLT improved WE and PFS during sustained walking. Despite a moderate effect, HR changes in response to OLT are difficult to interpret without additional measures of cardiorespiratory function. Larger and more mechanistic studies can provide further insight into this potential adaptation.

C-50 Exercise is Medicine®/Poster - EIM: Health Promotion, Benefits of Exercise, and Exercise Prescription

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

1758 Board #352 May 28 9:30 AM - 11:00 AM
A Home Based Telerehabilitation Exercise Program For Heart Failure Patients - Changes In Quality Of Life

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 (No relevant relationships reported)

Heart failure (HF) patients are strongly recommended to participate in cardiac rehabilitation programs. Due to frailty and rural living, many HF patients refuse to do so. A home based telerehabilitation program was designed to enable heart failure patients to exercise via video-conferencing in their homes. Video-conferencing allowed for two-way communication and for patients to exercise together. **PURPOSE:** This project aims to study the changes in quality of life in HF patients undertaking a telerehabilitation intervention, compared to controls.

METHODS: 67 patients were randomized into an exercise or control group if they had stable HF, were medically optimized, and refused to participate in standard outpatient rehabilitation. The exercise group received telerehabilitation for 3 months. Both groups participated in a 2-day "Living with HF" course. The EQ-5D (5L), and the Minnesota living with heart failure Questionnaire (MLHFQ) were administered to all participants before and after the intervention period. Patients were included in this analysis if they completed the EQ-5D and MLHFQ at baseline (BL) and at 3-month follow-up.

RESULTS: Mean age was 68 (65.6-71.1) years (82 % male). There was a significant decrease in EQ-5D score for the exercise group from BL to 3md follow-up (-1.23), $p = 0.015$. The decrease was not significant for the control group (-0.59), $p = 0.077$. Still, there was no significant difference between groups regarding changes in EQ-5D score for the exercise (-1.23, SD 2.41) and control groups (-0.59, SD 1.67), $p = 0.27$, or between groups regarding change in the EQ-5D VAS-score for exercise (5.18, SD 13.64) and control groups (5.48, SD 16.35), $p = 0.95$. We found a significant decrease in MLHFQ score for the exercise group from BL to 3md follow-up (-13.8), $p = 0.003$, and for the control group (-12.56), $p = 0.002$. Still, there was no significant difference between groups regarding change in MLHFQ score for the exercise group (-13.8, SD 21.23) and the controls (-12.56, SD 19.08), $p = 0.83$.

CONCLUSIONS: Both groups seem to increase the quality of life by participating in this study. This might be due to the attention by attending a study, coming to regular follow-ups, or information and motivation gained during the 2-day "living with HF" course.

1759 Board #353 May 28 9:30 AM - 11:00 AM
Effects Of Health Wearables On BMI And Weight In Clinical Populations: A Network Meta-analysis
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 (No relevant relationships reported)

PURPOSE: Clinical trials with various health wearable interventions are available to address overweight/obesity and chronic disease prevalence. Yet, no known research has used network meta-analysis to quantitatively synthesize the findings. Therefore, this network meta-analysis aimed at comparing the effects of health wearable interventions on body mass index (BMI) and weight loss in various clinical populations.

METHODS: A total of 347 published studies on health wearable intervention programs were retrieved and 28 studies met the following inclusion criteria: (1) data-based articles published in English between 2007 and 2019; (2) randomized controlled trial design; (3) subjects with or at high-risk of chronic diseases; and (4) investigated some type of intervention on BMI or weight loss (kg) using health wearables. Data extraction for comparisons was completed for six intervention categories: (1) control (T1; no intervention); (2) comparison group (T2); (3) Smart-wear (e.g., Fitbit, Polar M400) intervention (T3); (4) accelerometer/pedometer intervention (T4); (5) Smart-wear multi-component intervention (T5); and (6) accelerometer/pedometer multi-component intervention (T6). Package "pnetmeta" in R software was used to carry out the network meta-analysis. Statistical significance was determined by 95% confidence intervals (CIs) which did not include 0.

RESULTS: Based on mean difference comparisons, T6 and T4 were the most effective intervention strategies in reducing chronically ill patients' BMI compared with the other four treatments (Effect Size [ES] = -3.43, 95% CI: (-5.02, -2.05); ES = -2.03, 95%CI: (-3.30, -0.70), respectively). For weight reduction in chronically ill patients, T4, T5, and T3 interventions were the most effective intervention strategies compared with the three other treatments (ES = -4.38, 95%CI: (-7.53, -1.19); ES = -3.24, 95% CI: (-4.73, -1.68); ES = -2.53, 95%CI: (-3.86, -1.23), respectively).

CONCLUSIONS: Physical activity interventions using health wearables, especially multi-component interventions, are highly effective for reducing BMI and weight in patients with or at high-risk of chronic disease which may attenuate their conditions.

1760 Board #354 May 28 9:30 AM - 11:00 AM
A Nonexercise Prediction Equation For Cardiorespiratory Fitness Without The Use Of Physical Activity
 Robert A. Sloan¹, Marco Visentini-Scarzanella², Susumu S. Sawada, FACS³, Xuemei Sui, FACS⁴, Jonathan N. Myers, FACS⁵, Steven N. Blair, FACS⁶. ¹*Kagoshima University Graduate Medical School, Kagoshima, Japan.* ²*Kagoshima University, Kagoshima, Japan.* ³*Waseda University, Tokyo, Japan.* ⁴*University of South Carolina, Columbus, SC.* ⁵*Stanford Medicine, Pal Alto, CA.* ⁶*University of South Carolina, Columbia, SC.* (Sponsor: Steven N Blair, FACS)
 (No relevant relationships reported)

Low cardiorespiratory fitness (CRF) is an independent predictor of morbidity and mortality. The majority of healthcare settings use some type of electronic health record system (EHRs). However, many EHRs do not have CRF data collected, thereby limiting the types of investigations and analyses that can be done for research.

PURPOSE: To develop a nonexercise equation to estimate and classify CRF (METs) using variables commonly found in EHRs. **METHODS:** Participants were 41,861 apparently healthy adults (21.4% women) from the Aerobics Center Longitudinal Study examined from 1974 to 2005. Estimated CRF was based on sex, age, measured body mass index, measured resting heart rate, and smoking status. Actual CRF was measured by a maximal treadmill test. **RESULTS:** After nonlinear feature augmentation was conducted, separate linear regression models were used for male and female patients to calculate Pearson's correlation and regression coefficients. Cross-classification of actual and estimated CRF was conducted using the lowest 20th percentile as the low-fit category. Correlation coefficients were 0.68 (MD 1.33) and 0.63 (MD 1.23) for men and women respectively. The models explained 46% (SEE 1.69) and 40% (SEE 1.54) variance in CRF for men and women respectively. Correct category classification was found in 84% of men and 80% of women.

CONCLUSION: The regression models developed in the present study provided useful estimation and classification of CRF in a large population of men and women. The models may provide a valid method for conducting investigations using CRF data derived from EHRs. Supported by JSPS KAKENHI Grant 19K19437

1761 Board #355 May 28 9:30 AM - 11:00 AM
Cardiovascular Responses To Exercise Vary Between Cancer And Type 2 Diabetes
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Cancer and diabetes are among the most common and fatal diseases in the United States. Following diagnosis, approximately 25% of patients develop additional chronic conditions with hypertension being the most prevalent. Exercise can mitigate this risk; however, its effect is commonly tested in isolated clinical populations. There are fewer comparative analyses. **PURPOSE:** To compare cardiovascular responses to structured exercise among patients with cancer and type 2 diabetes. **METHODS:** We enrolled patients who had a diagnosis of cancer or type 2 diabetes in an exercise program lasting 10 weeks. Before and after the intervention, we assessed resting heart rate (RHR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP). Independent-samples t-tests compared the characteristics of each sample at baseline. Mixed model ANOVA with repeated measures compared cardiovascular changes between diagnostic groups. Linear regression tested the effect of diagnosis on change values holding confounders constant. **RESULTS:** Among subjects who completed the program, 58 had a diagnosis of cancer and 39 had a diagnosis of type 2 diabetes. At baseline, cancer survivors had lower SBP (p=0.006); groups did not differ in DBP, MAP, or RHR (p>0.250). Overall, subjects experienced a reduction in DBP (p=0.007) and exhibited a trend for improvement in MAP (p=0.052), but not RHR or SBP (p>0.100). There were interaction effects with diagnosis in DBP (p=0.044) and MAP (p=0.013), and there was a trend with SBP (p=0.064). Holding confounding variables constant, patients with diabetes improved more in DBP ($\beta=-5.046$, p=0.003) and MAP ($\beta=-5.334$, p=0.003) than cancer survivors. **CONCLUSIONS:** Chronic disease populations differ in their responses to exercise. In our sample, patients with type 2 diabetes experienced larger reductions in blood pressure than cancer survivors, demonstrating the importance of individualized exercise prescription in diverse clinical samples.

1762 Board #356 May 28 9:30 AM - 11:00 AM
Knowledge, Attitudes And Perceptions Of Type 2 Diabetes Mellitus And The Role Of Exercise Interventions
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Diabetes is a growing epidemic, with Type 2 Diabetes Mellitus (T2DM) being the most common type globally. There are approximately 15.5 million adults diagnosed with diabetes in Africa and over two thirds aren't fully educated about the condition. Regular exercise has shown to have a positive effect on T2DM but is underutilized in developing countries. **PURPOSE:** To identify the knowledge, attitudes and perceptions of T2DM and exercise interventions amongst patients attending a public hospital in KwaZulu Natal, South Africa. **METHODS:** A quantitative, cross-sectional, purposive study design was used. Participants with T2DM who were receiving treatment from the Wentworth public hospital in KwaZulu Natal, South Africa were recruited. A piloted questionnaire was used to identify the level of knowledge, attitudes and perceptions of patients in relation to T2DM and the role of exercise as an intervention. Data was analysed using descriptive and inferential statistics. Significance was set at p \leq 0.05. **RESULTS:** A total of 150 participants (male=63 and females=87) made up the sample. Majority of participants were between the ages of 50-59 (30%) and of Indian race (44.7%). Furthermore, 76.7% of the cohort reported that they were educated about T2DM as a medical condition. Results further showed that 98% of participants had a good knowledge of T2DM, 90.7% of the cohort had good knowledge of T2DM and exercise. There was a significant agreement that: T2DM management should include both exercise and a healthy diet, (M=4.38), p<0.0005; "I would use exercises prescribed by a professional to manage T2DM", (M=4.27), p<0.0005; Early detection of excessive weight and physical inactivity can delay or prevent T2DM (M=4.11), p<0.0005. **CONCLUSION:** Participants in this cohort demonstrated good knowledge, attitudes and perceptions of T2DM and the role of exercise in the management of the condition. The study provides evidence of the need for exercise interventions in a T2DM cohort in developing countries.

1763 Board #357 May 28 9:30 AM - 11:00 AM
Differences Between Included And Excluded Participants In An Exercise Study Following Resuscitation From Cardiac Arrest
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Introduction

Survivors of cardiac arrest (CA) frequently experience both physical and cognitive impairment. Few receive outpatient rehabilitation services. We are conducting a randomized trial to determine if therapeutic exercise (TE) improves health related quality of life, physical, and cognitive function after cardiac arrest. We assessed characteristics of included/non-included patients during the first 32 months of enrollment to determine if these populations differ from one another.

Hypothesis

Those who participate in the TE study have less severe initial illness severity, better neurologic outcomes, and more favorable baseline demographic characteristics than non-participants.

Methods

CA patients treated between June 2016 and February 2019 were included. CA survivors were eligible between hospital discharge and 6 months post-CA. Patients were called 3 times before being considered "lost to follow up" (LTF). T-test and Wilcoxon Rank-Sum were used to compare baseline demographics, initial illness severity (measured by the Pittsburgh Cardiac Arrest Category-PCAC), and discharge dispositions (measured by CPC and mRS) between groups.

Results

Of 234 eligible patients, 12 were enrolled (5.13%). Primary exclusions were LTF (n = 71, 30.34%), enrolled and later dropped or excluded (n = 66, 28.21%), or were admitted to a hospital, skilled nursing, or inpatient rehabilitation facility at the time of eligibility (n=39, 16.67%). Included participants did not differ from excluded with regards to age, gender, cardiac arrest location, PCAC, primary rhythm, temperature management, hospital or ICU length of stay, discharge disposition, mRS, or CPC score. [Table]

Conclusions

Demographic variables, illness severity, and outcome do not differ between participating and non-participating patients. Only 5% of eligible patients participated in the study. Further research to reduce LTF and increase study participation should be investigated.

	Eligible Sample N = 234	Enrolled N = 12	Not Enrolled	p-value
Male (%)	90 (38%)	6 (50%)	138 (62%)	0.399
Age (SD)	58 (15%)	53 (19)	59 (15)	0.103
OOHCA (%)	187 (80%)	9 (75%)	178 (80%)	0.663
Primary Rhythm (%)				
No loss of pulse	7 (3%)	-	7 (3%)	
V1/VF	111 (47%)	5 (42%)	106 (48%)	
PEA	62 (27%)	4 (33%)	58 (26%)	
Asystole	24 (10%)	2 (17%)	22 (10%)	
Unknown	30 (13%)	1 (8%)	29 (13%)	0.845
PCAC Score (%)				
Unknown	44 (19%)	2 (17%)	42 (19%)	
I	106 (45%)	5 (42%)	101 (45%)	
II	57 (24%)	3 (25%)	54 (24%)	
III	16 (7%)	1 (8%)	15 (7%)	
IV	11 (5%)	1 (8%)	10 (4%)	0.977
TTM (%)				
36 °C	83 (35%)	6 (50%)	77 (35%)	0.230
33 °C	30 (13%)	1 (8%)	29 (13%)	
Hospital LOS (IQR)	17 (7 - 21)	15 (9.5 - 17.5)	17 (7 - 21)	0.703
ICU LOS (IQR)	9 (2 - 11)	6 (3.5 - 8)	9 (2 - 12)	0.982
Disposition (%)				
Home	114 (49%)	7 (58%)	107 (48%)	
Acute Care Rehab	55 (23%)	3 (25%)	52 (24%)	
Skilled Nursing Facility			36 (16%)	
Long Term Acute Care	27 (16%)	1 (8%)	12 (6%)	
Hospice	14 (6%)	1 (8%)	1 (1%)	
Other	1 (1%)	-	12 (5%)	
	12 (5%)	-		0.912
mRS (%)				
0	10 (4%)	1 (8%)	9 (4%)	
1	16 (7%)	-	16 (7%)	
2	48 (21%)	4 (33%)	44 (20%)	
3	30 (13%)	1 (8%)	29 (13%)	
4	86 (37%)	4 (33%)	82 (37%)	
5	43 (18%)	2 (17%)	41 (19%)	0.759
CPC (%)				
1	26 (11%)	1 (8%)	25 (11%)	
2	50 (21%)	4 (33%)	46 (21%)	
3	154 (66%)	7 (58%)	147 (67%)	
4	3 (1%)	-	1 (1%)	0.753

1764 Board #358 May 28 9:30 AM - 11:00 AM
Health Benefits Of Fitness, Even For Individuals Within The Lowest Categories Of The Fitness Spectrum
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Research has determined cut-off values for the minimum physical fitness levels required to generate health benefits, such as decreased morbidity and longer survival. However, extremely unfit populations, such as older adults with intellectual disabilities, may not be able to reach those cut-off values. It is unknown how improvements in fitness impact health in these unfit populations. **PURPOSE:** To identify whether even among very unfit older adults with intellectual disabilities, small changes in fitness (with a focus on cardiorespiratory fitness, gait speed and grip strength) can translate into improvements in health. **METHODS:** In the Healthy Ageing and Intellectual Disabilities (HA-ID) study, the physical fitness of 900 older adults with intellectual disabilities (50 years and older) has been studied. Mortality was collected 5 years post baseline. The relationship between fitness and survival were analysed with multiple linear regression models and Cox proportional hazard models. **RESULTS:** The HA-ID study is the first study to provide data on the impact of very poor physical fitness levels on survival in an extremely unfit population. For cardiorespiratory fitness, 100% of the older adults with intellectual disabilities scored below the average reference range of the general population, for gait speed this was 43% of the men and 54% of the women, and for grip strength 77% of the men and 67% of the women with intellectual disabilities scored below the average reference range of the general population. Within these very low fitness levels, better baseline fitness was still associated with better survival (cardiorespiratory fitness HR = 0.997 [0.995-0.999], comfortable gait speed HR = 0.65 [0.54-0.78], grip strength HR = 0.97 [0.94-0.99]). **CONCLUSION:** Our data support that even small differences at the lower end of the physical fitness spectrum are associated with health benefits, which supports a stronger focus on improving fitness amongst this and other unfit patient populations. Improving physical fitness improves outcomes even in extremely unfit populations scoring well under the cut-off values for the general population.

1765 Board #359 May 28 9:30 AM - 11:00 AM
Does A Free Ticket For Local Transport Increase Physical Activity?
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PURPOSE: Active commuting can contribute to reaching recommended levels of physical activity (PA), and might therefore play an important role in PA promotion at the population level. The purpose of the study was to assess the changes in PA behavior after the introduction of a free ticket for local transport in the Federal State of Hessa in Germany.

METHODS: We conducted a retrospective online survey among the employees of Goethe University Frankfurt, Germany, and assessed employees' commuting (good/bad weather) and leisure time PA prior to and after the introduction of the free ticket. Group differences were calculated with the Wilcoxon test and the Mann-Whitney-U test. Associations were tested with Pearson's correlation coefficient. The level of significance was set at p≤0.05.

RESULTS: The link to the online survey was sent to 7935 employees, 989 (12.46%) responded, and 706 datasets (59% female) could be analyzed. No gender differences were found in total commuting time. With the availability of the free ticket public transport use increased significantly (53% vs 62% and 65% vs 76%), and car use decreased (17% vs. 9% and 20% vs. 12% in good and bad weather respectively). Public transport use included significantly more active transport minutes than car use (14±7 and 12±7 vs 3±3 and 3±3 in good and bad weather respectively). No change in leisure time PA was found. Weak associations showed between transport mode and body-mass-index, but not with smoking status.

CONCLUSIONS: In this study the introduction of free tickets for public transport led to changes in commuting behavior in favor of public transport, which implies increased active travel. It is reasonable to assume that such changes, if sustained, can bear public health relevance. Since Goethe University is located in a metropolitan area with an extensive public transport network around it, our results may not be generalizable for areas with less developed transit system.

THURSDAY, MAY 28, 2020

1766 Board #360 May 28 9:30 AM - 11:00 AM
Park-Based Physical Activity: Testing Feasibility, Acceptability, And Preliminary Effectiveness In Adults With Serious Mental Illness

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INTRODUCTION: Adults with serious mental illness (SMI) suffer from higher rates of premature mortality compared to the general population. Underlying modifiable cardiometabolic risk factors (e.g., obesity, poor fitness) are more prevalent and manifest earlier in those with SMI. Physical activity (PA) can improve health and quality of life in SMI populations, but challenges exist for effective PA interventions. Parks offer numerous health benefits including PA enjoyment and stress reduction, supporting them as ideal locations for PA interventions among SMI populations. Exercise Is Medicine (EIM) style park-based PA interventions are growing in popularity. Yet, little data exists for EIM interventions with SMI populations. **PURPOSE:** Test the feasibility, acceptability, and preliminary effectiveness of an EIM park-based PA intervention in adults with SMI. **METHODS:** Data were collected in Spring 2019. Participants diagnosed with SMI were recruited through a behavioral health facility. Park-based PA sessions (45 min) occurred 3 days/week for six weeks. Data were captured with baseline health assessments (e.g., body mass index: BMI), weekly attendance, and pre and post surveys. PA Class Satisfaction Questionnaire (PACSQ) captured class fun, enjoyment, and overall satisfaction on an 8-point scale (1 = strongly disagree, 8 = strongly agree). International PA Questionnaire captured minutes of PA. Fitness was captured via 6-minute walk test (6MWT). Wilcoxon signed-ranked tests explored intervention effectiveness. **RESULTS:** Participants (n = 4) were 50% male with mean age of 49 ± 5.7 years and BMI of 34 ± 7.4. Attendance ranged from 60-100%. All participants expressed high levels of class fun and enjoyment 7.5 ± 0.3 and overall class satisfaction 7.1 ± 0.60. All mean scores improved pre to post intervention, though no statistically significant changes were observed pre-test to post-test for BMI (30.7 ± 4.9 vs 30.1 ± 3.9 kg/m²), weight (76.8 ± 0.9 vs 75.6 ± 3.0 kg), 6MWT (383.3 ± 62.9 vs 408.3 ± 72.2 meters), and MET-min/week of PA (1068 ± 426.1 vs 1996 ± 1312.9). **CONCLUSION:** This study is the first to collect park-based PA intervention data in adults with SMI. Results indicate that adults with SMI did participate in and enjoy park-based PA sessions. Further pilot intervention work is planned to develop this intervention approach.

1767 Board #361 May 28 9:30 AM - 11:00 AM
Patterns Of High And Low Response To Regular Exercise Across Multiple Clinically Relevant Traits

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PURPOSE: We investigated if high- or low-responsiveness to exercise training aggregates in the same individuals or if the response patterns are randomly distributed across seven clinically relevant traits.

METHODS: A total of 566 participants from the HERITAGE Family Study completed a 20-week endurance training program (>95% compliance) and had complete response data available for maximal oxygen uptake, percent body fat, resting heart rate, and fasting levels of insulin, HDL-cholesterol, small LDL particles, and inflammatory marker GlycA. For each exercise response trait, race, sex, and generation-specific quintiles were created and high responders were defined as those within the 20th percentile representing the favorable end of the response trait distribution (e.g., top end for VO_{2max} response, bottom end for fasting insulin response), while low responders were defined as the 20th percentile from the least favorable end. Those between the 20th and 80th percentile were labeled as average responders.

RESULTS: Only one individual each was classified as a universal high or low responder for all seven traits (Table). Half (51%) of the cohort was both a low and high responder for at least one trait. About 24% had at least one high response but no low responses, 23% had one or more low-response traits but no high responses, and 2% were average responders across all traits. Pearson correlations between response traits were low, ranging from -0.22 to 0.11.

CONCLUSIONS: Inter-individual variation in exercise responses applied to all investigated cardiometabolic traits, even with the same exercise intervention and level of compliance. Neither high- nor low-responsiveness aggregated consistently in the same individuals, as a low responder for one trait may be a high responder for another.

From a clinical perspective, adherence to an exercise prescription is likely to produce multiple health benefits for an individual even if the targeted risk factor level doesn't improve.

Table. Distribution of the high and low training response scores

	# of high-response traits								Low-resp. total
	0	1	2	3	4	5	6	7	
0	1.9 (11)	6.7 (38)	9.5 (54)	5.3 (30)	1.9 (11)	0.4 (2)	0	0.2 (1)	25.9 (147)
1	6.9 (39)	13.4 (76)	8.8 (50)	4.8 (27)	1.1 (6)	0	0	0	35.0 (198)
2	7.8 (44)	7.0 (40)	4.6 (26)	2.3 (13)	0.7 (4)	0	0	0	22.4 (127)
3	4.8 (27)	5.0 (28)	0.9 (5)	0.4 (2)	0	0	0	0	11.1 (62)
4	2.3 (13)	1.1 (6)	0.5 (3)	0	0	0	0	0	3.9 (22)
5	0.5 (3)	0.5 (3)	0	0	0	0	0	0	1.0 (6)
6	0.5 (3)	0	0	0	0	0	0	0	0.5 (1)
7	0.2 (1)	0	0	0	0	0	0	0	0.2 (1)
High-resp. total	24.9 (141)	33.7 (191)	24.3 (138)	12.8 (72)	3.7 (21)	0.4 (2)	0	0.2 (1)	100 (566)

Frequencies are given as percentage (number of subjects)

1768 Board #362 May 28 9:30 AM - 11:00 AM
Individual, Interpersonal And Environmental Factors Associated With Exercise Prescription Utilization In Urban Minority Women

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 (No relevant relationships reported)

ACSM's *Exercise is Medicine* recommends that providers give patients exercise prescription referrals (EP) to community facilities, however data are lacking about minority patient use. **PURPOSE:** Explore potential correlates associated with EP use with a mixed-methods community-engaged design. **METHODS:** We collaborated with an urban women's only wellness facility that exchanges EP for 1-3 months of free access. Women were eligible if given an EP within the past year, ≥18 years of age, not pregnant, and without any conditions precluding physical activity (PA). Pilot data were collected by phone and included quantitative questionnaires (individual, interpersonal and environmental characteristics) and qualitative open-ended semi-structured interviews guided by the socioecological model. Transcribed interviews were coded and content analysis was used to identify themes. Utilization was defined as mean # visits/week over duration of membership (high: ≥1 visit/week). Means and percentages were compared between high and low utilization with t-tests and chi-square, respectively. **RESULTS:** Women (n=30) were 73% Black, 42.5±13.4 years, 57% employed, 50% ≤ high school diploma, 69% household income ≤45,000/yr, with BMI 35.5±7.2kg/m² and mean 0.7±1.1 visits/week (67% low; 33% high). Women with high utilization had less education, higher usual daily activity, lower lack of motivation, higher # family CVD risk factors and higher family hypercholesterolemia (Table 1). No differences were found for PA, sedentary behavior, self-efficacy, stage of change, social support, Walkscore, or distance to facility. Common themes identified in all women were sense of community and ease of location. Low utilization barriers were mismatched expectations and competing priorities; high utilization facilitator was readiness for lifestyle change. **CONCLUSIONS:** Factors associated with EP utilization may inform recruitment and tailored programming to promote EP utilization.

Table 1. Comparison of individual, interpersonal, and environmental factors for low vs. high utilization of exercise prescriptions (n=30).

Definition	Low Utilization <1x/week	High Utilization ≥1 x/week	p-value
N (% of total)	20 (67)	10 (33)	
Individual Factors: Demographics, Health Status, and Health Behaviors			
Race: Black (Hispanic/Non-Hispanic)	15 (75)	7 (70)	0.72
BMI (kg/m ²)	35.4 ± 7.9	35.7 ± 6.0	0.92
Education: ≤ high school n (%)	13 (65)	2 (20)	0.02
Household Income <45,000/year	14 (73)	4 (37)	0.42
Health: Self-perceived Mental Health (Range 0-100)	45.3 ± 13.5	41.9 ± 13.2 [*]	0.54
Self-perceived Physical Health	48.2 ± 7.5	53.3 ± 6.2	0.09
CVD Risk factors (#)	1.0 ± 1.0	0.6 ± 1.0	0.37
Sedentary Behavior: TV ≥2 hrs/day	13 (65)	7 (70)	0.78
Sitting (mins/day)	268 ± 211	307 ± 193	0.65
Usual Daily Activity: Sits	5 (25)	1 (10)	
Stand/walks	9 (45)	1 (10)	0.03
Lift loads	6 (30)	8 (80)	
Physical Activity: Walking (MET*mins)	766 ± 1041	1210 ± 1034	0.31
Moderate (MET*mins)	1036 ± 2180	2333 ± 3943	0.38
Vigorous (MET*mins)	1338 ± 2302	1809 ± 1936	0.60
Total (MET*mins)	3184 ± 3402	5352 ± 5609	0.22
Self-efficacy (Range 1-5)	2.5 ± 0.8	3.1 ± 0.9	0.08
Stage of Change: Pre-action/Action n (%)	10 (50) / 10 (50)	3 (33) / 6 (67)	0.40
Barriers: Lack of Time (Range 0-9)	3.0 ± 2.6	1.6 ± 2.3	0.18
Social Influence	3.9 ± 2.3	2.2 ± 2.4	0.09
Lack of Energy	4.3 ± 2.9	2.0 ± 2.9	0.07
Lack of Willpower/Motivation	6.0 ± 2.5 [*]	2.8 ± 2.8	0.007
Fear of Injury	2.0 ± 2.4	1.2 ± 1.8	0.40
Lack of Skill	1.2 ± 1.3	0.9 ± 1.5	0.55
Lack of Resources	4.0 ± 2.9	2.2 ± 2.3	0.12
Interpersonal and Social Factors			
Marital Status: Married n %	4 (20)	1 (10)	0.48
Children	2.1 ± 1.1	2.2 ± 1.7	0.78
CHAOS: Confusion, Order and Hubbub Scale (Range 15-60)	28.5 ± 11.1	27.3 ± 7.5	0.78
Social Support: Family Participation (Range 10-80)	20.4 ± 10.0	20.4 ± 8.9	0.99
Friend Participation	21.4 ± 9.4	16.6 ± 5.9	0.15
Family Health History CVD risk factors (#)	1.1 ± 1.1	2.0 ± 1.2	0.04
Diabetes n (%)	7 (35)	4 (40)	0.79
Hypertension n (%)	9 (45)	8 (80)	0.07
Cholesterol n (%)	3 (15)	5 (50)	0.04
CVD n (%)	2 (10)	3 (30)	0.17
Environmental Factors			
WalkScore (Range 0-100)	79.9 ± 13.2	78.6 ± 11.0	0.79
Walking distance to health center (miles)	1.5 ± 2.1	2.1 ± 1.7	0.58

* Perceived health <45 indicates impaired functioning
[†] Scores ≥5 considered an important barrier to overcome
 † Bolded p-values are statistically significant p<0.05; Note: Numbers vary for some variables since not all women answered all survey questions

3.6±0.6, self-motivation and empowerment was 3.5±0.6, and patient desire to have participated during treatment was 3.5±0.6 in n=30 (94%) BCS who responded to the questionnaire.

CONCLUSIONS: Attendance was acceptable yet compliance to exercise prescription was suboptimal. Increasing intensity, especially for strength, appeared to be the primary contributor to lack of compliance because volume and duration prescription components were frequently met. Nevertheless, there was overwhelming positivity regarding BCS enjoyment of program, confidence to exercise independently, and desire to have started exercising during treatment. Expanding GRH days and hours/day was a recurring feedback theme and may have improved attendance. These factors are important for future program designs to best accommodate BCS returning to physiological and daily life challenges following cancer treatment. Funding support: Breast Cancer Research Foundation (New York, NY).

1770 Board #364 May 28 9:30 AM - 11:00 AM
Comparison Of Different Types Of Community-based Exercise Programming In The Alberta Cancer Exercise (ACE) Study.

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 (No relevant relationships reported)

The benefits of exercise for cancer survivors (CS) have been clearly shown, but many CS do not meet exercise recommendations and the availability of cancer-specific programs is minimal in Alberta, Canada. The ACE Study is bringing evidence into practice by implementing community exercise programming for CS. To make delivery more feasible, sites have the option of offering circuit (CT) or group personal (PT) training. **PURPOSE:** To compare changes in fitness and patient reported outcomes from study baseline to 12-weeks in participants completing CT vs. PT. **METHODS:** As of Summer 2019, 459 CS have completed 12-weeks of either CT or PT in the ACE study in Edmonton, Alberta, Canada. CS of any cancer diagnosis and stage were eligible to participate. The twice weekly program consisted of either 1-hour group fitness circuit classes (CT; n=118) or personalised combined aerobic and resistance training sessions (PT; n=341). CS completed fitness assessments and questionnaires before and after the program. Outcomes included 6-minute walk distance; 1-repetition maximum (1RM) bench and leg press, shoulder and trunk flexibility, plank endurance test, one-legged balance, waist circumference, fatigue, and self-reported health. **RESULTS:** Adherence to the exercise program was 81.5% ± 18.1% (mean ± SD), with a trend toward better adherence in PT (mean difference = +3.5%; p=0.073). Significant improvements (all p<0.05; shown as mean change [MC]) were observed from baseline to 12-weeks in both groups for 6-minute walk distance (+34.8m); 1RM bench (6.3kg) and leg (14.2kg) press, trunk forward (2.7cm) and shoulder (right = 1.7°, left = 1.5°) flexion, plank endurance time (+31.7s), balance (right = 3.6s, left = 3.1s), waist circumference (-0.9cm), fatigue (+2.3pts/52), and self-reported health (+4.4pts/100). Compared to PT, those who completed CT had a significantly greater improvement in fatigue (mean change [MC]: +3.3 vs. +1.9 points; p<0.05), and a trend toward a greater improvement in trunk flexibility (MC: +3.2 vs. +2.1 cm; p=0.063). **CONCLUSION:** Although CS experienced significant improvements regardless of program type, differences in benefit exist between CT and PT. When feasible, matching the type of exercise programming to the individual needs, goals, and preferences of CS may maximize the benefits experienced.

1771 Board #365 May 28 9:30 AM - 11:00 AM
Do Exercise Oncology Guidelines Have To Be Met To Obtain Improvements In Breast Cancer Outcomes?

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 (No relevant relationships reported)

The importance of integrating exercise as part of cancer care is clear, with benefit potentially extending to survival. However, treatment-, personal and behavioural-related barriers may influence exercise undertaken during any given week. **PURPOSE** To explore whether compliance to weekly exercise targets predicts improvements in outcomes in women with breast cancer who participated in SAFE ACTRN12616000954426. **METHODS** Physically inactive breast cancer survivors (stage II-IV; mean age 50.1±9.0) were randomised to frequent- (20 sessions, n=30) or limited (5 sessions, n=30) supervision with an exercise physiologist during a 12-week individually-tailored exercise intervention. The weekly exercise target was consistent with international guidelines of 600 MET minutes including at least 2 resistance exercise sessions. Exercise undertaken (mode, frequency, minutes, intensity) was recorded weekly and used to calculate MET mins. Exercise compliance was defined as 1)

C-51 Free Communication/Poster - Implementation, Referral and Community Based Exercise Oncology

Thursday, May 28, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

1769 Board #363 May 28 9:30 AM - 11:00 AM
Breast Cancer Survivor Compliance And Satisfaction With A Community-based Exercise Program: Implications For Future Design

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 (No relevant relationships reported)

PURPOSE: Community-based exercise programs will be necessary to accommodate the volume of breast cancer survivors (BCS) in need of lifestyle/exercise guidance. However, attendance and enjoyment are critical components potentially preceding ideal outcomes. This study evaluated BCS compliance and satisfaction with 16-weeks of training at UNC Get REAL & Heel (GRH), a community-based exercise program. **METHODS:** BCS within 1 year of completing primary therapy (surgery, chemo, radiation) were prescribed 3, 1-hour days/week of combined aerobic and strength exercise training for 16 weeks at GRH. At exercise initiation, the intervention was designed to meet unique fitness/mobility needs of each BCS with gradual increases in intensity, duration, and volume of training. Compliance was the number of days BCS completed ≥80% of prescribed aerobic duration and strength sets/ reps at the prescribed intensity using Borg Rating of Perceived Exertion scale. Satisfaction was captured with an agreement scale questionnaire: 1 (strongly disagree) to 4 (strongly agree) and open-ended feedback after program completion. **RESULTS:** Thirty-two BCS (mean±SD; age 54±12ys, BMI 27.5±5) participated. They attended 73% of exercise sessions; yet average compliance was 26±9.6 days (54%) for aerobic and 14±5.2 days (29%) for strength. Program expectation and enjoyment was

average weekly volume \geq weekly target or 2) weekly target met in $\geq 80\%$ of weeks. Multivariable regression analyses (adjustment for age, disease stage, BMI and group allocation) were used to evaluate whether exercise compliance predicted change between pre- and post-intervention in physical health (PROMIS global), aerobic fitness (6-minute walk test) and strength (YMCA bench press). **RESULTS** 63% and 27% of sample (n=60) were compliant when defined by average weekly volume and $\geq 80\%$ of weeks, respectively. Having an average weekly exercise volume that was \geq weekly target predicted a clinically meaningful improvement in physical health ($\Delta \pm$ SE: 7.2 \pm 1.0 p<0.01), aerobic fitness (59.8 \pm 11.4 metres, p<0.05) and upper body strength (11.4 \pm 2.2, p=0.25). Meeting weekly targets $\geq 80\%$ of intervention weeks did not predict change in outcomes (p \geq 0.05). **CONCLUSION** These findings suggest that for achieving improvements in outcomes, it is important to ensure the volume of exercise undertaken over time meet targets, but that achieving weekly exercise volume targets on any given week is not. This represents reassuring evidence, particularly for patients who have short term declines in exercise undertaken as a consequence of accommodating fluctuating treatment-related symptoms, surgery requirements or new life circumstances.

1772 Board #366 May 28 9:30 AM - 11:00 AM
Are The ACSM Exercise Guidelines Safe And Achievable For Women Receiving Chemotherapy For Ovarian Cancer?

Tamara Jones¹, Rosalind Spence², Carolina Sandler¹, Andreas Obermair³, Michael Friedlander⁴, Linda Mileschkin⁵, Alison Davis⁶, Monika Janda³, Elizabeth Eakin³, Elizabeth Barnes⁷, Vanessa Beesley⁸, Louisa Gordon⁸, Alison Brand⁷, Sandra Hayes². ¹Queensland University of Technology, Brisbane, Australia. ²Griffith University, Brisbane, Australia. ³University of Queensland, Brisbane, Australia. ⁴Prince of Wales Hospital, Sydney, Australia. ⁵Peter MacCallum Cancer Centre, Melbourne, Australia. ⁶The Canberra Hospital, Canberra, Australia. ⁷University of Sydney, Sydney, Australia. ⁸QIMR Berghofer Medical Research Institute, Brisbane, Australia.
 (No relevant relationships reported)

Purpose: ECHO is a phase III, randomised, controlled trial (ACTRN12614001311640) evaluating the effect of exercise during first-line chemotherapy for women with ovarian cancer on progression-free survival (target sample, n=500). We report here preliminary findings on exercise safety and dose undertaken for the consenting women randomised to the exercise intervention.

Methods: Exercise-related adverse events (EAEs) were classified as grades 1-5 according to CTC-AE, and were assessed for exercise causality (not related, unlikely, possible, likely, certain) and whether modification to exercise prescription was required. Weekly exercise dose undertaken was recorded as minutes, intensity, mode and frequency. Data were collected by an Exercise Physiologist during weekly contact with participants over the intervention duration (duration is based on length of neo- and/or adjuvant chemotherapy; ~18 weeks). Exercise was considered safe if there were no grade 3 or higher EAEs, and in line with the new ACSM guidelines, the intervention was considered feasible for a participant if they completed ≥ 150 minutes of weekly, mixed-mode exercise $\geq 75\%$ of intervention weeks.

Results: To date, we have recruited 225 women, 113 of whom have been randomised to the exercise intervention. One or more EAEs was reported by 42% of participants in the exercise intervention. Typical grade 1 (85% of EAEs reported) and 2 EAEs included delayed onset muscle soreness or adverse fluctuations in treatment-related symptoms (e.g., pain at surgical site, fatigue) that may have been caused by exercise. While no grade 3 or higher EAEs were reported, 58% required exercise intervention modification (i.e., change in minutes, intensity, mode or frequency). The median weekly minutes of exercise reported was 186.5 (range: 0-610), yet only 34% of participants completed ≥ 150 min/week of mixed-mode exercise for $\geq 75\%$ of the intervention duration.

Conclusion: Exercise is proving safe during chemotherapy for ovarian cancer. Further, while an average of 150 minutes of mixed-mode exercise each week is feasible, flexibility in prescription is needed to accommodate individual circumstances (such as EAEs or typical treatment-related fluctuations in side effects) that inevitably present throughout the course of chemotherapy for ovarian cancer.

1773 Board #367 May 28 9:30 AM - 11:00 AM
Pink Matters: Impact Of Cause-related Marketing Campaign On Intentions To Test Breast Cancer

Woo-Young Lee¹, Kyungun Kim¹, Robert Slana¹, Choonghoon Lim², Youngjin Hur³. ¹University of Central Missouri, Warrensburg, MO. ²Seoul National University, Seoul, Korea, Republic of. ³Konkuk University, Seoul, Korea, Republic of.
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 (No relevant relationships reported)

PURPOSE: The role of the charity sport event on health promotion has been radically significant. In addition, cause-related marketing (CRM) is one of the most prominent strategies for event organizers to maintain the financial stability of the organization. Although many literatures focus on the business side of CRM, there is a lack of theoretical models that explains the association between CRM predictors and health campaign outcomes considering health behavior. Considering the importance of corporate sponsorship of philanthropic sport events, it is necessary to investigate how a health campaign in the sport event have an impact on stakeholders, especially those who participate in the event. Thus, the purpose of this study is to examine how the campaign is associated with the participant's health belief and ultimately change their health-promoting behavior using an extended model of CRM campaign.

METHODS: The structural equation modeling (SEM) was used to investigate the direct/indirect effects of the campaign on sponsor image and breast cancer test. This study was conducted with 1,000 females (18-56) who participated in the Pink Ribbon Marathon.

RESULTS: The overall structural model's goodness of fit showed excellent ($\chi^2 = 15489.377$, p<0.01; RMSEA = .049, 90% CI =.046-.052; SRMR =.075; TLI =.910; and CFI =.918). SEM revealed that the following factors of Sponsor Fit ($\beta = .736$, p<0.01). However, sponsor image, product reputation, and CSR were found to have no significant association with the campaign impact. Also, the findings of the results indicated that the impact of the campaign was found to have statistical significance with Perceived Barriers ($\beta = .151$), Perceived Threat ($\beta = -.0.168$), Self-Efficacy ($\beta =.405$), and Cues to Action ($\beta =.650$). All four factors regarding health belief positively influence on the intention to participate in breast cancer test.

CONCLUSIONS: The results show that the pink ribbon campaign led to a higher level of the intention for breast cancer test by mediating participants' existing health beliefs. Also, the effect of the campaign was expanded to creating a positive sponsor image. The findings provide insights into designing their cause-related marketing initiatives for practitioners. More detailed explanations concerning theoretical and practical implications will be presented.

1774 Board #368 May 28 9:30 AM - 11:00 AM
Qualitative Analysis Of Patient Comments Regarding Adherence To An Exercise Oncology Rehabilitation Program

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 (No relevant relationships reported)

Previously, we showed that medical professionals are the most effective referrals to exercise oncology rehabilitation programs. Determining why patients remain in such programs beyond referral is critical if patients are to obtain any health benefits during and after cancer treatment. **PURPOSE:** The purpose of this study was to identify those factors that promoted adherence through a qualitative analysis of patient comments. **METHODS:** Using previously collected data, four themes were identified for adhering to an exercise oncology rehabilitation program: personal results (46%), the trainer (28%), not yet meeting their goals (23%), and family influence (3%). Within these four themes, patient comments were reanalyzed to determine more specific response patterns clarifying patient motivations to continue with their respective program. **RESULTS:** The four major subthemes identified were physical health, mental/emotional health, the trainer/facility staff, and progress/success achieved. Across all four original themes, 39% of patients referenced their physical health while 7% mentioned their improved mental health as reasons for remaining in the program. Furthermore, 34% noted the role of the trainer with approximately 14% specifically linking the trainer with their progress/success in the program. Separately, approximately 20% identified their progress/improvements as the reason to continue in the program. **CONCLUSIONS:** While previously and currently presented data report that physical health and improvements recognized by the patient are primary motivators to maintain adherence to the exercise program, this study found that the trainer/staff of the facility also play a significant role in maintaining enrollment, and therefore, adherence to the rehabilitation program. It is likely the progress/success identified by the patients are most likely a result of the work of the trainer/facility staff. Therefore, combining these subthemes, we conclude that the trainer/facility staff is the most important factor in building patient confidence, trust, and most importantly, adherence to an exercise oncology program.

1775 Board #369 May 28 9:30 AM - 11:00 AM

Exercise During The Cancer Continuum: Patients' Knowledge And Perceived Barriers

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 (No relevant relationships reported)

PURPOSE: Exercise therapy programs are increasingly incorporated into oncological clinics, but it is largely unknown if this facilitates information availability or patients' exercise readiness. This survey compares the knowledge and barriers regarding exercise in cancer patients treated in an oncological clinic with an established exercise therapy and counseling program versus an oncological clinic without any exercise offers.

METHODS: Participants were recruited in an oncological outpatient clinic that provides an exercise therapy and counseling program (OC+Ex) and an oncological outpatient clinic without any exercise offers (OC). Information status concerning cancer diagnosis, treatment, exercise, and exercise-related barriers were assessed with an extended version of the EORTC QLQ-INFO-25 questionnaire and the Perceived Physical Activity Barriers (PPAB) scale. Results were compared using contingency tables and chi-square tests.

RESULTS: Out of 215 patients 200 returned the questionnaire (OC+Ex: n = 109; 64±13 yrs.; 85% during treatment; OC: n = 91; 60±11 yrs.; 96% during treatment). A comparable proportion of the patients of the OC+Ex and the OC felt moderately to well informed concerning cancer treatment (90% vs. 88%) and side effects (81% vs. 79%). Regarding exercise 31% vs. 15% and 23% vs. 29% of the patients in the OC+Ex versus the OC reported a high or moderate information status, while 18% (OC+Ex) or 27% (OC) stated to not have received any information (p < .05). Patients in the OC+Ex documented receiving specific exercise recommendations more often than patients in the OC (41% vs. 16%; p < .001), 25% (OC+Ex) or 3% (OC) reported a direct referral to a concrete exercise course/program (p < .001). 53% (OC+Ex) and 60% (OC) asked for more information about exercise. Perceived exercise barriers included fatigue (39%), physical weakness (31%), nausea (24%), pain/discomfort (23%), and lack of exercise routine (25%).

CONCLUSIONS: Our results indicate that an exercise program at an oncological clinic supports patients' knowledge about exercise. Further targeted triage and information activities including a stronger collaboration between oncologists and exercise specialists might contribute to further enhance patients' knowledge, to diminish perceived barriers and to improve exercise behavior.

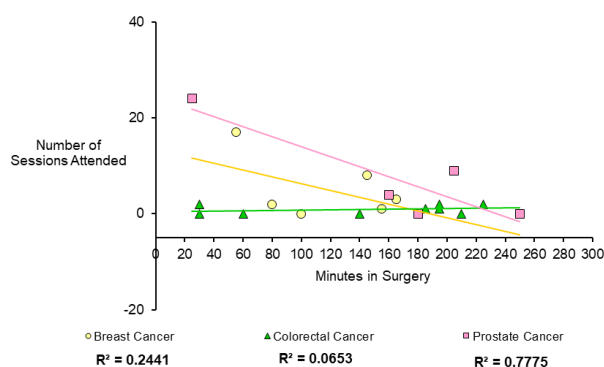
1776 Board #370 May 28 9:30 AM - 11:00 AM

Examination Of Pre-surgical Allied Health Referrals In Cancer Patients At A Regional Australian Hospital.

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There has been a recent international call to action for key stakeholders to create the infrastructure and cultural adaptations needed so that all people living with and beyond cancer can be as active as is possible. Among the reasons for this is a lack of clarity on the part of those who work in oncology clinical settings of their role in assessing, advising, and referring patients to exercise. **PURPOSE:** To conduct a retrospective sample audit of allied health referral for breast, prostate and colorectal cancer diagnoses scheduled for surgery. **METHODS:** A SQUIRE compliant retrospective study was conducted on a representative sample of electronic medical record (EMR) data harvested from the files of (n=100) patients diagnosed with either breast, colorectal and prostate cancer and scheduled for surgery at a regional hospital in Victoria, Australia. Association between 'time in surgery' (mins⁻¹) and number Allied Health (exercise physiology) sessions were performed using Pearson product-moment correlation. **RESULTS:** 62% of cancer referrals attended at least one allied health appointment. Bivariate comparison of referral to allied health revealed strong: prostate (r²=0.78), small/moderate: breast (r²=0.24), and no (r²=0.07) association between surgical time and frequency of allied health attendance amongst cancer diagnoses requiring surgery. **CONCLUSIONS:** Preliminary results from a small sample of pre-surgical exercise physiology referrals, indicate that breast, and prostate cancer diagnoses requiring surgery can achieve benefit from compliance with referral to Allied Health session, whereas colorectal cancer diagnoses are less clear.

Relationship between Allied Health Attendance and surgical time amongst Allied Health Referrals at a regional hospital in Victoria, Australia



1777 Board #371 May 28 9:30 AM - 11:00 AM

EXPLORE EXERCISE LEVEL AND PREFERENCES IN PANCREATIC CANCER PATIENTS

Alice Avancini¹, Valeria Maria Pala², Sabine Sieri², Vittorio Krogh², Luigi Mariani², Ilaria Trestini¹, Daniela Tregnano¹, Michele Milella¹, Sara Pilotto¹, Massimo Lanza¹. ¹University of Verona, Verona, Italy. ²National Cancer Institute, Milan, Italy.
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 (No relevant relationships reported)

A large percentage of pancreatic cancer (PC) patients can suffer from cachexia, a syndrome characterized by an ongoing loss of skeletal muscle mass, with or without fat mass. This condition leads to reduced muscle strength, which further worsen functional capacity. Exercise (EX) could be a potential measure to counteract the loss of functional capacity, nevertheless most of cancer patients are insufficiently active.

Purpose: Investigate the EX level, interest and preferences in PC patients. **Methods:** An anonymously survey was performed on a representative sample of PC patients at the Oncology Unit of Verona Hospital. The questionnaire assessed demographic, clinical characteristics and EX behavior, using the Leisure Score Index (LSI) from Godin's Leisure Time Exercise Questionnaire. The items regarding EX preferences and interest were drawn from previous researches. A descriptive analysis, presented as mean/medians for continuous variables and frequencies/percentages for categorical variables, was used. **Results:** 173 questionnaires were completed (58% response rate). The median age of subjects was 60 years old, 54% was male, 41% had completed high school. Medical information indicated that 52% had a metastatic disease and 86% were on active treatment. Only 11% of patients resulted sufficiently active (LSI ≥24), but among 82% were willing to start a specific EX program. Patients prefer receive EX information by oncologist (54%), followed by kinesiologist (23%), with a face to face approach (66%). PC patients chose to EX with "other cancer patients" (25%) or alone (17%). Subjects picked outdoors (28%) and at home (23%) as favourite places to perform EX. PC patients prefer to train two (31%) or three (36%) times/week, at light (45%) or moderate (40%) intensity. 31% of patients indicated to prefer an individual program to perform at home, 29% a training group with a kinesiologist, while 25% chose an individual program with a personal trainer. **Conclusion:** We found a small portion of PC patients active, a large interest to EX and a heterogeneity regarding the EX preferences. This underline the urgency to promote EX in this population and suggest that different EX program options should be considered to optimize compliance and adherence. This study is the first step to planning a specific EX program designed for PC patients.

THURSDAY, MAY 28, 2020

1778 Board #372 May 28 9:30 AM - 11:00 AM
Effects Of Community-based Supervised Exercise In The Body Composition And Strength Of Breast Cancer Survivors

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PURPOSE: To analyze the effects of a low-cost community-based supervised exercise program on body composition and muscle strength in breast cancer survivors.
METHODS: Twenty-one female survivors of breast cancer concluded a single-arm clinical trial with a control and an experimental phase. Each participant was evaluated in 5 consecutive moments: 16 and 8 weeks before intervention (M1 and M2), immediately before intervention (M3), and 8 and 16 weeks after the exercise program started (M4 and M5). Participants benefited from conventional care during the control phase (M1 to M3) followed by a community-based exercise program (M3 to M5). This consisted of 3 sessions per week of 60-min combining aerobic and strength exercise at moderate to vigorous intensity in group classes of no more than 20 participants with low-cost material. Body mass index (BMI), handgrip strength and sit-to-stand (STS) test were assessed in all the evaluation moments.
RESULTS: There were significant increases through time in handgrip strength in both surgical and non-surgical upper limbs ($p < 0.0001$) and in lower limbs functional strength ($p < 0.0001$) (table). BMI increased during control phase and decreased during the initial phase of exercise training program ($p = 0.050$). Serious adverse events were not reported. **CONCLUSIONS:** A low-cost community-based supervised exercise program is safe and improves body composition and strength in breast cancer survivors after primary treatment.

	M1	M2	M3	M4	M5	Effect size	P-value
Surgical limb handgrip strength (Kgf)	18.6±5.0	20.9±5.4*	21.2±4.9*	23.5±5.1*	26.6±6.6***	0.599	$p < 0.0001$
Non-surgical limb handgrip strength (Kgf)	19.6±5.4	21.4±5.9*	21.9±5.8*	23.8±5.5*	25.8±4.5**	0.423	$p < 0.0001$
STS (Reps)	12.0±2.8	13.7±3.4	14.1±3.6	15.1±3.6	16.5±3.6†	0.289	$p < 0.0001$
BMI (Kg/m ²)	30.9±5.5	30.9±5.6	31.1±5.5	30.3±5.4‡	30.7±5.3	0.125	$p = 0.050$

Legend: Results were tested with repeated measures analysis of variance and are presented as mean±SD; Post-Hoc analysis were corrected with Bonferroni. Effect size was calculated as Partial Eta Squared.*Higher than M1; ** Higher than M1-M3; ***Higher than M1-M4; † Higher than M1-M2; ‡ Higher than M3; $p < 0.05$.

1779 Board #373 May 28 9:30 AM - 11:00 AM
Accessing Medically-based Exercise Therapy Via Cardiac Rehabilitation And Preventive Cardiology

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 (No relevant relationships reported)

Background: Cardiac rehabilitation (CR) is a potential avenue to exercise therapy for cancer survivors (CS). **Purpose:** This investigation evaluated the status of medically-based exercise rehabilitation for CS in Arizona. **Methods:** A statewide structured telephone interview (STI) was conducted with CR programs ($n=34$) and cancer treatment centers (CTCs; $n=32$). **Results:** Compliance with the STI was 97% and 44% for CR and the CTCs respectively. Thirteen CR programs (39%) offered self-pay onsite supervised exercise training for CS. Two (6%) offered a preventive cardiology exercise consultation with a home-based prescription. Six (43%) CTCs offered exercise services to CS. Eleven (79%) CTCs referred survivors to physical therapy and five (36%) recommended community-based exercise programs. **Conclusion:** CR may be

viable option for onsite medically-based exercise therapy in the growing number of CS in Arizona. Preventive cardiology has an opportunity to expand these services and increase patient accessibility by offering medically-directed exercise physiology consultations. These delivery models provide a potential solution to the lack of rehabilitation resources available to CS. **Future Directions:** It is recommended that a directory of resources remains current with routine updates in an effort to increase patient accessibility to care. Additional cancer rehabilitation efficacy studies are needed to further clarify evidence-based practice guidelines and provide direction for optimal methods of healthcare delivery.

1780 Board #374 May 28 9:30 AM - 11:00 AM
Feasibility Of High-intensity Interval Training In Men With Prostate Cancer Undergoing Active Surveillance: Erase Trial

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 (No relevant relationships reported)

PURPOSE: To examine the feasibility of high-intensity interval training (HIIT) in prostate cancer patients on active surveillance from the Exercise duRing Active Surveillance for prostatE cancer (ERASE) trial.
METHODS: ERASE is a two-armed, single centre, randomized controlled trial in Edmonton, Alberta, Canada. Men diagnosed with very low- to favorable intermediate-risk prostate cancer undergoing active surveillance are approached via clinic visit or telephone call. Participants are randomized to either the HIIT group or usual care group. The HIIT group performs a 12-week, thrice-weekly, supervised, aerobic HIIT protocol on a treadmill for 28-40 min/session. Work and recovery intervals alternated every 2 minutes with workloads corresponding to 85-95% and 40% VO_{2peak}^* respectively. The target sample size is 66 to detect a significant between-group difference in VO_{2peak} of 3.5 ml/kg/min with a two-tailed alpha level of less than 0.05, 80% power, and a 10% drop-out rate.
RESULTS: To date, we have recruited from July 2019 to October 2020 with a planned additional 2 months of recruitment. Of 283 patients screened so far, 131 (46%) were eligible, and 43 (33%; mean age 67±7 years) were randomized (22 in the HIIT group; 21 in the usual care group). Ineligible patients were mostly living too far away (47%), too active (22%), or having medical issues (19%). Reasons for eligible patients declining were mostly lack of time (35%), not interested (34%), or lost contact (14%). Of 43 patients randomized so far, 33/35 (94%) have completed postintervention assessments. The reasons for dropout were unwilling to continue in the study and lost contact. Total number of attended sessions is 593/612 (96.9%) with 100% compliance to the HIIT protocol. Reasons for missed sessions were dropout (16 sessions), knee pain (2 sessions), and traveling (1 session). 6 participants in the HIIT group reported aggravation of a previous joint issue, 1 chest discomfort, and 1 light-headedness, all explainable by previous medical history.
CONCLUSION: Prostate cancer patients undergoing active surveillance are interested in HIIT and are able to achieve high adherence. Future analyses of ERASE will report the preliminary efficacy of HIIT for improving fitness outcomes, patient-report outcomes, and biomarkers related to cancer progression and survival.

C-52 Free Communication/Poster - Healthy Equity - Mixed Bag

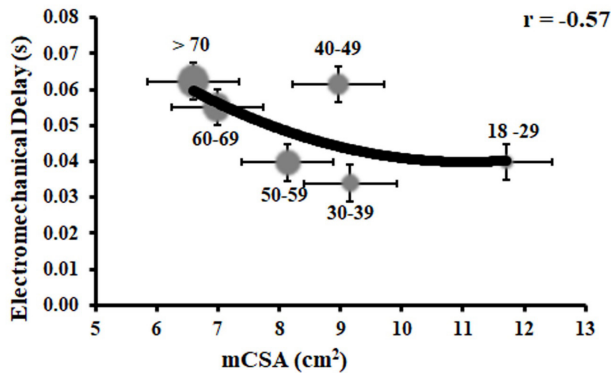
Thursday, May 28, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

1781 Board #375 May 28 9:30 AM - 11:00 AM
Quantifying The Relationship Between Contraction Efficiency And Muscle Size Across The Adult Lifespan

Alejandra Barrera - Curiel¹, Ryan J. Colquhoun², Jesus A. Hernandez - Sarabia¹, Jason M. DeFreitas¹. ¹Oklahoma State University, Stillwater, OK. ²University of South Alabama, Mobile, AL.
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 (No relevant relationships reported)

The neuromuscular system undergoes a natural structural and functional degradation associated with aging. Since the size of a muscle affects its stiffness, the age-related reduction in muscle mass may result in decreased contraction speed and efficiency. **PURPOSE:** To quantify the relationship between muscle size and contraction efficiency, as measured by electromechanical delay (EMD), across the adult lifespan. **METHODS:** Seventy-five adults between 18 and 84 yrs. old were included in this study. Panoramic ultrasound images were taken from each participants' rectus

femoris (RF). Muscle cross-sectional area was defined and measured as the area of interest that included as much muscle as possible (mCSA; cm²). In addition, surface electromyographical (EMG) signals were recorded from the RF while ten tendon taps were delivered to the patellar tendon. EMD was calculated as the time (s) between EMG onset and torque onset during the evoked reflex contractions. Bin widths were utilized to condense data, where subjects were grouped based on their age as follows: 18 - 29 yrs. (n = 37), 30 - 39 (n = 7), 40 - 49 (n = 4), 50 - 59 (n = 9), 60 - 69 (n = 5) and ≥ 70 (n = 4). Polynomial regression (2nd order) was performed to fit the apparent curvilinear relationship between EMD and mCSA. **RESULTS:** As can be appreciated in the figure below, EMD slowed and mCSA decreased with age. However, the relationship between EMD and mCSA was not significant (r = -0.57, p-value = 0.55). **CONCLUSION:** Surprisingly, EMD was not significantly related to mCSA. It is possible that this may be due to the middle-aged groups being underpowered, which led to an outlier bin (40-49 yrs. old). Additionally, a reflex contraction was used to measure EMD which might differ from the properties of a voluntary contraction. Further analyses might be needed to study the relationship between EMD and mCSA.



1782 Board #376 May 28 9:30 AM - 11:00 AM
Examination Of Neighboring Built Environment Related To Physique In Adolescent Japanese Children
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Doshisha University, Kyoto, Japan.
 Email: ctvd0005@mail4.doshisha.ac.jp
 (No relevant relationships reported)

Adolescence is the period in which height increases the most and physique is formed. In adolescence, the risk of obesity during adulthood, which can be a risk factor for various serious events, is about 75%. On the other hand, the neighboring built environment may influence weight status. **PURPOSE:** The purpose of this study was to determine the neighboring built environments that are associated with weight status in adolescent Japanese children. **METHODS:** We conducted a cross-sectional study that included 4437 children (2215 boys, and 2222 girls) enrolled in the 5th grade to the 9th grade in Japan. Monthly age, sex, height, and weight were assessed using questionnaires, and the body mass index (BMI) percentile was calculated. Using the Geographic Information System (GIS), the number of each of seven built environments (convenience store, fast-food restaurant, family restaurant, supermarket and department store, park, exercise facility, intersection) in each school district was tabulated. Data were analyzed using multiple regression analysis (stepwise method) with the BMI percentile as the dependent variable and each built environment as the independent variables. **RESULTS:** The number of parks ($\beta = -0.107$; $p < 0.001$) was independently associated with the BMI percentile ($r = 0.110$). In addition, when analyzed by school type, only the number of parks ($\beta = -0.081$; $p < 0.005$) was independently related in the 5th grade and 6th grade ($r = 0.081$), whereas the number of family restaurants ($\beta = 0.168$; $p < 0.001$) and supermarkets and department stores ($\beta = -0.111$; $p < 0.001$) were independently related from the 7th grade to the 9th grade ($r = 0.112$). **CONCLUSIONS:** These results suggest that the number of neighboring parks affects the weight status of adolescent Japanese children. Furthermore, for junior high school students, the number of neighboring family restaurants and supermarkets and department stores may also affect the weight status.

1783 Board #377 May 28 9:30 AM - 11:00 AM
Sports Participation And Changes In High-density Lipoprotein Among Lean Adolescents: Abcd Growth Study
 Romulo Araujo Fernandes¹, Jamile Sanches Codogno¹, Bruna Camilo Turi-Lynch², Suziane Ungari Cayres¹. ¹Sao Paulo State University - UNESP, Presidente Prudente, Brazil. ²Lander University, Greenwood, SC.
 (No relevant relationships reported)

PURPOSE: To analyze the effect of sport participation with different cardiorespiratory fitness demands on changes in high-density lipoprotein (HDL-c) levels of lean adolescents. **METHODS:** Longitudinal study with 1-year of follow-up (ABCD Growth Study). In all, 189 adolescents (mean age 15.6 ± 2.1) were followed from 2017 to 2018. Only lean adolescents were considered, those were stratified according to engagement in sports with different cardiorespiratory fitness demands: Control (CT [n=66]), low cardiorespiratory fitness demand (Low-CRF: gymnastics, baseball, karate, judo and kung-fu [n=35]) and high cardiorespiratory fitness demand (High-CRF: swimming, tennis, basketball and track & field [n=59]). HDL-c was assessed in fasting conditions. Absolute changes over time (Δ) and its 95%CI were used in ANCOVA models adjusted by covariates (p-value < 0.05). **RESULTS:** The High-CRF group was the only one with significant improvements for HDL-c (2.57 mg/dL [95%CI: 0.50 to 4.65]), which were significantly higher than CT (-2.87 mg/dL [95%CI: -4.97 to -0.78]) and Low-CRF (-1.47 mg/dL [95%CI: -3.95 to 1.01]) (ANCOVA, p-value = 0.017). **CONCLUSIONS:** Engagement in sports of high cardiorespiratory fitness demand seems to be beneficial for improvements in HDL-c levels in adolescents, even when childhood obesity is not present.

D-03 Highlighted Symposium - The Aging Neuromuscular System and the Protective Effects of Physical Activity

Thursday, May 28, 2020, 1:30 PM - 3:30 PM
Room: CC-3012

1786 **Chair:** Sandra K. Hunter, FACSM. *Marquette University, Milwaukee, WI.*
(No relevant relationships reported)

1787 May 28 1:40 PM - 2:10 PM
Keynote - The Aging Neuromuscular System and Fatigability of Limb Muscles

Sandra K. Hunter, FACSM. *Marquette University, Milwaukee, WI.*
(No relevant relationships reported)

1788 May 28 2:10 PM - 2:25 PM
Neural Control of Movement with Aging and Effects of Activity

Ashleigh E. Smith. *University of South Australia, Adelaide, Australia.*
(No relevant relationships reported)

Aging is associated with reduced neuromuscular function, which may be due to central nervous system changes in corticospinal excitability and a reduced capacity of the human brain to re-organize the strength of its connections (neuroplasticity). **PURPOSE:** This symposium presentation will highlight two complementary studies that determined the influence of aging and physical activity (PA) on motor cortical excitability and neuroplasticity, elicited with Transcranial Magnetic Stimulation (TMS). **METHODS:** In study one, corticospinal excitability was assessed in 28 young (22.4 ± 2.2 yr; 14 women) and 50 old adults (70.2 ± 6.1 yr; 22 women) by measuring motor evoked potentials (MEPs) elicited in motor cortical areas and targeting the vastus lateralis (VL) muscle of the quadriceps. In the second study, the response to a continuous theta burst stimulation paradigm (cTBS) was assessed in 27 old adults (66.5 ± 4.5, 13 women) by measuring MEPs in the first dorsal interosseous (FDI) muscle elicited after a single and paired cTBS paradigm- targeting the primary motor cortex. PA was measured in both studies using accelerometry (Actigraph GT-3x or GENEActiv, respectively). **RESULTS:** In study 1, irrespective of age and sex, individuals who achieved >10,000 steps/day had reduced corticospinal excitability of the VL muscles ($F[1.61, 85.6] = 3.49, p = 0.04$). In study 2, when accounting for age and sex, more time engaging in PA was associated with a greater neuroplasticity response to the cTBS paradigm ($r = -0.51, p = 0.007$). **CONCLUSION:** These studies provide evidence that PA in both young and old adults is associated with lower corticospinal excitability in the lower limb and an enhanced capacity of the motor cortex to re-organize the strength of its connections. Together these results suggest regular PA may protect against age-related movement decline through preservation of the inhibitory and excitatory networks within the primary motor cortex, resulting in maintenance of an optimal environment for neuroplasticity. Supported by NHMRC-ARC Dementia Research development fellowship awarded to Dr Ashleigh Smith (GNT 1097397) and NIH Grant R01 awarded to Dr Sandra K. Hunter.

1789 May 28 2:25 PM - 2:40 PM
Limits of Muscle Power with Aging: Evidence from the Whole-Limb to the Single Cell
Christopher W. Sundberg. *Marquette University, Milwaukee, WI.*
(No relevant relationships reported)

Advanced age is accompanied by a decreased ability to generate the power necessary to perform daily activities, which can be exacerbated by the increased fatigability when old adults perform dynamic contractions. **Purpose:** This symposium presentation will highlight a sequence of studies that integrate measures of whole muscle function with single cell contractile mechanics to identify the mechanisms for the age-related loss in muscle power and increased fatigability. **Methods:** Studies on the sites limiting power of the whole limb incorporated measures of transcranial magnetic stimulation, electrical stimulation, electromyography and ³¹P phosphorus magnetic resonance spectroscopy. To test if impairments in cross-bridge function could explain age-related decrements in power and increased fatigability, studies also included biopsies of the vastus lateralis and investigated single cell contractile mechanics in maximal

and submaximal Ca²⁺ and across a range of elevated hydrogen (H⁺) and inorganic phosphate (Pi). **Results:** Age-related increases in power loss during a fatiguing dynamic knee extension exercise were closely associated with greater changes in involuntary contractile properties ($r = 0.75$) and intramuscular accumulation of H⁺ ($r = -0.84$) and Pi ($r = 0.92$), but not associated with the ability of the nervous system to activate the muscle. Elevated H⁺ and Pi, as well as submaximal Ca²⁺, caused marked reductions in cross-bridge function. However, other than severe atrophy (>40%) of fast fibers in old men and women, single cell contractile function was well-preserved in all conditions with aging. **Conclusion:** These data suggest that the age-related loss in power is determined primarily by atrophy of fast fibers, while the increased fatigability is explained by a greater accumulation of H⁺ and Pi. The data also suggest that the ideal exercise intervention to improve power with aging should target increasing fast fiber size and decreasing metabolite accumulation.

These studies were supported by a National Institute of Aging Ruth L. Kirschstein predoctoral fellowship (AG052313) and an American Heart Association postdoctoral fellowship (19POST34380411) to Christopher Sundberg and a National Institute of Aging R01 (AG048262) to Robert Fitts and Sandra Hunter.

1790 May 28 2:40 PM - 3:10 PM
Keynote - Skeletal Muscle with Aging, and Physical Activity
Russell S. Richardson. *University of Utah, Salt Lake City, UT.*
(No relevant relationships reported)

D-10 Thematic Poster - Bone and Integrative Physiology

Thursday, May 28, 2020, 1:30 PM - 3:30 PM
Room: CC-2007

1820 **Chair:** Shannon L. Mathis. *University of Alabama Huntsville, Huntsville, AL.*
(No relevant relationships reported)

1821 Board #1 May 28 1:30 PM - 3:30 PM
Associations Between Sedentary Behaviors And Visceral Adiposity On Bone Mineral Density In Women
Jose Rocha-Rangel¹, Alexandra Auslander², Desiree N. Caballero², Amanda M. Kirk², Kristin M. Merki², Archie D. Bayacal², Michael T. Liang, FACSM¹. ¹California State Polytechnic University, Pomona, Pomona, CA. ²California State Polytechnic University, Pomona, Diamond Bar, CA. (Sponsor: Michael T Liang, FACSM)
Email: Joserocha@cpp.edu
(No relevant relationships reported)

American society has become increasingly sedentary putting this population at higher risks of developing chronic disease such as osteoporosis. One potential link between sedentary behaviors and risk of chronic disease progression is obesity. Studies comparing fracture incidence in obese and non-obese women have demonstrated that obesity is associated with increased risk of fracture at some skeletal sites but seems to be protective at others. Researchers have suggested that certain types of obesity may be a strong predictor of risk of osteoporosis-related non-spine fractures. **PURPOSE:** The purpose of this study is to examine the relationships between physical activity levels (PA), obesity and bone mineral density (BMD) in adult sedentary women. **METHODS:** Twenty-three women, aged 45-65, were instructed to wear an accelerometer for one week, and participate in a Dual energy X-ray absorptiometry (DXA) scan for determining BMD of the whole body (WBMD), lumbar spine (L1-L4), femoral neck (FN) and forearm as well as body fat mass and lean mass. Participants were divided based on obesity status into two groups, high and low BMI. A one-way ANOVA analysis was used to detect differences in BMD and PA levels by group. Multiple linear regression was used to analyze the effect of PA measures and body composition on BMD. **RESULTS:** Light PA decreased whole body BMD (WBMD) ($\beta = -13.5, p = .012$) while body fat percentage (BF%) and fat free mass (FFM) increased it ($\beta = 1754.7, p = .041$ and $\beta = 3.558, p = .001$). Light PA, BF% and FFM all yielded a higher L1-L4 lumbar spine BMD ($\beta = -.003, p = .05, \beta = 0.641, p = .037$ and $\beta = .001, p = .017$, respectively). The higher the total amount and the longer the length of sedentary bouts increased arm BMD ($\beta = .052, p = .038$ and $\beta = .016, p = .000$). In addition, greater MET values yielded higher forearm BMD ($\beta = 6.085, p = .020$). **CONCLUSIONS:** These results demonstrate that PA levels and fat mass have a significant effect on sedentary adult women's bone density levels. Further investigation of causal mechanisms underlying these associations is warranted.

1822 Board #2 May 28 1:30 PM - 3:30 PM

Sex-specific Associations Between Muscle Performance And Bone Mineral Density During Adolescence And Young Adulthood

Fátima Baptista¹, Diana Luís¹, Vera L. Zymbal¹, Kathleen F. Janz, FACSM². ¹University of Lisbon, Lisboa, Portugal. ²University of Iowa, Iowa, IA. (Sponsor: Kathleen F Janz, FACSM)
Email: fbaptista@fmh.ulisboa.pt
(No relevant relationships reported)

Measures of muscle size are considered the best predictors of areal bone mineral density (aBMD). However, the role of muscle function may be particularly important for public health since muscle function can be improved via the modifiable factor of physical activity; whereas, muscle size is heavily influenced by the non-modifiable factor of genetics. **Purpose:** The aim of this study was to analyze the contribution of muscle mass in the relationship between muscle function and aBMD (g/cm²) of the whole body, hip, and right arm. **Methods:** The sample included 462 participants from 9 to 20 yrs (212 girls:13.7±2.3yrs; 250 boys:13.8±2.4yrs) without clinical conditions affecting muscle or bone. Bone variables were assessed by DXA. Muscle function was operationalized as the maximum power per body mass (W/kg) measured during a vertical counter movement jump on a force platform and the maximum handgrip strength (kg) assessed with a dynamometer. Muscle size (kg) was operationalized as appendicular lean soft tissue (aLST) from the total DXA body scan. Mediation model effects were estimated using the PROCESS macro, and 95% bootstrap confidence intervals were constructed to examine the indirect (mediated by muscle size) effects of muscle function on bone outcomes. Body height and maturity offset were used as covariates. **Results:** The mediation analyses indicated an indirect effect of vertical jump power on aBMD of WBLH and total hip through aLST in both boys and girls (p<0.001). In boys, aLST explained 59.0% (β=0.001 95%CI [0.001, 0.002]) and 33.7% (β=0.002 95%CI [0.001, 0.003]) of the total effects of vertical jump power on aBMD of WBLH and total hip, respectively. In girls, the percentages of the total effects of vertical jump power on aBMD explained by aLST were 69.3% (β=0.001 95% CI [0.001, 0.002]) at the WBLH and 51.9% (β=0.002 95%CI [0.001, 0.003]) at the total hip. Associations between handgrip strength and aBMD of the right arm were also partially explained by aLST, specifically 31.6% (β=0.001 95%CI[0.001, 0.002]) in boys (p<0.001) and 55.2% (β=0.002 95%CI[0.001, 0.003]) in girls. **Conclusion:** The higher proportion of explained variability due to muscle size that we report in girls (when compared to boys) suggests that girls may be missing out of the “value added” osteogenic effect of muscle function associated with physical activity.

1823 Board #3 May 28 1:30 PM - 3:30 PM

Circulating Bone Biomarkers Are Altered Following A Single Bout Of Strenuous Load Carriage Exercise

Jeffery S. Staab, Laura J. Lutz, Stephen A. Foulis, Julie M. Hughes, Erin Gaffney-Stomberg. *US Army Research Institute of Environmental Medicine, Natick, MA.*
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(No relevant relationships reported)

Military training creates a multi-stressor environment which has been associated with risk of stress fracture. Understanding the acute bone biomarker responses to exercise can provide a model to study how various stressors or interventions affect bone and its adaptation to physical training. **Purpose:** To characterize the effects of a militarily relevant exercise on circulating bone biomarkers. **Methods:** 20 Soldiers (18 male, 2 female); age 21.2±0.9 y, performed a 60 min self-paced treadmill time trial at 1% grade while wearing 30% of body weight vest (EX) and a resting control trial (CON) in a randomized, crossover design. Fasted blood samples were collected at 0630 h (AM) and EX or CON trials commenced ~0900 h. Blood samples were collected before (PRE) and after (POST) exercise, and at +1, +2, and +4 h after EX or time-matched during CON. Additionally, fasted samples were collected for the next 3 mornings at 0630 h (AM Day +1 to +3). Parathyroid hormone (PTH), ionized calcium (iCa), osteocalcin (OCN), sclerostin (SOST), C terminal propeptide of type 1 collagen (CTX), N-terminal propeptide of type 1 collagen (PINP), bone alkaline phosphatase (BAP), and tartrate resistant acid phosphatase (TRAP5b) were assayed and all samples except AM were adjusted for changes in plasma volume from PRE. Data were analyzed using repeated measured ANOVA. Data are mean ± SE. **RESULTS:** Compared to PRE, PTH was significantly higher (104±32%, p<0.01) and iCa was lower (-2.5±0.8%, p<0.01) at POST during EX but not during CON. OCN was higher at +1 through +4 h than PRE by 15.9±13.0-20.5±12.0% (p<0.01) during EX but unchanged during CON. SOST was elevated by 29.1±14.2% (p<0.01) at POST vs PRE EX but later time points were not different than CON. CTX was elevated vs PRE at +1 h (43.6±22.2%, p<0.01) in EX condition only; later time points were higher (p<0.01) than PRE under both conditions. PINP, BAP, and TRAP5b were not different from PRE during EX or CON. There were no changes in the AM Day 1-3 samples except OCN was lower than CON on Day +2 and +3.

CONCLUSIONS: Consistent with prior reports, iCa decreased and PTH increased immediately post EX. Some markers of bone resorption and OCN were increased post EX. In sum, the temporal pattern of these biomarkers suggest a transient post exercise increase in resorption, but these changes disappear within 24 h after exercise.

1824 Board #4 May 28 1:30 PM - 3:30 PM

EFFECTS OF DIET ALTERATIONS, WITH OR WITHOUT FECAL MICROBIAL TRANSPLANTS, ON BONE INTEGRITY

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(No relevant relationships reported)

High fat feeding exerts a negative impact on bone quality and strength. Gut microbiota have been strongly linked to bone outcomes in several models, though a clear mechanism linking alterations in gut microbiota, diet composition, and bone has not yet been elucidated.

PURPOSE: To determine if alterations in diet, with or without fecal microbial transplants (FMT) can rescue bone integrity in diet-induced obesity. **METHODS:** 6-wk old male C57BL/6 mice (n=10/group) were randomized to a low-fat (LF) or high fat, high sugar (HFS) diet *ad libitum* for 13 wks. HFS mice were randomized to one of three groups for 4 wks: LF diet with FMT from the LF mice (HFS/LF+), LF diet with sham FMT using PBS (HFS/LF), or HFS diet with FMT from the LF mice (HFS/HFS+) to simulate the impact of combined diet alteration and addition of “healthy” microbes, diet alterations only, and addition of “healthy” microbes only, respectively. Animals had free access to a running wheel until terminated at 23 wks of age. Statistical analyses were performed using a two-way ANOVA and Tukey’s *post-hoc* test. **RESULTS:** HFS/HFS+ mice showed greater absolute femoral neck (FN) strength versus HFS/LF and HFS/LF+ mice (p<0.003), while LF/LF mice had the greatest relative FN strength versus all groups (p<0.016). Whole femur bone mineral density (BMD, g/cm³) was greater in HFS/HFS+ versus all groups (p<0.023); LF/LF mice had the highest BMD when normalized to body weight (p<0.029). Immunostaining for tumor necrosis factor alpha, sclerostin, insulin-like growth factor 1, and interferon gamma in cortical and cancellous bone revealed no differences between groups. Despite no difference in marrow adipocyte number (#/mm²) between groups, HFS/HFS+ mice had greater marrow adipocyte size (μm²) versus LF/LF mice; diet alteration, with and without transplanted “healthy” microbes, was able to partially attenuate increased marrow adipocyte size. **CONCLUSIONS:** A change in diet from HFS to LF led to reduced absolute FN strength compared to HFS/HFS+ and LF/LF mice, with no apparent effect from transplanted “healthy” gut microbes. LF/LF mice had greater relative femoral neck strength. Altering diet, with and without FMT’s, was sufficient to partially rescue the detrimental impacts of high fat, high sugar feeding on bone integrity.

1825 Board #5 May 28 1:30 PM - 3:30 PM

IMPACT OF MATERNAL EXERCISE ON CORTICAL GEOMETRY AND TRABECULAR MICROARCHITECTURE IN MOUSE OFFSPRING

Rebecca K. Dirkes, Ethan D. Weiss, Rebecca J. Welly, Jiude Mao, Jessica Kinkade, Victoria J. Vieira-Potter, Cheryl S. Rosenfeld, Pamela S. Bruzina. *University of Missouri Columbia, Columbia, MO.*
(No relevant relationships reported)

Exercise during gestation is safe and has many positive effects on the offspring, such as improved cardiovascular health and nervous system development. However, whether gestational exercise positively impacts skeletal development is unknown.

PURPOSE: To determine whether maternal exercise throughout gestation and lactation positively impacts cortical geometry and trabecular microarchitecture of the femur in mouse male and female offspring. **METHODS:** In this longitudinal study, sexually mature C57BL/6 female mice were given *ad lib* access to a standard rodent chow. Two weeks before mating, females were randomized into two groups: voluntary wheel running treatment (EX) or sedentary control (SED). Females were mated to C57BL/6 males and continued treatment or control through both gestation and lactation. One male and one female offspring from each dam (n=7/group/sex) were selected and given *ad lib* access to a high-fat diet until 16 weeks of age, when final body weight was measured and femora collected. Cortical geometry of the mid-diaphysis and trabecular microarchitecture of the distal right femur were assessed via micro-computed tomography (μCT) with a voxel size of 12 μm. ANOVA or ANCOVA with final body weight (BW) as a covariate was used to determine the effects of maternal exercise on trabecular and cortical bone outcomes, respectively. **RESULTS:** There were no differences in BW between SED and EX male offspring. EX male offspring had smaller total area (Tr.Ar, p=0.075) and marrow area (Ma.

Ar, $p=0.025$), and a higher cortical-to-total area ratio (Ct.Ar/Tt.Ar, $p=0.017$) compared to SED males. EX males had lesser trabecular thickness ($p=0.049$) but higher connectivity density ($p=0.029$) compared to SED. EX female offspring had greater BW than SED offspring ($p=0.064$). EX females had smaller Tt.Ar ($p=0.017$), Ma.Ar ($p=0.033$), and Ct.Ar ($p=0.063$) versus SED. EX female offspring had greater trabecular spacing ($p=0.046$) and degree of anisotropy ($p=0.040$), and lower trabecular number ($p=0.034$) compared to SED.

CONCLUSION: Maternal exercise during gestation and lactation decreased cortical bone area independent of body weight and negatively impacted trabecular microarchitecture in both male and female offspring.

1826 Board #6 May 28 1:30 PM - 3:30 PM
C-mirna Expression Responses To Whole-body Vibration And Resistance Exercise In Postmenopausal Women

Samuel R. Buchanan, Hoang V. Nguyen, Ryan Miller, J. Mikhail Kellawan, Christopher Black, FACSM, Michael Bembem, FACSM, Debra Bembem, FACSM. *The University of Oklahoma, Norman, OK.* (Sponsor: Dr. Debra Bembem, FACSM)
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 (No relevant relationships reported)

Circulating microRNAs (c-miRNA, miR) are potential biomarkers for age-related changes in musculoskeletal function. There is a paucity of data on c-miRNA responses to exercise, especially in postmenopausal women (PMW). Evaluating alterations in the expression of c-miRNA may provide deeper insight into the benefits of exercise for bone health in aging populations. **PURPOSE:** The purpose of this study was to characterize the effects of acute bouts of resistance exercise (RE) and whole-body vibration (WBV) on selected c-miRNAs that regulate bone metabolism (miR-21-5p, -23a-3p, -133a-3p, -148a-3p) in PMW ($n=10$). **METHODS:** Subjects performed a high intensity RE condition and a WBV condition in random order. RE consisted of 3 sets, 10 reps, 70% 1RM for leg press, shoulder press, lat pulldown, leg extension, and hip adduction isotonic exercises. For WBV, 5-1 min bouts were performed (20 Hz, 3.38 mm peak-to-peak displacement) each separate by 1 min rest on a Galileo vibration platform. Morning blood samples after an overnight fast were collected pre, immediately-post (IP), 60 min, 24 hrs, and 48 hrs after exercise to measure c-miRNA and TRAP5b. C-miRNA expression was corrected for plasma volume (PV) shifts using the equation: $\% \Delta PV = (\log(100)/(\log(100) - \log(\text{Hct Pre})) * \log(100) * (\log(\text{Hct Pre}) - \log(\text{Hct Post}))/\log(\text{Hct Post}))$. The correction factor was subtracted from the Cq values for each exercise sample. **RESULTS:** PV significantly decreased for both conditions at IP ($p=0.04$), thus serum variables were corrected for PV shifts. There was a significant condition \times time interaction for miR-21 ($p=0.019$), which decreased in relative expression from 60p (1.61 ± 0.31) to 24h (0.80 ± 0.16) after WBV but not after RE. MiR-23a-3p, -133a-3p, -148a-3p showed no significant expression changes for either exercise condition. TRAP5b concentrations significantly decreased 24h (WBV $-7.56\% \pm 5.27$, RE $-3.44\% \pm 4.33$) after exercise ($p < 0.01$) even after correcting for PV shifts ($p < 0.01$). **CONCLUSION:** C-miR-21-5p was downregulated at 24 hrs in response to an acute bout of WBV. Both types of exercise also decreased serum TRAP5b 24 hrs post-exercise, indicating decreased bone resorption. This is the first known study to correct c-miRNA expression for PV shifts.

1827 Board #7 May 28 1:30 PM - 3:30 PM
EFFICACY OF ORAL VITAMIN D SUPPLEMENTATION OR SIMULATED SUNLIGHT ON BONE DURING MILITARY TRAINING

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 (No relevant relationships reported)

25-hydroxyvitamin D (25(OH)D) ≥ 50 nmol·L⁻¹ is essential for bone health. Vitamin D deficiency during arduous training has implications for increased stress fracture risk. Vitamin D is mainly synthesised from skin exposure to the sun; around 20% of vitamin D is obtained from the diet. **PURPOSE:** This study compared the efficacy of vitamin D supplementation by oral pill *versus* simulated sunlight on bone macro- and micro-architecture during a 13-week military training course in winter. **METHODS:** Eighty male infantry recruits (mean \pm SD, age 22 ± 3 years, height 1.78 ± 0.07 m, body mass 77.9 ± 10.7 kg) received oral vitamin D₃ (1,000 IU·D⁻¹ for 4 weeks and then 400 IU·d⁻¹ for 8 weeks, $n = 21$), an oral placebo ($n = 19$), solar-simulated radiation (SSR, $1.3 \times$ standard erythemal dose in T-shirt and shorts, $3 \text{ d}\cdot\text{wk}^{-1}$ for 4 weeks and $1 \text{ d}\cdot\text{wk}^{-1}$ for 8 weeks, $n = 22$), or placebo SSR ($n = 18$). Total 25(OH)D was measured by LC-MS/

MS in week 1, 5 and 13, and bone density and structure was assessed at the ultra-distal dominant tibia by HR-pQCT (Xtreme CTI, Scanco) in week 1 and 13. **RESULTS:** Oral vitamin D₃ and SSR increased 25(OH)D from week 1 (51 ± 22 and 43 ± 21 nmol·L⁻¹) to week 5 (78 ± 23 and 79 ± 15 nmol·L⁻¹) and week 13 (75 ± 15 and 76 ± 12 nmol·L⁻¹, $P < 0.001$). The oral and SSR placebos did not change 25(OH)D from week 1 (51 ± 40 and 41 ± 17 nmol·L⁻¹) to week 5 (45 ± 4 and 41 ± 16 nmol·L⁻¹), but 25(OH)D increased in both groups by week 13 (60 ± 4 and 65 ± 15 nmol·L⁻¹, $P \leq 0.010$). Supplementation and training did not affect total, trabecular or cortical volumetric bone mineral density, cortical area, trabecular volume, number or thickness, or cortical pore diameter (main effects of time, $P \geq 0.105$; group \times time interactions, $P \geq 0.258$). Training increased cortical thickness (1.30 ± 0.25 to 1.32 ± 0.25 mm), and reduced trabecular area (682 ± 133 to 680 ± 133 mm²) and spacing (360 ± 58 to 345 ± 71 μm , main effects of time, $P \leq 0.041$), but supplementation had no effect (group \times time interactions, $P \geq 0.181$). There was a significant group \times time interaction for cortical perimeter ($P = 0.033$) and porosity ($P = 0.049$); training had no effect on either measure for any group ($P \geq 0.068$). **CONCLUSION:** Vitamin D supplementation in winter, using strategies to increase total 25(OH)D above $50 \text{ nmol}\cdot\text{L}^{-1}$, exerted no effect on bone macro- or micro-architecture beyond the osteogenic effects of exercise training.

1828 Board #8 May 28 1:30 PM - 3:30 PM
Predictors And Prevalence Of Low Bone Mineral Density And Bone Stress Injuries In Ultramarathon Runners

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 Email: exophoria@gmail.com
 Reported Relationships: T.B. Høeg: Salary; Napa Medical Research Foundation. Other (please describe): Personal laboratory testing from InsideTracker.

BACKGROUND: Low bone mineral density (BMD) and bone stress injuries (BSI) are highly prevalent among collegiate runners due to risk factors that have been well elucidated. Though initial data suggest ultramarathon runners are at high risk for low BMD and BSI, the prevalence of and risk factors for low BMD and BSI among this older population of long-distance runners has not been thoroughly investigated. **PURPOSE:** To determine the prevalence of and risk factors for low BMD and history of BSI in male and female ultramarathon runners **METHODS:** 123 ultramarathon runners who qualified for a 161km endurance race were recruited via pre-race email invitation in 2018 and 2019. Pre-race assessments included a survey on BSI history, dietary habits, body mass index and menstrual history in females; dual energy x-ray absorptiometry (DXA) scan; and, in 2019, serum evaluation for ferritin, total testosterone, free testosterone and estradiol. Poisson regression was used to evaluate risk factors for BSI; and linear regression or Pearson's correlation coefficients when evaluating correlates of BMD. **RESULTS:** 40 women and 83 men (mean age 41.8 and 46.2 years, respectively) were enrolled and completed the survey with 36 women and 72 men completing DXA's and 19 women and 32 men completing serum evaluation. 79.5% of men and 37.5% of women reported history of at least one BSI. 15% of women and 28.9% of men had low BMD (Z-score < -1.0). Low BMD was significantly or near-significantly associated with history of BSI: the age-adjusted risk ratio per BMD risk point was 1.86 ($p=.036$) for men and 2.03 ($p=.056$) for women. Oligomenorrhea was correlated with lower BMD values in women (beta coefficient $=-.39$ SD per risk point for total hip BMD, $p=.038$; and beta coefficient $=-.35$ SD per risk point for femoral BMD, $p=.054$). Of the blood markers, higher testosterone correlated with higher hip ($r=.40$, $p=.022$); and femoral ($r=.39$; $p=.027$) BMD in males and higher estradiol correlated with higher spine BMD ($r=.47$; $p=.043$) in females. **CONCLUSIONS:** BSI history and low BMD were highly prevalent among male ultramarathon runners and less so among females. Low BMD was associated with a history of BSI. Higher levels of sex hormones were correlated with higher BMD in both men and women. Oligomenorrhea was correlated with lower BMD in women.

D-11 Thematic Poster - Hydration Strategies and Assessment

Thursday, May 28, 2020, 1:30 PM - 3:30 PM
 Room: CC-2010

1829 Chair: William M. Adams. *University of North Carolina at Greensboro, Greensboro, NC.*
 (No relevant relationships reported)

1830 Board #1 May 28 1:30 PM - 3:30 PM
A Urine Color Chart Is An Accurate Tool For Self-identification Of High Urine Concentration In Athletes
 Floris C. Wardenaar, Daniel Thompsett, Kathryn Pesek, Abigail T. Colburn, Kaila Vento, Dean Bacalzo, Stavros Kavouras, FACSM. *ARIZONA STATE UNIVERSITY, Phoenix, AZ.*
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 (No relevant relationships reported)

PURPOSE: Urine color (U_c) charts can be a reliable field tool to assess urine concentration, but no self-reporting athlete data is available. This study compares U_c scores from athletes against research team scores and urine osmolality values. **METHODS:** Urine samples were collected from college athletes ($n=173$, 68% male, median age 20). To standardize U_c scoring, a box was constructed with a set distance (14 inch) towards the 30 ml sample and placed behind a 1.2x1.2 inch opening against a white backdrop. Athletes and two research members independently scored U_c using the chart described by Armstrong in 1994. Differences in researcher U_c were discussed until consensus was established. To control for lighting, two 28-Watt white LED lights were placed aside of the box and the U_c chart. Samples were measured for urine osmolality in duplicate via freezing point depression. **RESULTS:** Median athlete and researcher scores for U_c values were 2 with an interquartile range (IQR) 1-3 and urine concentration of 744 (474-940) $\text{mmol}\cdot\text{kg}^{-1}$. A significant lower number of samples with $U_c < 2$ was reported by athletes ($n=60$) vs. researchers ($n=44$), $P=0.02$. Correlations for U_c against urine osmolality were similar for athlete and researcher scores indicated by a similar $r: 0.56$, $P < 0.001$. Based on athlete score receiver operating characteristics (ROC), U_c has a fair diagnostic capability for identifying urine with an osmolality $\geq 800 \text{ mmol}\cdot\text{kg}^{-1}$ based on an area under the curve (AUC) of 0.71. Contingency tables, based on the ROC optimal threshold for $U_c \geq 2$ (with sensitivity 0.89% and specificity 0.53%) showed 68% among athletes vs. 60% among researchers' correct classification for being euhydrated or underhydrated. Of the athletes 27% misclassified themselves as being underhydrated ($U_c \geq 2$) with urine concentration below $800 \text{ mmol}\cdot\text{kg}^{-1}$, but only 5% of samples were misclassified suggesting proper hydration while osmolality values indicated underhydration. **CONCLUSIONS:** Validity of reporting U_c by athletes was similar to researchers. Although accuracy could be justified as fair, the U_c misclassification for athletes with high urine osmolality values was minimal. Indicating that U_c can help athletes to self-identify urine concentrations above $\geq 800 \text{ mmol}\cdot\text{kg}^{-1}$ that may predict underhydration. Funded by a Global Sport Institute award at ASU.

1831 Board #2 May 28 1:30 PM - 3:30 PM
Comparison Of Different Methods For Urine Hydration Assessment
 Anthony F. Ludwig, Chandler B. Rudolph, Hunter D. Evans, Noah J. Erb, Cory L. Butts. *Weber State University, Ogden, UT.*
 (Sponsor: Dr. Brendon P. McDermott, FACSM)
 (No relevant relationships reported)

Several instruments and techniques to assess hydration via urine exist; but which is used for evaluation depends on diagnostic accuracy, reliability, cost, and convenience. Urine specific gravity assessed via refractometry is a common field technique for urine assessment; however, previous comparisons of different refractometers have provided contradicting reports of bias. **PURPOSE:** To identify agreement between different refractometers (manual and digital) to measure urine specific gravity, as well as assess the diagnostic accuracy of urine specific gravity compared to osmolality. **METHODS:** Free-living participants ($n = 39$, 27 males, 12 females, age 25 ± 5 y, ht 1.76 ± 0.09 m, wt 81.1 ± 15.2 kg, BMI 26.2 ± 4.1) volunteered to provide a spot urine sample. Each sample was evaluated in duplicate with an osmometer (Osmo1 Single-Sample Micro-Osmometer), manual refractometer (Atago MASTER-SUR/Na), and digital refractometer (Atago PAL-10S). Bland-Altman analysis was performed to assess agreement between manual and digital refractometers. Diagnostic accuracy of refractometers to identify concentrated samples (≥ 1.025) was conducted using receiver operating characteristic curves with osmolality ($\geq 850 \text{ mOsm/kg}$) as the standard. **RESULTS:** Samples evaluated with the digital (1.018 ± 0.008) and manual (1.018 ± 0.007) refractometers were highly correlated ($r = 0.998$, $P < 0.001$). Bland-Altman

analysis demonstrated high agreement between manual and digital refractometers (mean difference: 0.0002 ± 0.0004). Compared with osmolality, the digital refractometer identified concentrated samples with an area-under-the curve (AUC) of 0.86, sensitivity of 0.71, and specificity of 1.00. The manual refractometer identified concentrated samples with an AUC of 0.89, sensitivity of 0.79, and specificity of 1.00. **CONCLUSION:** This study demonstrated a high agreement between manual and digital refractometers, suggesting either instrument would be acceptable for use. When compared to osmolality, both instruments provided excellent specificity for identifying diluted samples, but moderate sensitivity for identifying concentrated samples.

1832 Board #3 May 28 1:30 PM - 3:30 PM
Optimizing Baseline Body Mass Measurements To Determine Hydration Status
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 (No relevant relationships reported)

Baseline hydration status is typically determined through collecting 3 consecutive days of free-living nude body mass (BM). However, this method might not capture individuals in their euhydrated state. **PURPOSE:** To determine differences between euhydrated and free-living 3, 5, and 7 day hydration measures. **METHODS:** 27 males and 25 females (male age, 21 ± 1 years; female age, 20 ± 1 years; male BM, 79.38 ± 13.31 kg; female BM, 65.52 ± 11.80 kg) participated in this study. First morning nude BM, urine specific gravity (USG), urine color (U_{COL}), and urine osmolality (U_{OSMO}) were assessed for 10 consecutive days. Participants arrived euhydrated the first 3 days ($USG < 1.020$). The average of days 1-3 (euhydrated baseline), 4-6 (free-living 3 day baseline), 4-8 (free-living 5 day baseline), and 4-10 (free-living 7 day baseline) were calculated. Repeated measures ANOVA with LSD post-hoc comparisons were performed. Data are reported as mean \pm standard deviation ($M \pm SD$) and 95% confidence intervals (95%CI), $p < 0.05$. **RESULTS:** Euhydrated baseline USG was lower ($M \pm SD$ [95%CI], 1.009 ± 0.003 [1.008, 1.009]) than free-living 3 day ($M \pm SD$ [95%CI], 1.017 ± 0.005 [1.016, 1.019]), 5 day ($M \pm SD$ [95%CI], 1.018 ± 0.005 [1.016, 1.019]), and 7 day ($M \pm SD$ [95%CI], 1.018 ± 0.005 [1.016, 1.019]), $p < 0.05$. Euhydrated baseline U_{COL} was lower ($M \pm SD$ [95%CI], $2 \pm [2, 3]$) than free-living 3 day ($M \pm SD$ [95%CI], 5 ± 1 [4, 5]), 5 day ($M \pm SD$ [95%CI], 5 ± 1 [1.016, 1.019]), and 7 day ($M \pm SD$ [95%CI], 5 ± 1 [4, 5]), $p < 0.05$. Euhydrated baseline U_{OSMO} was lower ($M \pm SD$ [95%CI], 381.87 ± 102.95 [353.21, 410.53] mOsmol) than free-living 3 day ($M \pm SD$ [95%CI], 651.84 ± 191.77 [598.45, 705.23] mOsmol), 5 day ($M \pm SD$ [95%CI], 652.88 ± 187.46 [600.69, 705.07] mOsmol), and 7 day ($M \pm SD$ [95%CI], 659.24 ± 182.33 [608.48, 710.00] mOsmol), $p < 0.05$. Euhydrated baseline BM was lower ($M \pm SD$ [95%CI], 72.60 ± 14.32 [68.61, 76.59] kg) than free-living 3 day ($M \pm SD$ [95%CI], 71.72 ± 14.67 [67.64, 75.81] kg) but not different than 5 day ($M \pm SD$ [95%CI], 72.24 ± 2.02 [68.19, 76.28] kg) or 7 day ($M \pm SD$ [95%CI], 72.05 ± 2.02 [68.00, 76.09] kg), $p < 0.05$. **CONCLUSIONS:** A free-living 3 day baseline is 1.21% lower than a euhydrated 3 day baseline BM. Therefore, a three-day euhydrated, 5 or 7 day free-living baseline BM may be useful to define a true hydration baseline, which is important when dehydration level is described by %BM loss.

1833 Board #4 May 28 1:30 PM - 3:30 PM
Characterizing Seven Day 24-hour Urinary Hydration Markers In College-aged Men And Women
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 Reported Relationships: **W.M. Adams: Royalty; Springer. Industry contracted research; Statim Technologies, LLC, QCK, LLC.**

Maintaining a day-to-day state of euhydration is advantageous for acute and long-term health. However, little data exists examining 24h hydration status in free-living emerging adults (18 – 25y). **PURPOSE:** Thus, the purpose of this study was to assess 24h urinary hydration markers across 7 days in male and female college students. **METHODS:** Eighteen participants (male, $n=11$; female, $n=7$; mean \pm SD; age, 23 ± 3 y; height, 164.6 ± 15.3 cm, body mass, 73.48 ± 15.86 kg; body fat, 19.4 ± 9.4 %) provided a 24-hour urine sample on 7 consecutive days. Measures of 24h urine volume (U_{VOL}), urine osmolality (U_{OSM}), urine specific gravity (U_{SG}), and urine color (U_{COL}) were assessed each day. Differences in 24h urinary hydration markers between weekdays and weekend days were assessed. **RESULTS:** Across 7 days, mean U_{VOL} , U_{OSM} , U_{SG} , and U_{COL} was 1.59 ± 0.89 L, $628 \pm 284 \text{ mOsm}\cdot\text{kg}^{-1}$, 1.020 ± 0.007 , 3.8 ± 1.6 , respectively. There were no differences (all $p > 0.05$) between weekday and weekend days for mean U_{VOL} (1.61 ± 0.82 vs. 1.56 ± 0.72 L), U_{OSM} (626 ± 270 vs. $627 \pm 235 \text{ mOsm}\cdot\text{kg}^{-1}$), U_{SG} (1.020 ± 0.007 vs. 1.020 ± 0.006), and U_{COL} (3.8 ± 1.4 vs. 3.8 ± 1.5), respectively. Mean weekend day measures of U_{VOL} (adj $R^2 = 0.507$, $p = 0.001$), U_{OSM} (adj $R^2 = 0.547$, $p < 0.001$), U_{SG} (adj $R^2 = 0.551$, $p < 0.001$), and U_{COL} (adj $R^2 = 0.608$, $p < 0.001$) were

all significantly associated with mean weekday measures. **CONCLUSION:** Our results suggest that, in this sample population of college students, individuals tended to have stable 24-hour urinary hydration measures across weekdays and weekend days. Despite finding relative stability in 24 hour urinary hydration markers across a week, we are unable to discuss factors associated with day-to-day variation in these measures. Integrating other factors such as previous personal and family medical history, physical activity, dietary intake, body composition, racial/ethnic background, and socioeconomic status may further elucidate variations in day-to-day hydration status and the role hydration plays in emerging adults on health.

1834 Board #5 May 28 1:30 PM - 3:30 PM
The Effects Of Mode Of Rehydration On Stress Hormone Response To Subsequent Maximal Intensity Exercise In The Heat.

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PURPOSE: Endocrine response to strenuous exercise in the heat can serve as an indicator of the amount of strain the body is experiencing. Previous intravenous (IV) versus oral rehydration studies found no difference cortisol (CORT) response between modes of rehydration, but mixed norepinephrine (NOR) response with ORAL during an exercise-heat challenge (EHC). The purpose of this study was to examine the effects of mode of rehydration on the stress-hormone response to a subsequent EHC that more closely mimics a real-life athletic situation utilizing three traditional modes of rehydration *ad libitum* (ADL), IV and ORAL and combined half IV and half ORAL (I+O) fluids of identical volume.

METHODS: Ten healthy, non-smoking, active men (age 23.3 ± 1.1 y; height, 177.8 ± 2.8 cm; body mass, 81.4 ± 1.3 kg; body fat, 11.0 ± 1.0%; O_{2max} , 58.8 ± 1.3 ml·kg⁻¹·min⁻¹) completed four trials consisting of dehydration by -4% body mass, rehydration to -2% body mass, and an EHC comprised of 25 min of running at 60% O_{2max} , a maximal effort 0.5 mile run, five minutes of rest and five min of self-paced repetitive box lifting (RBL). Plasma catecholamines [epinephrine (EPI) and NOR] and CORT were analyzed at baseline, post-exercise dehydration, immediately before EHC (EHCPRE), immediately-post 0.5 mile run (EHC30), immediately-post RBL (EHCIP), and 15 minutes post-RBL. Data was analyzed with a two-way repeated measures ANOVA or Student's t-test, p < 0.05.

RESULTS: Catecholamine response was not significantly different between modes of rehydration, but significantly increased during EHC (EHCPRE - EPI 0.52±0.44 pmol·L⁻¹, NOR 2.64±0.89 nmol·L⁻¹; EHC30 - EPI 3.59±1.89 pmol·L⁻¹, NOR 21.66±7.42 nmol·L⁻¹; EHCIP - EPI 1.31±0.84 pmol·L⁻¹, NOR 15.45±6.63 nmol·L⁻¹). CORT response was significantly lower during I+O (EHCPRE: 451.8±118.5 nmol·L⁻¹, EHCIP 505.4±237.9 nmol·L⁻¹) compared to all other trials (EHCPRE 567.1±240.5 nmol·L⁻¹, EHCIP - 603.6±270.1 nmol·L⁻¹).

CONCLUSIONS: These results suggest a synergistic effect of I+O on plasma CORT concentration resulting in reduced adreno-cortical response. It is possible the I+O treatment resulted in reduced hormonal response or increased removal rate due to a combination of oropharyngeal response and rapid plasma volume restoration since stress was controlled across conditions.

1835 Board #6 May 28 1:30 PM - 3:30 PM
Hydration Status Response To Bolus Frequency And Volume Intake During Exercise In Heat

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 (No relevant relationships reported)

Workplace hydration recommendations suggest consuming 237mL of fluid every 15-20 min during physical work in the heat. It is unknown if these recommendations promote hydration during work and if consuming larger boluses of water less frequently maintains hydration better than smaller boluses of water consumed more frequently.

PURPOSE: Examine if consuming 500mL water every 40 min maintains hydration better than 237mL water every 20 min during work in the heat.

METHODS: Seven healthy adults completed 2 trials while fasted, either consuming 237mL water every 20 min (237) or 500mL water every 40 min (500). Subjects performed 2 h of treadmill exercise at 6.4kph, 1.0% grade in 34°C, 30% relative humidity wearing shorts and a t-shirt, followed by 2 h of rest in a temperate room.

Heart rate (HR), rectal temperature (T_{rec}), skin temperature (T_{skin}), were measured throughout exercise and recovery. Gastrointestinal (GI) symptoms were measured during exercise. Nude body mass was measured pre- and post-exercise. Blood and urine samples were collected pre- and post-exercise, and after recovery.

RESULTS: HR, T_{rec} , and T_{skin} increased from pre- (58±10, 62±9 bpm; 36.8±0.3, 36.7±0.3°C; 32.3±0.4, 32.3±0.9°C) to post- (132±29, 136±33 bpm, p=0.01; 38.1±0.6, 38.0±0.7°C, p=0.01; 35.5±0.6, 35.6±1.1°C, p<0.01) exercise and returned to baseline (62±10, 68±15 bpm, p=0.88; 36.7±0.2, 36.7±0.2°C, p=1.00; 32.9±0.7, 32.6±1.0°C, p=0.89) following recovery, in 237 and 500, respectively. GI symptoms were similar among trials and times (p=0.38). In 500, urine specific gravity was lowest following recovery (1.005±0.003) compared to pre- (1.015±0.002, p<0.01) and post- (1.011±0.006, p=0.02) exercise. Plasma osmolality was not different between post-exercise (282±3, 281±4 mOsm/L) and recovery (283±1, 284±2 mOsm/L) compared to pre-exercise (287±6, 286±3 mOsm/L, p=0.96) in 237 and 500, respectively. Changes in plasma volume were similar among trials and times (p=0.78). Post-exercise body mass loss (-0.1±0.5, 0.0±0.5 kg, p=0.28) and sweat rate (0.7±0.2, 0.6±0.5 L/h, p=0.41) were similar, in 237 and 500, respectively. **CONCLUSIONS:** Hydration status was similar between drinking larger, less frequent water boluses and smaller, more frequent boluses. These findings provide flexibility for workers to take less frequent hydration breaks.

D-12 Thematic Poster - Muscle Damage and Injury

Thursday, May 28, 2020, 1:30 PM - 3:30 PM
 Room: CC-2009

1836 Chair: Cory W. Baumann. University of Minnesota, Twin Cities, MN.
 (No relevant relationships reported)

1837 Board #1 May 28 1:30 PM - 3:30 PM
Muscle Damage Increases Autophagy Activation In Untrained Young Men

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Introduction: The autophagic process is a key regulator of muscle repair and steroid hormones have been shown to alter this autophagic response. To date, no study has determined the effects of the acute resistance exercise (RE)-induced hormonal response on the autophagic process during muscle regeneration.

Purpose: To examine the effect of the acute RE-induced hormone response on the autophagic process in untrained young men.

Methods: Untrained young men (n=8, 22 ± 3y; height: 180 ± 5.7cm; weight: 80 ± 15kg) completed two sessions of 80 unilateral maximal eccentric knee extensions. Immediately after knee extensions, participants completed either 20-min of rest (CON) or upper body resistance exercise (EX). Muscle samples were collected from the vastus lateralis before exercise (BL), and 12-hr and 24-hr after exercise sessions. Real-time PCR was used to determine the gene expression for autophagic initiation signaling markers (i.e. FOXO3, MTOR, and AKT) and autophagic markers (i.e., ATG5, ATG7, LC3A, LC3B, ULK1, and p62).

Results: A significant (p<0.05) time effect was found for AKT, FOXO3A, ATG5, and p62 expression. AKT expression increased from BL to 12-hr (1.97 ± 0.34-fold) and 24-hr (1.33 ± 0.12-fold) and FOXO3A expression decreased from BL at 12-hr (3.15 × 10⁻⁴ ± 2.94 × 10⁻⁴-fold) and 24-hr (1.43 × 10⁻⁵ ± 3.02 × 10⁻⁶-fold). Additionally, p62 increased from BL at 12-hr (4.11 ± 1.26-fold) and ATG-5 expressions increased from BL at 12-hr (1.62 ± 0.30-fold). A trend was found for MTOR towards an increase from BL at 12-hr.

Conclusion: In response to muscle damage, the autophagic response increased from baseline in untrained young men; however, our data suggest that exercise-induced circulatory factors did not affect the autophagic process in untrained men.

1838 Board #2 May 28 1:30 PM - 3:30 PM

Curcumin Supplementation Suppresses Ubiquitin Proteasome System Activity Following Exercise-Induced Muscle Damage In HumansThomas D. Cardaci, Steven B. Machek, Dylan T. Wilburn, Paul S. Hwang, Emiliya S. Suezaki, Darryn S. Willoughby, FACSM. *Baylor University, Waco, TX.* (Sponsor: Darryn Willoughby, FACSM)

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(No relevant relationships reported)

PURPOSE: Curcumin is a natural polyphenolic compound with profound antioxidant and anti-inflammatory properties. Moreover, combined curcumin and piperine supplementation has shown improved curcumin bioavailability by 2000%. Multiple studies have demonstrated that exposure to curcumin leads to dysregulation of the ubiquitin-proteasome system (UPS) in cell culture. However, to date, no data has investigated curcumin's ability to influence UPS activity in a human model. Therefore, the purpose of this study was to investigate the effects of curcumin and piperine supplementation on markers of UPS activity following exercise-induced muscle damage in human skeletal muscle. **METHODS:** Twenty-three recreationally active male and female participants were randomized into a curcumin + piperine (CUR; n=11); or placebo + piperine (PLA; n=12). Both groups were instructed to consume 2g of their respective supplement and 20mg of piperine for 11 consecutive days. Following 8 consecutive days of supplementation, participants performed a 45-min eccentrically-biased muscle damaging treadmill protocol at 60% $\dot{V}O_{2max}$. Muscle Biopsies and delayed muscle soreness (DOMS) analyses were performed 30 minutes prior and 3-, 24-, 48-, and 72-hours post exercise-induced muscle damage. Muscle ubiquitin, MAFbx, ubiquitin specific peptidase 19 (USP19), and chymotrypsin-like protease (CLP) concentrations were measured using ELISA kits. A 2x5 repeated measures ANOVA with pairwise comparisons was conducted with significance set at $p < 0.05$. **RESULTS:** Both groups had a significant time effect for DOMS ($p < .001$). Pairwise comparisons indicated DOMS was significantly greater from baseline at all time points except 72 hours post muscle damage. No significant differences were found for CLP or USP19 across any time points. Regardless of time, there was a significant group effect for ubiquitin ($p = .012$) and MAFbx ($p = .016$) where CUR was significantly lower than PLA. **CONCLUSION:** Curcumin appears to attenuate muscle ubiquitin and MAFbx in response to a muscle damaging protocol. As key markers of protein degradation, this implies decreased ubiquitination and a subsequent reduction in proteasomal activity. Therefore, curcumin supplementation potentially plays a role in preserving skeletal muscle mass through decreased muscle breakdown.

1839 Board #3 May 28 1:30 PM - 3:30 PM

Numb And Numb-like Responses To Exercise Induced Muscle Damage In Human Skeletal MuscleMatthew P. Buback¹, Kevan W. Stout¹, Julia E. Tomtschik¹, Ethan E. Peterson¹, Melissa L. Hipp¹, Zach A. Grahm², Christopher P. Cardozo³. ¹The University of Kansas, Lawrence, KS.²Birmingham VAMC; University of Alabama at Birmingham, Birmingham, AL. ³Center for the Medical Consequences of Spinal Cord Injury; Medical Service, James J. Peters VAMC; Icahn School of Medicine at Mount Sinai, Bronx, NY. (Sponsor: Philip Gallagher, FACSM)

(No relevant relationships reported)

Numb and Numb-Like (NumbL) are adaptor proteins. Among their functions is control of cell fate determination and progression of cell differentiation. While no role for NumbL has been found in cells of the myogenic lineage, Numb promotes myogenic differentiation of satellite cells. The roles these proteins in human skeletal muscle in response to exercise-induced muscle damage have yet to be examined. **PURPOSE:** The purpose of this investigation is to examine changes in the expression of Numb and NumbL in human skeletal muscle after a bout of muscle damage via eccentric exercise. **METHODS:** Twelve male subjects signed an informed consent approved by The University of Kansas's Institutional Review Board and were randomly assigned to one of two groups: a control group (n = 6) or a damage group (n = 6). Subjects completed a one repetition maximum (1RM) in leg extension followed by seven sets of ten repetitions of eccentric leg extension at 120% of 1RM with a two minutes of rest period between sets. Three muscle biopsies of the *vastus lateralis* were collected at baseline, two days post-, and five days post-muscle damage and analyzed utilizing Western blot and quantitative reverse transcription polymerase chain reaction analyses. The results were analyzed using a 2 X 3 (Group X Time) repeated-measures ANOVA. **RESULTS:** No significant differences in mRNA expression were observed for *Numb* between groups two days post- and five days post-damage ($p = 0.37$ and $p = 0.29$, respectively). There was no significant difference in *NumbL* for the exercise group (3.101 ± 1.763) in comparison to the control group (0.838 ± 0.234) two days post-exercise induced muscle damage ($p = 0.27$). However, there was a significant increase in *NumbL* at five days post-exercise between the exercise group (1.773 ± 0.358) and the control group (0.726 ± 0.087) from baseline measures ($p = 0.04$). No significant

differences in Numb or NumbL proteins were observed at any time point or between the control group and exercise group ($p > 0.05$). **CONCLUSION:** Numb expression was unaltered post-muscle damage, while NumbL mRNA expression was increased after muscle damage. These results indicate that NumbL may have a greater role in muscle repair after strenuous exercise in humans than previously thought. Funding provided by NIA grant 5R01AG060341-02 to CPC and the CSACSM Doctoral Grant.

1840 Board #4 May 28 1:30 PM - 3:30 PM

Exosomes Isolated From Platelet-rich Plasma And Mesenchymal Stem Cells Promote Functional Recovery After Muscle InjuryShama R. Iyer, Amanda L. Scheiber, Paul Yarowsky, R. Frank Henn III, Satoru Otsuru, Richard M. Lovering. *University of Maryland School of Medicine, Baltimore, MD.* (Sponsor: Edward McFarland, FACSM)

(No relevant relationships reported)

PURPOSE: Clinical use of platelet-rich plasma (PRP) and mesenchymal stem cells (MSCs) have gained momentum as viable treatment options for muscle injuries. Exosomes, or small cell-derived vesicles, could be helpful if they could deliver the same or better physiological effect without cell transplantation into the muscle. The purpose of this work was to determine if local delivery of exosomes derived from PRP (PRP-exos) or MSCs (MSC-exos) to injured muscles hastens recovery of contractile function. **METHODS:** Using Sprague-Dawley rats, platelets were isolated from blood and MSCs were isolated from bone marrow and expanded in culture; exosomes from both were isolated through ultracentrifugation. The tibialis anterior muscles were injured *in vivo* by maximal lengthening contractions. Muscles were injected with PRP-exos or MSC-exos (immediately after injury, and days 5 and 10 after injury); shams received an equal volume of saline. In addition, histological and biochemical analysis was performed on tissues for all groups. **RESULTS:** Injury resulted in a significant loss of maximal isometric torque ($66 \pm 3\%$) that gradually recovered over 2 weeks. Both PRP-exos and MSC-exos accelerated recovery, with similar improved recovery of contractile function over the saline treated group at days 5, 10, and 15 ($P < 0.05$). A significant increase in centrally nucleated fibers was seen with both exos groups by day 15 ($P < 0.05$). Muscles treated with PRP-exos had increased expression of *Myogenin* gene expression ($P < 0.05$), whereas muscles treated with MSC-exos had reduced expression of *TGF- β* ten days after muscle injury. **CONCLUSIONS:** Exosomes derived from PRP or MSCs can facilitate recovery after a muscle strain injury in a small-animal model, likely due to factors that can modulate inflammation, fibrosis and myogenesis. With their small size, low immunogenicity, and ease with which they can be obtained, exosomes could represent a novel therapy for many orthopedic ailments.

1841 Board #5 May 28 1:30 PM - 3:30 PM

Recovery From Eccentric Injury Is Maintained In Aging Sarcopenic MuscleAna P. Valencia, Ashton Samuelson, Rudolph Stuppard, David J. Marcinek. *University of Washington, Seattle, WA.*

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(No relevant relationships reported)

PURPOSE: The progressive loss of muscle function and mass with age, known as sarcopenia, is a leading cause for falls and reduced quality of life in the elderly. Eccentric contractions have been known to induce muscle damage, and it has been suggested that eccentric induced muscle damage (EIMD) contributes to sarcopenia. More recently, however, eccentric training has gained attention as means to improve muscle function in the elderly. These differing views highlight the need for clarification on how EIMD affects sarcopenic muscle performance, particularly force frequency, fatigue, and kinetics of muscle contraction. **METHODS:** Male CB6F1 mice were used at 7-9 mo (adult) and 29-31 mo (old) of age. *In vivo* measurement of plantarflexor function was assessed in anesthetized mice using an Aurora Scientific 305C servomotor by stimulating the tibial nerve. Force-frequency and fatigue were assessed at baseline and 3 days following EIMD. EIMD was induced by 20 eccentric contractions of the plantarflexors by forcing dorsiflexion during a maximal contraction. **RESULTS:** At baseline old mice had lower force (12 ± 1.8 vs 15.2 ± 0.8 mN-m) and were more fatigue resistant compared to adult mice. During the EIMD protocol, old mice lost significantly more force compared to adult mice ($34.8\% \pm 11.5$ vs $26.3\% \pm 4.2$ respectively). Surprisingly, old mice recovered most of their force ($96.4\% \pm 2.0$ vs $90.6\% \pm 6.5$ adult) and contraction kinetics 3 days after EIMD. Rates of muscle fatigue did not significantly change 3 days after EIMD compared to baseline in either age group. **CONCLUSIONS:** The plantarflexors of old mice were more susceptible to injury by maximal eccentric contractions compared to adult. However, old mice did not differ from adult mice in their ability to recover muscle function 3 days after EIMD. The impaired regenerative capacity often reported for sarcopenic muscle was not evident under these conditions. The similar recovery in adult and old mice could be due to nature of the EIMD protocol, the muscles tested, and the use of muscle performance rather than molecular and structural markers of damage. These results

indicate that mild EIMD may not have a long-term deleterious effect on sarcopenic muscle performance. Further research is needed to determine if EIMD can improve function of sarcopenic muscle.

1842 Board #6 May 28 1:30 PM - 3:30 PM
Effects Of Exercise-induced Muscle Injury On Quadriceps Muscle EMG During Locomotion

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Exercise-induced muscle injury is characterized by long-lasting muscle strength deficits and soreness but whether these changes alter quadriceps muscle activation and knee pain development during subsequent locomotor activity is unclear. **PURPOSE:** To determine the effects of downhill running-induced muscle injury on quadriceps muscle torque and soreness, knee pain, and muscle activation during a standardized run. **METHODS:** 12 recreationally active males, 18-35 years old were randomly assigned to either a downhill running group (DR; n = 6) or level running control group (CON; n = 6). Quadriceps muscle maximum isometric torque at 20°, 45° and 90° of knee flexion, and muscle and knee pain were measured before, immediately following and 24 hours after either DR (45 min at -12% grade) or level running (10 min) protocols. Vastus medialis (VM), rectus femoris (RF), and vastus lateralis (VL) muscle activation were measured bilaterally via surface EMG during level running at 75% of heart rate maximum. Bilateral muscle and knee pain were measured using a visual analog scale (100 mm). **RESULTS:** CON group experienced no significant (p>0.05) decreases in maximal isometric torque of quadriceps muscles, or changes in muscle and knee pain, or normalized integrated EMG (niEMG) during running. DR group produced significantly (p<0.05) less peak torque at all joint angles immediately following (14.1±5.0-21.4±4.6%) and 1-day (15.4±5.3-23.9±5.1%) after DR. Compared to pre-injury (2.5±1.9 mm), quadriceps muscle soreness increased (p<0.008) immediately after (31±9 mm) and at 1-day (46±6 mm) after DR, whereas knee pain increased (p=0.003) at 1-day (Pre 4±3 mm vs. 1 d 27±6 mm). niEMG in the left VM was 131±16%-142±23% (p=0.06) and right VL was 131±16-144±22% (p=0.07) of pre-injury values immediately after and 1-day after DR. **CONCLUSIONS:** Exercise-induced muscle injury increases quadriceps muscle strength deficits and soreness, and knee pain that appear to alter activation of certain quadriceps muscles during subsequent locomotion.

1843 Board #7 May 28 1:30 PM - 3:30 PM
Eccentric And Concentric Resistance Training Alterations In Muscle Z-line Proteins

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Few studies are available on the alterations of resistance training on muscle Z-lines. Thus, it is of great importance to understand long time effects of resistance training on the mechano-stability and mechano response on muscle Z-lines proteins. **Purpose:** The present study was conducted to ascertain how Z-lines proteins (myopodin/SYNPO 2 and α -actinin) are altered by eccentric and concentric resistance training leading to possible alterations in mechano-stability and mechano-response. **Methods:** Ten (10) healthy male subjects with age (25.3 ± 1.4 years), height (1.87 ± 0.09 m), weight (73.2 ± 11.6 kg) and BMI (24.4 ± 3.3 kg·m⁻²) were grouped into eccentric resistance (n= 5) and concentric resistance (n=5) training. Subjects underwent twelve (12) weeks of resistance training intervention on the dominate leg. Muscle biopsies were taken in five time points (T0,T1,T2,T3,T4) on the forelimb of the vastus lateralis muscle and immunohistochemistry double staining protocol were implemented. Images were taken using confocal laser scanning microscope and protein distribution was morphometrically analysed by line scanning to find-out the alterations of myopodin/SYNPO2 and α -actinin on muscle Z- lines. Paired student's t-test was used for analysis to compare a given time point to the basal value (T0), whilst an unpaired student's t-test was used for between groups analysis. **Results:** We observed a significant value (0.44 ± 0.07, p < 0.007) for between group (eccentric and concentric) for myopodin/SYNPO 2 for time (T4), as well as significant value (0.50 ± 0.25, p < 0.034) between time (T0 and T4) for eccentric training on myopodin/SYNPO 2. Also, we observed a significant value (0.69 ± 0.09, p < 0.013) between group (eccentric and concentric) for Z-line for time (T3). The results show that myopodin/SYNPO 2 is more restricted or distributed in the Z-line region. Also, it could be that the compression of Z-line at time (T3) led to a higher signal at the reducing ratio of α -actinin for both eccentric and concentric training, which depends on the time and type of training in a dose-response manner.

Conclusion: Long-term exposure of resistance training, especially eccentric type, affects Z-lines (myopodin/SYNPO 2 and α -actinin) proteins functional architecture and structure against myofibrillar stress.

1844 Board #8 May 28 1:30 PM - 3:30 PM
Characterization Of Muscle Damage And Inflammation Following Repeated Maximal Eccentric Loading Of The Trunk

Anne Schraplau, Dominik Sonnenburg, Monique Wochatz, Tilman Engel, Anne Schomoeller, Lucie Risch, Hannes Kaplick, Frank Mayer. *University of Potsdam, Potsdam, Germany.*
(No relevant relationships reported)

Eccentric exercises (ECC) induce reversible muscle damage, delayed-onset muscle soreness and an inflammatory reaction that is often followed by a systemic anti-inflammatory response. Thus, ECC might be beneficial for treatment of metabolic disorders which are frequently accompanied by a low-grade systemic inflammation. However, extent and time course of a systemic immune response after repeated ECC bouts are poorly characterized. **PURPOSE:** To analyze the (anti-)inflammatory response after repeated ECC loading of the trunk. **METHODS:** Ten healthy participants (33 ± 6 y; 173 ± 14 cm; 74 ± 16 kg) performed three isokinetic strength measurements of the trunk (concentric (CON), ECC1, ECC2, each 2 wks apart; flexion/extension, velocity 60°/s, 120s MVC). Pre- and 4, 24, 48, 72, 168h post-exercise, muscle soreness (numeric rating scale, NRS) was assessed and blood samples were taken and analyzed [Creatine kinase (CK), C-reactive protein (CRP), Interleukin-6 (IL-6), IL-10, Tumor necrosis factor- α (TNF- α)]. Statistics were done by Friedman's test with Dunn's post hoc test (α =.05). **RESULTS:** Mean peak torque was higher during ECC1 (319 ± 142 Nm) than during CON (268 ± 108 Nm; p<.05) and not different between ECC1 and ECC2 (297 ± 126 Nm; p>.05). Markers of muscle damage (peaks post-ECC1: NRS 48h, 4.4±2.9; CK 72h, 14407 ± 19991 U/l) were higher after ECC1 than after CON and ECC2 (p<.05). The responses over 72h (stated as Area under the Curve, AUC) were abolished after ECC2 compared to ECC1 (p<.05) indicating the presence of the repeated bout effect. CRP levels were not changed. IL-6 levels increased 2-fold post-ECC1 (pre: 0.5 ± 0.4 vs. 72h: 1.0 ± 0.8 pg/ml). The IL-6 response was enhanced after ECC1 (AUC 61 ± 37 pg/ml*72h) compared to CON (AUC 33 ± 31 pg/ml*72h; p<.05). After ECC2, the IL-6 response (AUC 43 ± 25 pg/ml*72h) remained lower than post-ECC1, but the difference was not statistically significant. Serum levels of TNF- α and of the anti-inflammatory cytokine IL-10 were below detection limits. Overall, markers of muscle damage and immune response showed high inter-individual variability. **CONCLUSION:** Despite maximal ECC loading of a large muscle group, no anti-inflammatory and just weak inflammatory responses were detected in healthy adults. Whether ECC elicits a different reaction in inflammatory clinical conditions is unclear.

D-13 Thematic Poster - RPE, Pain and Fatigue

Thursday, May 28, 2020, 1:30 PM - 3:30 PM
Room: CC-2011

1845 **Chair:** Aaron J. Stegner. *Univ. of Wisconsin, Madison, WI.*
(No relevant relationships reported)

1846 Board #1 May 28 1:30 PM - 3:30 PM
Perceived Exertion Is Elevated In Chronic Fatigue Syndrome And Fibromyalgia: A Meta-analysis Of Case-control Studies

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Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) and fibromyalgia (FM) are two debilitating, medically unexplained illnesses primarily characterized by fatigue and widespread musculoskeletal pain, respectively. Prior case-control studies suggest that perceived exertion (RPE) is elevated in ME/CFS and FM, however, other studies have found that RPE responses to exercise do not differ between patients and healthy controls. We used a meta-analytic approach to quantify the effect of exercise on RPE in ME/CFS and FM. **Purpose:** Quantify the population effect of acute aerobic exercise on RPE in ME/CFS and FM. **Methods:** We conducted a meta-analysis of case-control studies involving ME/CFS and FM patients that reported RPE responses

to acute aerobic exercise. Articles published prior to June, 2018 were located with searches of PubMed, Scopus/Embase, CINAHL, and CENTRAL. To be included in the final analysis, studies also had to report data on heart rate (HR) responses to exercise for patients and controls. Hedges' *d* effect sizes for RPE and HR were calculated and aggregated using random effects models. **Results:** Forty effects were extracted from 36 studies involving 971 patients (age = 42.2±6.1; BMI = 25.2±1.8; percent female = 77.8±23.1) and 762 healthy controls (age = 40±6.3; BMI = 24.7±1.4; percent female = 74.4±25). We observed a large ($d=0.84$; 95% CI: 0.61, 1.07), significant ($p<0.001$), and heterogenous ($I^2=78.8$) effect indicating that RPE responses to exercise were higher in patients than controls. We also found a small ($d=-0.42$; 95% CI: -0.58, -0.26), but significant ($p<0.001$) effect indicating lower HR responses in patients than controls. **Conclusion:** RPE is elevated in ME/CFS and FM despite potentially lower physical exertion than healthy controls during exercise. This finding warrants further investigation to determine if RPE responses to exercise can provide insight into pathophysiological mechanisms of these illnesses. Future work may include exploring the strength of association between exercised-induced changes in RPE and physiological outcomes as well as experimentally manipulating RPE responses to exercise using methods such as pharmacological blockade or transcranial magnetic stimulation. **Jacob Lindheimer was supported by Department of Veterans Affairs grant: IK2-CX001679**

1847 Board #2 May 28 1:30 PM - 3:30 PM
A Novel Role Of ASICs In Immediate Exercise-Induced Pain And Exercise Performance

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INTRODUCTION: Exercise training is an effective therapy for many pain-related conditions, and there is a difference in pain perception between athletes and unconditioned people. The mechanisms by which exercise modulates pain are poorly understood. Painful conditions can be associated with elevated levels of protons, metabolites and inflammatory factors, which can activate receptors and/or ion channels on nociceptive sensory neurons including acid sensing ion channels (ASICs) and transient receptor potential cation channel subfamily V member 1 (TRPV1). Additionally, strenuous exercise also causes the release of similar chemical signals, and ASICs within muscle afferents may mediate immediate exercise-induced pain (IEP) and fatigue, as well as reflex hemodynamic changes. We hypothesized that ASICs and TRPV1 have role in IEP and maximal exercise performance. **METHOD:** First, C57BL/6 mice were divided into sedentary (SED), low-intensity continuous training (LICT) and high-intensity interval training (HIIT) groups. Mice were trained on a treadmill every other day for 4 weeks. SED mice were placed on a non-moving treadmill for similar periods of time. After 4 weeks, exercise performance, ASICs and TRPV1 mRNA levels within lumbar dorsal root ganglion (DRG) were measured. In a separate group, we measured IEP at baseline and following exhaustive exercise before and after HIIT. In a third study, we compared the IEP and exercise performance in ASIC3^{-/-} versus wild type (WT) mice. **RESULTS:** We found HIIT improved exercise performance compared to LICT and sedentary groups, diminished ASICs and TRPV1 mRNA levels in lumbar DRG, and reduced IEP. We also found a negative relationship between mRNA levels of ASICs and TRPV1 and exercise performance ($r = -0.59$, $p < 0.001$). In addition, ASIC3^{-/-} showed a significant lower IEP compared to WT mice, while there was no difference in maximal exercise performance between groups. **CONCLUSION:** In summary, ASIC3 is required for IEP following exhaustive exercise, and exercise training downregulates ASICs and TRPV1 in muscle afferents and diminishes IEP. These findings suggest a possible role of ASICs in benefits of exercise training for many pain and fatigue conditions such as fibromyalgia and chronic fatigue syndrome conditions. Supported by Department of Veteran Affairs.

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1848 Board #3 May 28 1:30 PM - 3:30 PM
Pain Modulation Is Associated With Moderate Physical Activity In Gulf War Veterans With Chronic Pain

Stephanie M. Van Riper¹, Aaron J. Stegner¹, Jacob V. Ninneman¹, Alexander Boruch¹, Jacob B. Lindheimer², Ryan J. Dougherty¹, Neda E. Almassi¹, Laura D. Ellingson, FACS³, Patrick J. O'Connor, FACS⁴, Dane B. Cook, FACS⁵. ¹University of Wisconsin - Madison, Madison, WI. ²William S. Middleton Veterans Memorial Hospital, Madison, WI. ³Western Oregon University, Monmouth, OR. ⁴University of Georgia, Athens, GA. Email: svanriper@wisc.edu
 (No relevant relationships reported)

Veterans of the Persian Gulf War (GV) suffer unresolved widespread chronic musculoskeletal pain (CMP) that significantly impacts their functional ability and quality of life. Pain modulation is impaired in some groups with CMP and can be augmented with acute exercise. Further, we have shown that physical activity behaviors in women with fibromyalgia are positively associated with pain modulation. Whether this relationship occurs in GV with CMP is unknown. **PURPOSE:** To examine the relationships between self-reported and accelerometer measures of physical activity and pain modulation in GV with CMP. **METHODS:** Sixty-eight GV with CMP were recruited and 55 completed physical activity assessments that included completing the International Physical Activity Questionnaire and wearing an Actigraph accelerometer for one week. Psychophysical pain testing was used to assess pain modulation. Painful heat stimuli were delivered alone and during completion of a distracting cognitive task, the Stroop Color and Word Test. Participants rated pain intensity and unpleasantness using Gracely Box Scales (0-20). Multiple linear regression analyses were used to determine whether physical activity significantly predicted pain responses during the distracting cognitive task while controlling for age (years), body mass index (BMI), pain symptom severity (McGill Pain Questionnaire), and mood (Profile of Mood States). **RESULTS:** Forty-three GV with CMP were included in the analyses (age = 50.0 (SD 6.7) years; weight = 100.7 (SD 37.2) kg; height = 1.7 meters (SD 8.3); Average Widespread Pain Index scores = 7.0 (SD 3.3)). Moderate physical activity ($\beta=-0.45$), based on accelerometer measurements, was a significant predictor of pain responses during distraction ($F(5, 37) = 2.572$, $p < 0.05$); adjusted $R^2 = 0.16$. Relevant covariates (age, BMI, mood and pain symptom severity) were not significant predictors of pain ratings. Self-reported physical activity ($\beta=-0.08$) was not a significant predictor of pain responses during distraction ($F(5, 45) = 1.298$, $p > 0.05$). **CONCLUSION:** These results suggest that being physically active may help to maintain pain regulatory mechanisms in GV with CMP, but the strength of the relationship was weak and requires further research. Supported by US Department of Veterans Affairs grant #01CX000383.

1849 Board #4 May 28 1:30 PM - 3:30 PM
Acute Exercise Increases Pain Threshold And Subjective Psychoactive Mood State

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 (No relevant relationships reported)

Prescription pain medication can be addictive and have long-term health consequences. Alternative pain-relieving strategies are becoming increasingly sought after. Exercise is known to have a pain-relieving effect which is thought to be mediated through the dopaminergic system. **PURPOSE:** To examine the relationships between minimum pain threshold (MPT), exercise blood lactate (EBL), and the self-reported psychoactive effects of exercise based on questions from the Morphine-Benzedrine Group, Morphine and Excitement subscales of the Addiction Research Center Inventory (ARCI) following acute exercise in college aged students. **METHODS:** Twelve college aged students (age = 20.9 ± 0.5yr) underwent 5 minutes of light leg cycling as a warmup. Following the warmup, they cycled for 20 minutes at 8 METS with an additional 5-minute cooldown. Measurements were taken prior to exercise and just before the cool down. EBL was collected as a measure of relative exercise intensity. The MPT was measured using a Wagner "Pain Test" algometer on the extensor carpi radialis. Results were assessed using a Student's T-Test. **RESULTS:** Following exercise the MPT was increased by 62.1% ± 2.8 ($P<0.001$). Women had a greater increase in MPT (25.7 ± 9.1%) relative to men (15.8 ± 9.4%; $P<0.05$). EBL increased from an average of 1.8 ± 0.6 mmol/L at baseline to 4.1 ± 0.7 mmol/L following exercise ($P<0.01$). There was a positive linear correlation between MPT and EBL ($r^2=0.59$; $P<0.05$). Indicating greater EBL levels were related to increased MPT. Positive responses from the ARCI subscale increased by 27 ± 3.3% following exercise ($P<0.05$). There was no effect of sex nor EBL on positive responses on the ARCI. **CONCLUSIONS:** These data suggest moderate intensity exercise can increase MPT and to a greater extent in women. Further, MPT correlated with increased EBL indicating that greater relative exercise intensity may modulate a greater increase

MPT. Moderate intensity exercise increased positive responses on the ARCI providing evidence that the dopaminergic system may drive changes to MPT. However, positive responses did not correlate to EBL which may suggest another variable may augment pain reduction with increased exercise intensity.

1850 Board #5 May 28 1:30 PM - 3:30 PM
Towards Standardized Instructions For Measuring Perception Of Effort And Muscle Pain During Physical Exercise

Benjamin Pageaux¹, Pierre Clos², Franco Impellizzeri³, Michel Audiffren⁴, Paul Stapley⁵, Vincent Grémeaux⁶, Stéphane Perrey⁷, Patrick J. O'Connor, FACSM⁸, Samuele M. Marcora⁹, Romuald Lepers², Davy Laroche¹⁰. ¹Université de Montréal, Montreal, QC, Canada. ²Université de Bourgogne, Dijon, France. ³University of Technology Sydney, Sydney, Australia. ⁴Université de Poitiers, Poitiers, France. ⁵University of Wollongong, Wollongong, Australia. ⁶Université de Lausanne, Lausanne, Switzerland. ⁷Université de Montpellier, Montpellier, France. ⁸University of Georgia, Athens, GA. ⁹University of Bologna, Bologna, Italy. ¹⁰CHU Dijon-Bourgogne, Dijon, France. (Sponsor: Patrick J O'Connor, FACSM) Email: benjamin.pageaux@umontreal.ca (No relevant relationships reported)

PURPOSE: Perceptions of effort (PE) and muscle pain (MP) influence performance and engagement in regular physical exercise. Literature-based standardized instructions describe PE as resulting from multiple sensory cues including "aches". This description of PE creates a possible confound when PE and MP are being considered separately. This project uses standardised, confound-free instructions and tests their validity during cycling exercise.

METHODS: After removing confounding factors from PE's instructions (Borg, 1998), we used The Borg CR Scales® Folder (Borg, 2008) to adapt these instructions to the CR100 scale®. MP was measured with instructions available from Cook et al. 1997 and adapted to the CR100 scale®. For availability in English and French, the instructions were translated and back-translated following standardised procedure. Semantic validity was confirmed by bilingual participants (N = 8) during pilot testing. Then, twenty-two participants visited the laboratory thrice. During the first visit, participants performed an incremental test to exhaustion to determine their cycling peak power output (PPO). During both visits 2 and 3 (randomized order), subjects performed four 1 min cycling bouts at 4 workloads (40, 60, 80, 100% PPO) twice. The bouts were separated by either 15 min of rest or a time to exhaustion test at 80% PPO. PE and quadriceps MP intensity were assessed during each exercise. Differences were tested using Friedman tests on the values reported at each workload and the change scores between workloads.

RESULTS: During the incremental test, changes in PE and MP in response to changes in workloads were dissociated only for power outputs below 50% PPO (P < 0.001). During the 1 min cycling bouts, changes in PE and MP in response to changes in workloads were dissociated (P < 0.001). Following completion of the time to exhaustion test, PE and MP increased (P < 0.001). During each exercise, PE was higher than MP (~10 a.u., P < 0.001).

CONCLUSION: The observed difference in the intensity of PE and MP, as well as their response to changes in workload provide experimental support in favour of the use of confound-free instructions to monitor PE and MP during cycling exercise. Future studies should test this possibility for other exercise modalities involving similar and other muscle groups.

1851 Board #6 May 28 1:30 PM - 3:30 PM
SEX DIFFERENCES IN PAIN SENSITIVITY ARE ELIMINATED WHEN NORMALIZED TO LIMB SPECIFIC LEAN MASS

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Women are more sensitive to pressure pain threshold testing compared to men, however the underlying mechanism(s) that explain these differences have not been fully elucidated. Pain sensitivity has been shown to be influenced by BMI, but less is understood when examining the role of limb specific fat and lean mass on pain sensitivity. **PURPOSE:** To examine how fat mass and lean mass influence pressure pain sensitivity in men and women. **METHODS:** Pressure pain thresholds (PPT) of 102 participants (50 female) were assessed in the vastus lateralis (VL) and brachioradialis (BR) using a pressure algometer on the left (L) and right (R) sides of the body. Whole body and limb specific fat and lean tissue were assessed via DXA scan. **RESULTS:** Women had higher percent body fat (32.3% ± 9.2 vs 20.1% ± 9.2,

P<0.001), absolute total body fat (21.4kg ± 9.9 vs 16.9kg ± 9.9, P=0.02), and had less lean mass (41.1kg ± 5.5 vs 62.4kg ± 8.9; P<0.001) than their male counterparts. Limb specific sex differences were also seen in both fat mass and lean mass in the R-BR (fat: 199.7g ± 125.6 vs 148.1g ± 100.4, P=0.02; lean: 770.1g ± 180.5 vs 1355.4 ± 319.5; P<0.001), L-BR(fat: 202.3g ± 110.4 vs 150.9g ± 113.6, P=0.02; lean: 736.1g ± 180.6 vs 1308.9 ± 318.2; P<0.001), R-VL (fat: 3732.3 ± 1600.5 vs 2601.9 ± 1360.2, P<0.001; lean: 4755.9 ± 839.0 vs 7261.4g ± 1243.8; P<0.001), and L-VL (fat: 3595g ± 1505.3 vs 2379.6g ± 1156.6, P<0.001; lean: 4574.5g ± 1000.3 vs 7154.8g ± 1239.1; P<0.001). Women had lower PPT's in the R-BR (321.9 ± 128.9 vs 466.2 ± 220.3, P<0.001), L-BR (308.6 ± 114.1 vs 444.5 ± 229.9, P<0.001), R-VL (460.4 ± 166.2 vs 677.5 ± 254.9, P<0.001) and L-VL (433.5 ± 156.6 vs 646.1 ± 262.5, P<0.001) when compared to men. When normalized to site specific lean mass PPT's, no differences were seen in any of the measured sites (R- BR; P = 0.15, L-BR; P = 0.15, R-VL; P=0.55, L-VL; P=0.31). However, when normalized to fat mass, the sex differences remained (R-BR; P<0.001, L-BR; P<0.001, R-VL; P<0.001, L-VL; P<0.001). **CONCLUSION:** When PPT's were normalized to lean mass, sex differences disappeared; however the sex differences remained when PPT's were normalized to fat mass. This finding suggests that having less lean mass may play a role in increased pain sensitivity and could indicate why women are more sensitive to pain compared to males.

1852 Board #7 May 28 1:30 PM - 3:30 PM
Effects Of Pre-induced Fatigue Vs. Concurrent Pain On Neuromuscular Performance Of Locomotor Muscles

Jenny Zhang¹, Danilo Iannetta¹, Giorio Varesco², Guillaume Y. Millet², Saied J. Aboodarda¹. ¹University of Calgary, Calgary, AB, Canada. ²Jean Monnet University, Saint-Étienne, France. Email: mu.zhang@ucalgary.ca (No relevant relationships reported)

Fatigue and muscle pain perceived during high-intensity exercise has long been implicated in attenuation of exercise tolerance, but the influence of these perceptual responses on regulation of neuromuscular performance during exercise is unknown.

PURPOSE: To examine the effects of pre-induced fatigue and concurrent rising pain (evoked by muscle ischemia) in one leg on motor fatigability and corticospinal excitability and inhibition of the contralateral leg. **METHODS:** Twelve healthy males(mean±SD; age: 27±4 yrs) undertook four experimental protocols including unilateral cycling to task failure at 80% of peak power output with i) the right-leg (RL), ii) the left-leg (LL), iii) RL immediately preceded by LL protocol (FAT-RL), and (iv) RL while blood flow was occluded in the contralateral (left) leg (PAIN-RL). The single-leg cycling exercise and neuromuscular assessments were carried out on a validated custom-built recumbent cycle ergometer that facilitates post-fatigue assessments within 1 second. Participants performed maximal and submaximal 5-s right-leg knee extensions, during which transcranial magnetic and femoral nerve electrical stimuli were delivered to elicit motor evoked potentials (MEP) and compound muscle action potentials (Mmax), respectively. **RESULTS:** Pre-induced fatigue reduced the right leg cycling time-to-task failure (332±137 s) to a greater extent than concurrent pain (460±158 s), compared to RL (580±226 s) (p<0.001). The maximal voluntary contraction (MVC) force declined less following FAT-RL (p<0.019) and PAIN-RL (p<0.032), compared to the RL. Voluntary activation declined, and the corticospinal excitability recorded from knee extensors increased similarly following the three conditions(p<0.05). However, the pre-induced fatigue, but not concurrent rising pain, reduced corticospinal inhibition compared to RL (p<0.05). **CONCLUSIONS:** These findings suggest that regardless of the origin or mechanisms modulating sensory group III/IV afferents (i.e. pre-induced fatigue vs. concurrent rising pain), the limit of exercise tolerance remains the same and exercise will be terminated upon achievement of sensory tolerance limit. The inhibitory neural feedback evoked by the two interventions however may have distinctive effects on corticospinal inhibition.

1853 Board #8 May 28 1:30 PM - 3:30 PM
The Influence Of Physical Activity On Pain Sensitivity In Gulf War Veterans With Chronic Pain

Jacob V. Ninneman¹, Aaron J. Stegner¹, Jacob B. Lindheimer¹, Neda E. Almassi¹, Stephanie M. Van Riper¹, Nicholas P. Gretzon¹, Alex E. Boruch¹, Ryan J. Dougherty¹, Laura B. Ellingson, FACSM², Patrick J. O'Connor, FACSM³, Dane B. Cook, FACSM⁴. ¹UW-Madison, Madison, WI. ²Western Oregon University, Monmouth, OR. ³University of Georgia, Athens, GA. ⁴William S. Middleton Memorial Veterans Hospital, Madison, WI. (Sponsor: Dane B. Cook, FACSM) Email: jninneman@wisc.edu (No relevant relationships reported)

Physical activity improves quality of life and decreases symptoms in chronic pain. Data from our lab and others have demonstrated increases in pain sensitivity following acute exercise in chronic pain. Conversely, regular physical activity is associated with lower pain sensitivity and greater pain modulation in civilians with chronic pain. Whether this same relationship occurs in Gulf War Veterans (GV) with chronic

widespread musculoskeletal pain (CMP) is unknown. **PURPOSE:** To determine the relationship between physical activity and pain sensitivity in GV with CMP. **METHOD:** GV (n=68) were recruited from south central WI as part of a 16-week exercise training trial and 55 completed baseline assessments that included physical activity and pain sensitivity measurements. Physical activity was measured using both self-report (International Physical Activity Questionnaire) and accelerometer (ActiGraph GTX) methods. Experimental pain testing consisted of three levels of noxious heat (45, 47, and 48.9°C), each presented five times. Ratings of pain intensity and unpleasantness were obtained following each stimulus using Gracely Box Scales (0-20). Multiple linear regression was used to determine whether self-reported and/or accelerometer measures of physical activity predicted pain ratings controlling for age (years), body mass index, and disease severity (Widespread Pain Index (WPI)). **RESULTS:** Forty-two GV with CMP were included in the analyses (age = 50.5 (SD 6.9) years; weight = 101.6 (SD 40.9) kg; height = 1.74 meters (SD 8); Average WPI = 7.5 (SD 3.2)). Neither self-reported ($\beta = 0$) nor accelerometer-based ($\beta = -0.02$) measures of moderate-to-vigorous physical activity (IPAQ: 505.25 (559.1); GTX: 70.6 (40.9)) significantly ($p > 0.05$) predicted either pain intensity or unpleasantness. Disease severity ($\beta = 0.46$), and age ($\beta = 0.23$) were significant ($p < 0.05$) predictors of unpleasantness but not intensity (Model $p = 0.02$, adjusted $R^2 = 0.19$). **CONCLUSION:** These results suggest that physical activity does not affect the sensitivity of the nociceptive system to painful heat in GV with CMP. Future research examining different pain modalities and/or physical activity interventions may better clarify the associations between physical activity and CMP. Supported by Dept. of Veterans Affairs grant: IO1-CX000383.

D-14 Thematic Poster - Sleep

Thursday, May 28, 2020, 1:30 PM - 3:30 PM
Room: CC-2000

1854 Chair: Scott R. Collier, FACSM. *Appalachian State University, Boone, NC.*
(No relevant relationships reported)

1855 Board #1 May 28 1:30 PM - 3:30 PM
The Relationship Between Changes In Sleep, Inflammatory Biomarkers, And Energy Expenditure In Female Soccer Players
 Brittany N. Bozzini, Bridget A. McFadden, Harry P. Cintineo, Alexa J. Chandler, Michelle A. Arent, Shawn M. Arent, FACSM. *University of South Carolina, Columbia, SC.*
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(No relevant relationships reported)

The chronic stress of training and frequent travel during the competitive soccer season may adversely affect sleep and thus, recovery in collegiate athletes. **PURPOSE:** To examine the relationship between changes in sleep, inflammatory biomarkers, and exercise energy expenditure (EEE) throughout the season. **METHODS:** DI female soccer players (N=24) were monitored throughout the competitive season. During all training and games, EEE (kcal/kg) was evaluated using an integrative GPS and heart rate monitoring system, which was individualized based on pre-season performance testing. Pittsburgh Sleep Quality Index (PSQI) questionnaires, weight assessments, and blood draws were completed prior to pre-season and at weeks 2, 4, 8, & 12 of the season. Total cortisol (TCORT), free cortisol (FCORT), c-reactive protein (CRP), IL-6, and TNF α were analyzed. Change scores were calculated between timepoints for each biomarker, GlobalPSQI, Sleep Duration (SD), and Sleep Quality (SQ) scores. Pearson product correlations were conducted between change scores as well as EEE_{AVG} between timepoints with significance set at $p < .05$. **RESULTS:** Δ GlobalPSQI was not related to any measures, except Δ SD and Δ SQ ($r = .39, r = .51; p < .05$). Δ SD and Δ SQ were both significantly correlated to Δ IL-6 ($r = -.21, r = -.23; p < .05$). Δ IL-6 was positively correlated to Δ CRP ($r = .32, p < .05$), Δ TNF α ($r = .43, p < .05$), and Δ FCORT ($r = .26, p < .05$). Δ CRP was also significantly related to Δ TCORT ($r = .24, p < .05$). EEE_{AVG} was not associated with any measures ($p > .05$). **CONCLUSIONS:** There appears to be a relationship, albeit weak, between sleep measures and IL-6, with increased SD and SQ (i.e. decreased PSQI score) related to increases in IL-6. Additionally, increased IL-6 was associated with increases in other proinflammatory and stress markers, potentially indicative of fuel mobilization and physiological repair responses. The cumulative load of the competitive season could indicate an increased need for recovery, thus yielding compensatory increases in SD and perceived SQ. Further research is warranted using objective sleep measures to examine the observed relationship in soccer players. Funding provided by Quest Diagnostics

1856 Board #2 May 28 1:30 PM - 3:30 PM
Exploration Of Sleep Quality And Mood States During Varied Training Period In Collegiate Triathletes
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(No relevant relationships reported)

PURPOSE: To evaluate the periodic changes in fatigue state, sleep quality, and mood states in response to different training periods in collegiate triathletes. **METHODS:** Thirteen collegiate triathletes with supervised regular periodic training program (age: 18-25 yrs) voluntarily participated in this study. During the period of study, the standardized training logs and diary were provided by their coach, and the training load/volume, Profile of Mood Sates questionnaire (POMS), Epworth Sleepiness Scale (ESS), and Pittsburgh Sleep Quality Index (PSQI) were used to periodically to measure and record the changes of our outcome measurements from 3 months in prior to the primary national triathlon competition (total investigating duration: 3.5 months). **RESULTS:** The monthly training volume gradually increased from 825 to 1176 min in one-month (peaked value) before competition and decreased to 786 min in 2-weeks before the competition. However, the sleep quality (PSQI and ESS) did not show any difference among different training periods. The overall PMOS score exhibited no difference across varied training periods. However, the sub-elements of POMS in depression/dejection and fatigue/inertia were peaked in one-month before the national competition ($p < .05$), and the tension/anxiety element was significantly increased by 4-folds above baseline in 2-weeks before the competition ($p < .05$). **CONCLUSIONS:** We demonstrate that the sleep quality was not affected during different training period. However, the depression/dejection, fatigue/inertia, and tension/anxiety appear to react differently in different timing patterns in response to varied training periods in these collegiate athletes. Our study may provide the evidence primarily focusing on the student collegiate triathletes, which would be important for coaches to closely monitor the timing of mood states changing across different training periods to achieve better training outcomes.

1857 Board #3 May 28 1:30 PM - 3:30 PM
Self-reported, Sleep Behaviors And Barriers Of Adolescent Athletes
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Reported Relationships: M.L. Anderson: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..

BACKGROUND: Many adolescent athletes fail to meet sleep duration recommendations, however little is known about self-reported barriers preventing adequate sleep. **PURPOSE:** To investigate current and ideal sleep behaviors, as well as barriers to sleep in a group of adolescent athletes. **METHODS:** Adolescent athletes (n = 258, 16.3 ± 1.4 y; 196 male, 62 female) from 8 sports completed a standardized electronic survey regarding sleep behaviors and perceived barriers to sleep. The survey assessed current and ideal sleep onset, offset, and duration. Athletes were presented a list of common pre-bed activities and asked if they ever engaged in each activity in the hour prior to bed. Similarly, a list of potential barriers to falling asleep once in bed were presented. Frequency of all barriers (nights per week) was assessed. Comparisons between ideal and current behaviors were made using ANOVA and t-tests as appropriate. Barriers were ranked to identify which were most responsible for impacting sleep behaviors. Normally and non-normally distributed data are presented as mean ± SD, and mean with associated 95% confidence interval [95% CI], respectively. **RESULTS:** Significant differences were found between ideal (9:24 ± 1:18 (h:min)) and school night (8:14 ± 1:43), ideal and non-school night (9:56 ± 1:57), and school and non-school night sleep durations ($p < 0.05$). The most frequent pre-bed activities were: engaging in social media (5.6 nights per week, 95% CI [5.3,5.9]), communication with others using technology (4.9 [4.6,5.2]), and socializing (4.9 [4.6,5.2]). School work (3.0 [2.7,3.2]) was the most cited barrier to getting into bed at the desired time, followed by engaging with social media (2.6 [2.2,2.9]) and communicating using technology (2.1 [1.8,2.4]). Once in bed, worrying about school work (1.5 [1.2,1.7]) and worrying about sport (1.4 [1.1,1.7]) were the two most cited barriers to falling asleep. **CONCLUSION:** Discrepancies exist between actual and desired sleep duration with athletes preferring to obtain more sleep on school nights. School work as well as the use of technology are top barriers preventing adolescent athletes from achieving their ideal bedtime. Focus should be placed on behavior change strategies, including time management, to overcome these known barriers to sleep.

1858 Board #4 May 28 1:30 PM - 3:30 PM
The Effect Of Nap Duration On Sleep Inertia, Muscle Strength, And 3-km Cycling Time Trial Performance
 Angela Petretta, Nicholas Thomas, Michael Saunders, FACSM, Trent Hargens, FACSM, Nicholas Luden. *James Madison University, Harrisonburg, VA.* (Sponsor: Michael Saunders, FACSM)
 (No relevant relationships reported)

PURPOSE: To determine the impact of napping (15-min and 30-min) on sleep inertia, peak muscle strength, and 3-km cycling time trial performance. **METHODS:** Six recreationally-trained college-aged participants (Age, 22 ± 1 y; VO_{2max} , 43 ± 12 ml·kg⁻¹·min⁻¹) completed a familiarization- and 3 experimental trials in the afternoon. Following a night of modest sleep restriction (range: 4.6-5.8 h), participants underwent exercise testing without a nap and following 15-min (Nap15) and 30-min (Nap30) naps. Peak isokinetic leg extension force (120 deg·sec⁻¹) and computer-simulated 3-km cycling time trial (TT) performance were assessed 30 min after napping. Sleep inertia was quantified using the Karolinska Sleepiness Scale and the Tower of London cognitive task before and after each nap. Repeated measures ANOVAs were used to assess differences in peak strength and 3-km TT performance between conditions, while a 3 x 2 (nap condition by time) repeated measures ANOVA was used to assess sleep inertia. **RESULTS:** 3-km TT power output was similar across conditions (no-nap = 212 ± 84 W, Nap15 = 208 ± 95 W; Nap30 = 213 ± 95 W). Though peak strength following Nap30 was not statistically lower than no-nap ($p = 0.12$), peak strength was $8.0 \pm 0.8\%$ lower in Nap30 compared to Nap15 ($p < 0.05$). Sleep inertia was similar across conditions. **CONCLUSION:** These data suggest that napping prior to competition will not improve performance but rather may impair peak power-oriented activities. Data should be gathered to assess the impact of longer duration napping and the potential performance benefits of napping following more severe sleep restriction.

1859 Board #5 May 28 1:30 PM - 3:30 PM
Sleep And Prior Exercise Influence Wingate Performance - Should These Be Controlled When Assessing Anaerobic Performance?
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 (No relevant relationships reported)

A variety of factors can influence anaerobic performance, including time of day, training status, fatigue, sleep duration and quality, psychological state, hydration, and food intake. These variables may interact to influence performance. **PURPOSE:** To compare anaerobic performance in individuals across three time periods of the day (morning, afternoon, and evening), and determine if sleep and/or prior exercise influence performance. **METHODS:** Ten healthy, physically active adults were recruited to do three 30-second Wingate tests: Morning (6:00am to 11:59am), afternoon (12:00pm to 4:59pm), and evening (5:00pm to 9:00pm). The order of tests was randomized and all testing was completed over one week. Prior to each test, subjects were provided similar instructions, and they completed pre-test questionnaires evaluating the duration of sleep the previous night and whether they abstained from strenuous exercise during the past 24 hours. Standard 30-second Wingate parameters were collected during each trial. Repeated measures ANOVA examined performance across each time period. **RESULTS:** All subjects completed the three testing protocols. There was no main effect of time of day on peak power ($p=0.989$). When subjects were grouped based on prior strenuous exercise there was a trend for significance in peak power ($p=0.070$) and a significant change in maximum speed ($p=0.039$). Those who abstained from strenuous exercise had higher peak power (32.7% improvement) and maximum speed (21.5% improvement). When subjects were grouped based on sleep, similar results were observed: those who slept at least seven hours had higher peak power (17.6% improvement; $p=0.055$) and higher maximum speed (15.7% improvement; $p=0.036$). **CONCLUSION:** Pre-screening questions or guidelines for sleep and activity may be important to control when examining anaerobic performance. When subjects abstain from strenuous exercise and get adequate sleep they demonstrate improved Wingate performance.

1860 Board #6 May 28 1:30 PM - 3:30 PM
Stretching And Meditation Improve Heart Rate Variability, Positive Feelings, And Quality Sleep In Active Adults.
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 (No relevant relationships reported)

Physical and mental health is a prevailing research topic as adults balance the demands of daily life. One strategy to maintain wellbeing is to adhere to a physical activity routine. Countless studies have demonstrated that regular exercise increases fitness and decreases depression. Therefore, recent investigations focus on protocols to easily measure the effectiveness of specific programs to maximize benefits. Heart rate variability (HRV) is an example of a noninvasive variable that provides insight about cardiovascular health and recovery. Stretching and meditation are two practices that past research has demonstrated increase HRV. **PURPOSE:** To evaluate if a fusion of stretching and meditation improves heart rate variability, positive feelings, and quality sleep in active adults. Our hypothesis is that performing a sequence of stretches (20-30 minutes) with subsequent meditation (10 minutes) three nights per week will enhance recovery (higher HRV) in addition to induce positive feelings and quality sleep. **METHODS:** Sixty-six adults between 24-67 years who regularly exercised at least five hours per week, without stretching or meditation, collected their morning heart rate and exercise heart rate with a chest transmitter for two weeks. Next, we assigned (age and activity matched) half the participants to an experimental stretching and meditation protocol three nights per week. Both groups continued the heart rate collection for another two weeks. Each participant also completed a weekly survey with questions addressing their satisfaction with life, physical as well as mental feelings, and quality of sleep. **RESULTS:** In the experimental group, heart rate variability, positive feelings (confidence, motivation), and quality sleep were significantly greater during the second two weeks while resting heart rate and negative feelings (sadness, anxiety) were significantly less (all comparisons $p \leq 0.02$). To contrast, in the control group, there were no significant differences between the measurement weeks. **CONCLUSIONS:** Our data demonstrate that 30-40 minutes of stretching and meditation three nights per week can be an effective routine to enhance both physical and mental health in active adults.

1861 Board #7 May 28 1:30 PM - 3:30 PM
Differences In Sleep Quality In Elite Youth Athletes During And After The Competitive Season
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 (No relevant relationships reported)

PURPOSE: Our study investigated the differences in sleep architecture and health in and out of a competitive season. **METHODS:** Nine competitive youth athletes between the ages of 12 and 16 who compete for either the tumbling and trampoline team or the diving team were recruited for this study. Data was collected for 3 consecutive nights during the competition and for 3 consecutive nights during post season. Data was then analyzed using the Sleep Profiler™ scoring software. All data is expressed as Mean +/- SEM. **RESULTS:** Mean nocturnal pulse was statistically different from in season versus post season ($p = 0.049$, +/- ; 66.8 ± 9.6 bpm in season versus 61.7 ± 6.3 bpm post season). Sleep efficiency, WASO, and spindle duration were all not statistically different from in season to post season. Sleep latency, REM, and NREM sleep though not statistically different from in season to post season have a strong correlation. **CONCLUSION:** These data demonstrate a significant decline in mean heart rate when an athlete moves from competition season to the non-competitive season. These data show that gymnastic training in addition to competition training may lead to deleterious cardiovascular changes. Future studies should elucidate the impact and volume of training a youth athlete undertakes and the benefits and risks on physiological and psychological well-being.

1862 Board #8 May 28 1:30 PM - 3:30 PM
Increased Sleep Is Associated With Higher Maximal Aerobic Capacity In NCAA Division 1 Athletes
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(No relevant relationships reported)

Prior research regarding sleep and endurance performance has primarily focused on sleep deprivation or sleep restriction among sedentary or recreationally active individuals. Little is known about the effect of real-world sleep fluctuations on aerobic capacity and performance in elite athletes. **PURPOSE:** To determine the impact of sleep duration acutely and chronically on maximal aerobic capacity ($\dot{V}O_{2max}$) and ventilatory threshold (VT) in NCAA division 1 athletes.

METHODS: Over 2 years, 254 collegiate Division I varsity athletes from multiple sports (17-23 years old) performed incremental maximal exercise testing to determine $\dot{V}O_{2max}$ and VT. On the day of testing, participants reported sleep duration for the prior night and the average sleep duration for the prior month. Acute:chronic sleep was calculated as the ratio of prior night to prior month sleep. Variables were grouped by prior night and prior month sleep duration (<8 hours or \geq 8 hours/night) as well as acute:chronic (<1, \geq 1). $\dot{V}O_{2max}$ and VT were compared between groups using independent t-tests. Separate linear mixed effect models were used to evaluate the relationship between acute and acute:chronic sleep on $\dot{V}O_{2max}$ and VT, while adjusting for age and individual repeated measures.

RESULTS: Athletes who slept \geq 8 hours the night before the test had significantly higher $\dot{V}O_{2max}$ than those who slept <8 hours (53 ± 5.1 v 51.1 ± 6.8 ml/kg/min, $p=0.02$). Athletes who slept more than usual before the test (acute:chronic sleep \geq 1) had higher $\dot{V}O_{2max}$ (53 ± 5.9 v 50.8 ± 6.6 ml/kg/min, $p=0.01$) and VT (43.1 ± 5.4 v 39.4 ± 7 ml/kg/min, $p<0.01$) than those who slept less than usual. In the multivariable models, prior night sleep duration was predictive of $\dot{V}O_{2max}$ (1.0 ± 0.31 , $p<0.01$) and VT (0.91 ± 0.33 , $p=0.01$), and acute:chronic sleep was predictive of $\dot{V}O_{2max}$ (6.8 ± 2.2 , $p<0.01$) and VT (8.6 ± 2.3 , $p<0.01$).

CONCLUSIONS: Among collegiate NCAA division 1 athletes, increased sleep duration is associated with significantly greater $\dot{V}O_{2max}$ and VT, both of which are important predictors of athletic performance. In addition to the well-known and wide-ranging physical and mental benefits of sleep, interventions to increase sleep duration among elite athletes may improve endurance performance, and would support the NCAA's mission to promote the well-being and lifelong success of college athletes.

D-15 Free Communication/Slide - Exercise Training, Intensity and Fitness

Thursday, May 28, 2020, 1:30 PM - 3:30 PM
 Room: CC-3014

1863 **Chair:** Rachel A. Tinius. *Western Kentucky University, Bowling Green, KY.*
(No relevant relationships reported)

1864 May 28 1:30 PM - 1:45 PM
Muscular Strength Cut-points For Detection Of Type 2 Diabetes Risk In Apparently Healthy Adults
 Elise C. Brown¹, Duncan S. Buchan², Samar Madi¹, Breanne Gordon¹, Dorin Drignei¹. ¹*Oakland University, Rochester, MI.* ²*University of the West of Scotland, Lanarkshire, United Kingdom.*
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(No relevant relationships reported)

In the early stages of type 2 diabetes, patients are often asymptomatic. More screening tools are needed for early detection of diabetes in this increasing patient population. Low muscular strength is associated with increased diabetes risk, and use of handgrip dynamometers to determine normalized grip strength (NGS) may serve as a cost-effective diabetes screening tool for clinical and community settings.

PURPOSE: To establish sex- and age-specific NGS cut-points for estimating diabetes risk in apparently healthy adults.

METHODS: Publicly available National Health and Nutrition Examination Survey 2011-2012 and 2013-2014 data were used, and informed consent was obtained from all participants. Those aged 20-80 years who were free of underlying health conditions such as stroke, cardiovascular diseases, and cancer were retained ($n=4,451$ participants; 67.9% aged 20-50 years; young males, $n=1,609$, mean age= 33.39 [95% CI= $32.5, 34.3$] years; young females, $n=1,412$, mean age= 33.27 [95% CI= $32.3, 34.2$] years). Grip strength was assessed using a handgrip dynamometer, and normalized

by adjusting for body mass. Risk for diabetes was determined using the American Diabetes Association diagnostic criteria. A logistic regression for survey data controlling for sociodemographic, anthropometric, and lifestyle covariates was used to determine NGS cut-points.

RESULTS: NGS was a significant predictor for diabetes ($p=0.0472$), and the established cut-points for estimating diabetes risk was 0.76 (young men), 0.59 (young women), 0.62 (older men), and 0.47 (older women). When comparing estimated rates and actual diabetes risk, the risk percentages reported for all subgroups were similar. The risk percentages included 1.59 [95% CI= $0.76, 2.42$] (young men), 2.58 [95% CI= $1.64, 3.53$] (young women), 3.01 [95% CI= $0.44, 5.57$] (older men) and 2.03 [95% CI= $0.34, 3.73$] (older women).

CONCLUSIONS: NGS cut-points presented in this study may be a useful screening tool for estimating diabetes risk in apparently healthy adults, and these cut-points could be implemented in community and clinical settings for early diabetes detection.

1865 May 28 1:45 PM - 2:00 PM Utilizing Causal Pathway Analysis To Predict Change In Cardiorespiratory Fitness In The STRRIDE Randomized Trials

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(No relevant relationships reported)

Exploring high-throughput data in a causal pathway framework facilitates accurate and parsimonious multivariable predictive models for clinical outcomes. Developing these models elucidates mechanisms by which regular exercise elicits health benefits.

Purpose As a proof-of-concept, we tested the utility of causal pathway discovery for predicting changes in $\dot{V}O_{2peak}$ across the STRRIDE trials.

Methods A total of 532 adults from three STRRIDE studies were randomized to one of 7 exercise interventions, ranging from doses of 8-22 kcal/kg/week; intensities of 50-75% $\dot{V}O_{2peak}$; and durations of 6-9 months. Six groups included aerobic exercise, two included resistance training, and one included dietary intervention. Graded maximal exercise treadmill testing with expired gas analysis determined Absolute $\dot{V}O_{2peak}$. The Fast Causal Inference algorithm was applied to discover the mechanistic relationship among 231 clinical and transcriptomic variables with 200 bootstrap resamples to assess the stability of the discovered causal graph. To estimate effect sizes, $\dot{V}O_{2peak}$ was regressed on variables in its local causal neighborhood.

Results Forty-four variables were identified in the causal vicinity (within three edges away) of $\dot{V}O_{2peak}$ following exercise intervention in more than 50% of bootstrap resampling runs. Exercise intensity, age, and pre-training $\dot{V}O_{2peak}$ were identified as the direct causes of post-training $\dot{V}O_{2peak}$. Among the studied variables, none mediated the effect of exercise dose. The following exercise combinations were the most effective in changing $\dot{V}O_{2peak}$: high amount/vigorous intensity aerobic training ($\beta=0.39$ L/min); low amount/vigorous intensity aerobic plus resistance training ($\beta=0.33$ L/min); low amount/vigorous intensity aerobic training ($\beta=0.27$ L/min); high amount/moderate intensity aerobic training ($\beta=0.26$ L/min); low amount/moderate intensity aerobic training ($\beta=0.19$ L/min); and resistance training ($\beta=0.18$ L/min).

Conclusions Multivariable causal graph-based inference confirmed an exercise dose-response for $\dot{V}O_{2peak}$. As we develop and incorporate additional molecular data, our future research will use this approach to maximize predictive ability for other clinical phenotypes to help make personalized lifestyle medicine a functional reality.

1866 May 28 2:00 PM - 2:15 PM Evaluating Individual Training Adaptations With Heart Rate Variability Following High Intensity Functional Training

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Structured training programs fail to accommodate low and high responders. Training monitoring allows program changes to optimize outcomes. Monitoring heart rate variability (HRV) and its variance are thought to reflect the degree of individual adaptation and recovery to exercise training programs. However, it is unclear if HRV responses are indicative of change in aerobic capacity ($\dot{V}O_{2max}$) and strength in high intensity functional training (HIFT).

PURPOSE: To evaluate if increases in $\dot{V}O_{2max}$ and strength are related to differential changes in HRV following 6-weeks of HIFT. **METHODS:** Active men ($n=26$; age = 22.6 ± 4.3 years) and women ($n=29$; age = 23.7 ± 4.3 years) participated in six weeks (5 d \cdot week⁻¹) of HIFT. At baseline and posttest, $\dot{V}O_{2max}$ and one-repetition

maximum for squat, deadlift and overhead press were totaled (CFT) to serve as training outcomes. Daily HRV was measured upon waking via a smartphone photoplethysmography application throughout. **RESULTS:** VO_{2max} increased in two HRV response profiles while CFT increases occurred regardless of profile. There was a main effect for time in CFT ($p < .05$) but not for VO_{2max} ($p > .05$). There was a significant inverse relationship between ΔHRV and Δ coefficient of variance ($r = -0.46$, $p < .05$). No significant relationships between baseline HRV and ΔHRV ($r = -0.12$, $p > .05$), ΔCV ($r = 0.03$, $p > .05$), ΔVO_{2max} ($r = 0.21$, $p > .05$), or ΔCFT ($r = -0.01$, $p > .05$) were identified. The relationship scatterplot between ΔHRV and ΔCV was used to classify participants into four unique HRV response profiles, HRV_{up}/CV_{up} , HRV_{up}/CV_{dn} , HRV_{dn}/CV_{dn} , and HRV_{dn}/CV_{up} . One-way MANOVA with a Tukey post-hoc test revealed significant differences in ΔVO_{2max} ($F_{3,70.3} = 2.5$, $p < .05$) between HRV response profiles. HRV_{up}/CV_{dn} profile increased VO_{2max} compared to the HRV_{dn}/CV_{dn} profile (mean difference = 7.5%, 1.0-14.1%; $p < .05$). Further, VO_{2max} decreased in the HRV_{dn}/CV_{dn} profile compared to the HRV_{up}/CV_{up} profile (mean difference = -7.8%, -15.0-0.50%; $p < .05$). No significant difference was found for ΔCFT between HRV profiles ($p > .05$); all HRV profiles significantly increased CFT (mean difference = 32.78 \pm 6.97, $p < .05$). **CONCLUSION:** Improving multiple training outcomes is desired in HIFT, so a HRV_{dn}/CV_{dn} profile may indicate a decline in VO_{2max} . Thus, training should be altered to optimize aerobic adaptations.

1867 May 28 2:15 PM - 2:30 PM
Effects Of Amount, Intensity, And Mode Of Exercise Training On HOMA - The STRIDE Clinical Trials

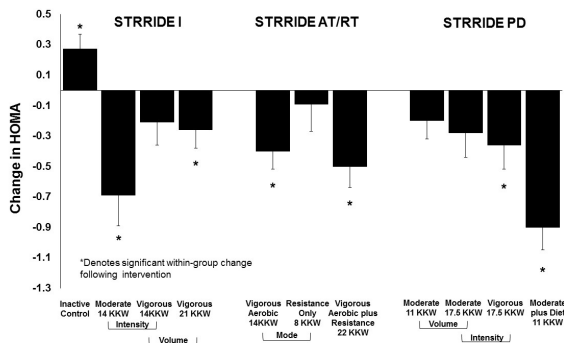
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Purpose. To examine the effects of amount, intensity, and mode of exercise training on HOMA (a marker of fasting insulin resistance) across 10 exercise-only interventions from the three STRIDE (Studies of Targeted Risk Reduction Interventions through Defined Exercise) clinical trials.

Methods. A total of 518 subjects completed the three trials with pre and post intervention HOMA values. Subjects with dyslipidemia [STRIDE I (n=224) and STRIDE AT/RT (n=144)] or prediabetes [STRIDE-PD (n=150)] were randomized to either control group or one of 10 interventions, ranging from doses of 8-22 kcal/kg/week (KKW); intensities of 50-75% VO_{2peak} ; and durations of 6-9 months. Two groups included resistance training and one group included diet intervention (weight loss of 7%). Fasting blood samples were obtained at baseline and 16-24 h after the final exercise bout. Paired t-tests determined within group change score significance ($p < .05$).

Results. In the inactive controls. HOMA increased significantly —became more insulin resistant. After training, all intervention groups became more insulin sensitive; 6 of these 10 groups had significant improvements in HOMA. In non-statistical comparisons across the trials, the diet + exercise group had the greatest improvement (-0.90 \pm 0.9); resistance training alone experienced the least improvement in HOMA. The 14 KKW moderate intensity (STRIDE I) and the aerobic + resistance training (STRIDE AT/RT) groups obtained 77% and 55% of the improvement observed in the diet + exercise group from STRIDE-PD. Only 4 of the 7 aerobic exercise groups had significant improvements.

Conclusion. On average, STRIDE interventions improved fasting insulin resistance. Adding resistance to aerobic training elicits an additive training effect on insulin resistance. In individuals with prediabetes, incorporating dietary intervention with aerobic training results in the most robust improvement in fasting insulin resistance.



1868 May 28 2:30 PM - 2:45 PM
Non-metabolic VCO₂ Recovery Off-kinetics, And Performance Fatigability Following Chronic Exercise

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 (No relevant relationships reported)

Purpose: This study characterized the role of non-metabolic expired carbon dioxide (nm-VCO₂) in the relationship between recovery and performance fatigability (PF). **Methods:** Twenty adults (men, n=9, age=44.7 \pm 13.9 years; women, n=11, age=50.3 \pm 11.1 years) completed peak cardiopulmonary exercise tests (CPET) and submaximal constant work rate tests (CWRT) on the cycle ergometer on separate days before and after a vigorous, 4-week aerobic exercise training (AET) regimen. Each test was followed by a 10-minute passive recovery and endurance test at 70% of peak watts attained during CPET. PF was indexed by endurance test duration following both peak CPET (End1) and CWRT (End2), peak CPET time (pk-Time) and watts (pk-Watts). Metabolic indices were total VCO₂ (tVCO₂), metabolic VCO₂ (m-VCO₂), nm-VCO₂, and recovery VO₂ and VCO₂ off-kinetics response indices (ORI). Data were analyzed using paired t-tests and correlations and compared before and after AET. **Results:** Significant improvements in recovery and PF measures were observed after AET, along with significant increases in tVCO₂ and nm-VCO₂. No significant change in m-VCO₂ was observed.

VO ₂ -off ORI (ml/min/s)	VCO ₂ -off ORI (ml/min/s)	End1 (s)	End2 (s)	pk-Time (s)	pk-Watts	tVCO ₂ (ml)	m-VCO ₂ (ml)	nm-VCO ₂ (ml)
7.48 \pm 7.52 p<0.001*	4.11 \pm 5.05 p<0.001*	265 \pm 337 p<0.01*	321 \pm 392 p<0.01*	63 \pm 40 p<0.001*	24 \pm 19 p<0.001*	1512 \pm 2225 p<0.01*	904 \pm 2255 p=0.089	608 \pm 666 p<0.001*

Relationships between measures of recovery and PF were observed, though the strength of the relationships were diminished (pk-Time, pk-Watts) or became non-significant (End1, End2) after controlling analyses for the effect of nm-VCO₂.

	End1	End2	pk-Time	pk-Watts
VO ₂ -off ORI	-0.307 (p=0.058)	-0.300 (p=0.067)	-0.714 (p<0.001*)	-0.755 (p<0.001*)
VCO ₂ -off ORI	-0.236 (p=0.149)	-0.151 (p=0.365)	-0.647 (p<0.001*)	-0.698 (p<0.001*)

Conclusion: The current study suggests nm-VCO₂ may moderate the relationship between recovery and PF and may have implications regarding AET induced buffering dynamics and its role in fatigue resistance during activity above moderate intensities.

1869 May 28 2:45 PM - 3:00 PM
Non-exercise Equations For Determining Change In Cardiorespiratory Fitness

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 (No relevant relationships reported)

CRF is a strong and independent predictor of morbidity and all-cause mortality beyond traditional risk factors. However, CRF is not routinely measured in clinical settings where cost, time, training, and discomfort on behalf of the patient have all been cited as barriers to routine integration. An alternative to measuring CRF is to estimate it using a non-exercise CRF equation. It is currently unknown whether eCRF can be used to estimate change in mCRF following the adoption of regular exercise. **Purpose:** To determine whether change in estimated cardiorespiratory fitness (eCRF) is associated with change in measured CRF (mCRF) independent of exercise amount and intensity over 24 weeks. **Methods:** Participants were 163 sedentary adults with abdominal obesity (waist circumference: mean 109.9 (SD; 11.5) cm) randomly assigned to: i) no-exercise control (n=42), ii) low-amount, low-intensity exercise (LALI; n=39), iii) high-amount, low-intensity exercise (HALI; n=51), iv) high-amount, high-intensity exercise (HAHI; n=31). mCRF was measured using a maximal treadmill test at baseline, 8, 16 and 24 weeks. eCRF was calculated using a published non-exercise equation with the following variables: sex, age, waist circumference, resting heart rate, self-selected physical activity.

Results: Participants attended 115 of 120 exercise sessions prescribed (96.0 (4.0) % adherence). eCRF change from baseline to 8, 16 and 24 weeks was not different from mCRF change for control, LALI or HALI (P=.03). In HAHI, eCRF change was significantly greater than mCRF change at all time points (P<.001). Change in mCRF and eCRF at 24 weeks were separated into tertiles to determine whether there were systematic differences between the two measures. Tertile scores revealed that for LALI and HALI, eCRF change significantly overestimated the lowest mCRF tertile (P=.001) and underestimated the highest mCRF tertile (P=.003). For HAHI, eCRF change overestimated mCRF within both the lowest and middle tertile (P=.005).

Conclusion: eCRF change was associated with mCRF change at 24 weeks independent of exercise amount but not intensity. Systematic variation between eCRF

and mCRF highlights a possible limitation when using eCRF to follow change in mCRF, specifically, that eCRF does not capture the individual variability of the mCRF response.

1870 May 28 3:00 PM - 3:15 PM

Relationship Of Blood Lactate And Sweat Lactate To Exercise Intensity

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(No relevant relationships reported)

Typical procedures for measuring blood lactate involve either finger stick blood samples or venous blood draws. The literature is equivocal regarding whether sweat lactate values change with exercise intensity. Recently, wearable technology devices have been developed to measure sweat lactate. **PURPOSE:** To examine the relationship between sweat lactate and blood lactate values during incremental exercise. **METHODS:** This study consisted of 12 (8 male, 4 female) healthy recreationally active individuals (VO_{2peak} 35.5 ± 7.6 ml/kg/min) between the ages of 18 and 25 (22 ± 2 yrs) who volunteered for the study. Participants performed an exercise test on a cycle ergometer to volitional fatigue to determine blood lactate, lactate threshold, VO_{2peak} , and peak heart rate (HR). Blood lactate was collected via finger stick at each 3-min stage of exercise. Participants performed a subsequent exercise session at 40, 60, and 80% heart rate reserve (HRR). During the 20-min stages of this test, blood and sweat lactate were collected during each intensity level. Sweat lactate was collected in a sweat "pouch" at each state of exercise. Sweat lactate samples were analyzed via the lactate oxidase method on a Chemwell 2910 chemistry analyzer. Blood lactate samples were analyzed using a Lactate Plus analyzer. Whole body sweat rate was calculated from pre- and post-exercise body weight at each intensity, factoring in water consumed and urine voided. **RESULTS:** Sweat rate increased with increasing intensity (40%: 9.66 ± 7.58 ; 60%: 18.10 ± 12.51 ; 80%: 24.32 ± 15.44 ml/min). Sweat lactate significantly differed between 60 and 80% intensities (15.66 ± 5.73 , 12.52 ± 4.44 mmol/L, respectively), $P = 0.03$. Blood lactate levels at 40, 60, and 80% intensities were 2.67 ± 1.15 , 3.60 ± 1.90 , and 4.83 ± 1.52 , respectively ($P < 0.001$). **CONCLUSIONS:** These findings agree with Buono, Lee, & Miller, 2010 who found sweat lactate decreases as sweat rate increases. It is likely that sweat lactate decreases with increasing exercise intensity due to dilution as sweat rate increases. From this data, it appears that sweat lactate does not demonstrate a relationship with blood lactate that warrants replacing blood lactate in exercise testing with sweat lactate. This may be due to the lactate in sweat originating from eccrine glands and thus is not reflective of muscle metabolism.

1871 May 28 3:15 PM - 3:30 PM

Heat Training Improves Cardiovascular Responses And Briefly Blunts Sprint Performance In Elite Sprint Track Cyclists

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PURPOSE: To investigate the effects of short-term heat training on sprint performance and cardiovascular function in elite sprint track cyclists. **METHODS:** Five elite male sprint cyclists (23.8 ± 2.0 years; peak power output = 22.8 ± 1.3 W·kg⁻¹) completed 5 d of training for ~60 min in hot conditions (30-35°C, 40-60% relative humidity (RH)) consisting of sprint-interval training and resistance training. Sprint performance was assessed using an inertial load ergometer in temperate conditions (~20°C, 50% RH) on day 1 and 5 of heat training, and 72 h post. Cardiovascular responses were assessed (~20°C, 50% RH) pre and 24 h post heat training and included a submaximal cycling test and resting plasma volume measurement. During the first (heat training day 1 = HT1) and last (HT5) resistance training session thermoregulatory measurements were recorded. **RESULTS:** There was a transient decrement in performance as observed by a small very likely decrease in sprint peak power output (-4.3% (90% CL -6.1, -2.5)) and small possible decrease [-2.0 rpm (-5.1, 1.2)] at 24 h post heat training. This decrement recovered to baseline within 72 h for both sprint performance (trivial change [0.2% (-3.4, 3.9)]) and optimal cadence (trivial change [-0.8% (-3.5, 2.0)]).

Core temperature during HT5 was lower (-0.29-0.36°C from 10 to 40 min; small possible decrease) during exercise but there was no effect of heat training on skin temperature or sweat rate compared with baseline values. Following heat training, heart rate during submaximal exercise decreased [-10 bpm (-18, -2); large very likely] and recovery heart rate increased [11 bpm (9, 14); large most likely], compared with baseline values. There was a small likely increase in plasma volume [6.3% (2.7-10.0)] immediate post 5 d HT, compared with baseline values. **CONCLUSION:** Our findings indicate that markers of cardiovascular stability improved with short-term heat training, and that sprint performance was suppressed at 24 h but rebounded at 72 h post.

D-16 Free Communication/Slide - Protein Metabolism

Thursday, May 28, 2020, 1:30 PM - 3:15 PM
Room: CC-3020

1872 **Chair:** Stefan M. Pasiakos, FACSM. *USARIEM, Natick, MA.*
(No relevant relationships reported)

1873 May 28 1:30 PM - 1:45 PM

Hot-water Immersion Does Not Increase Post-exercise Muscle Protein Synthesis Rates

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(No relevant relationships reported)

Protein ingestion and heating are strategies employed by athletes to improve post-exercise recovery and, as such, to facilitate muscle reconditioning following exercise. However, whether post-exercise heating affects post-prandial protein handling and subsequent muscle protein synthesis rates during recovery from exercise has not been assessed.

Purpose: To assess the impact of post-exercise heating on post-prandial myofibrillar protein synthesis rates during recovery from a single bout of resistance-type exercise in healthy, young males.

Methods: Twelve healthy, male adults (age: 23 ± 1 y) performed a single bout of resistance-type exercise followed by 20 min water immersion of both legs. One leg was immersed in hot water (46°C: HWI) while the other leg was immersed in thermoneutral water (30°C: CON). After water immersion, a beverage was ingested containing 20 g intrinsically L-[1-¹³C]-phenylalanine and L-[1-¹³C]-leucine labelled milk protein with 45 g of carbohydrates. In addition, primed continuous L-[ring-²H₃]-phenylalanine and L-[1-¹³C]-leucine infusions were applied, with frequent collection of blood and muscle samples to assess myofibrillar protein synthesis rates *in vivo* over a 5 h recovery period.

Results: Muscle temperature immediately after water immersion was higher in the HWI compared to the CON leg (37.5 ± 0.1 vs 35.2 ± 0.2 °C; $P < 0.001$). Incorporation of dietary protein-derived L-[1-¹³C]-phenylalanine into myofibrillar protein did not differ significantly between the HWI and CON leg during the 5 h recovery period (0.025 ± 0.003 vs 0.024 ± 0.002 MPE; $P = 0.953$). Post-exercise myofibrillar protein synthesis rates did not differ between the HWI and the CON leg based upon L-[1-¹³C]-leucine (0.050 ± 0.005 vs 0.049 ± 0.002 h⁻¹, respectively; $P = 0.815$) as well as L-[ring-²H₃]-phenylalanine (0.048 ± 0.002 vs 0.047 ± 0.003 h⁻¹, respectively; $P = 0.877$).

Conclusions: Hot-water immersion during recovery from resistance-type exercise does not increase the post-prandial rise in myofibrillar protein synthesis rates. In addition, post-exercise heating does not increase the capacity of the muscle to use dietary protein derived amino acids for *de novo* muscle protein accretion during subsequent recovery.

1874 May 28 1:45 PM - 2:00 PM

High Compared To Standard Essential Amino Acid Intakes Enhance Whole-Body Protein Balance During Energy Deficit

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(No relevant relationships reported)

BACKGROUND: The effects of energy deficit on postabsorptive, postprandial, and post-resistance exercise muscle protein synthesis are generally well described. However, few studies have assessed whole-body protein turnover responses to energy deficit and concomitant protein feeding after exercise, particularly after ingesting varying amounts of essential amino acids (EAA). Assessing the post-exercise whole-body protein kinetic response to EAA feeding during energy deficit may provide a critical indication of the potential protein requirements needed to prevent disruptions in whole-body protein balance induced by the metabolic stress of underfeeding. **PURPOSE:** Determine the effects of consuming varying EAA intakes on integrated whole-body protein turnover during energy deficit. **METHODS:** Nineteen males (mean \pm SD; 23 \pm 5y; 25.4 \pm 2.7 kg/m²) completed a randomized, double-blind crossover study consisting of two, 5d periods of controlled energy deficit (30 \pm 4%), separated by a 14d washout. Whole-body protein synthesis (PS), breakdown (PB), and net protein balance (NET) were determined at rest and post-resistance exercise at the end of each energy deficit period using primed, constant infusions of ²H₂-phenylalanine and ³H₂-tyrosine. Drinks providing standard (0.10g/kg/meal, 7.87 \pm 0.87 g) and high (0.30g/kg/meal, 23.5 \pm 2.54 g) EAA amounts were consumed post-exercise. Whole-body protein turnover (g protein/180min) is expressed as the change between the postabsorptive, resting period and the postprandial, post-resistance exercise period. **RESULTS:** Stimulation of PS (3.6 \pm 0.6 vs. 0.2 \pm 0.5) and suppression of PB (-25.5 \pm 1.2 vs. -9.8 \pm 0.7) was greater for high than standard EAA (P < 0.05). The resulting NET was more positive for high (29.0 \pm 0.9) than standard (10.0 \pm 0.4) EAA (P < 0.05). **CONCLUSION:** These data demonstrate that higher EAA intake enhances net protein balance in response to the combined stress of exercise and energy deficit, largely by attenuating protein breakdown, suggesting higher protein meals are necessary to support whole-body protein balance during the metabolic stress of underfeeding. Supported by USAMRDC; authors' views not official U.S. Army or DoD policy.

1875 May 28 2:00 PM - 2:15 PM

Energy Deficit Attenuates Muscle Protein Synthetic Responses To Essential Amino Acids

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(No relevant relationships reported)

BACKGROUND: Peripheral essential amino acid (EAA) concentrations regulate muscle protein synthesis (MPS). During energy balance, consuming ~9 g EAA doubles postprandial peripheral EAA concentrations and increases resting MPS by nearly 50%. During energy deficit, EAA requirements may be elevated due to a greater carbon skeleton requirement for energy metabolism. We examined if similar or greater increases in peripheral EAA concentrations during energy deficit stimulate the same magnitude increase in MPS as in energy balance.

PURPOSE: Determine the effects of peripheral increases in EAA concentrations and the stimulation of MPS during energy balance and deficit.

METHODS: Data were derived from two independent controlled studies assessing the effects of consuming high and low doses of EAA on peripheral EAA concentrations and MPS (²H₂-phenylalanine, direct incorporation method) during energy balance (BAL HIGH/LOW) and energy deficit (DEF HIGH/LOW). In BAL, measures were determined in 8 healthy adults (mean \pm SD; 21.4 \pm 2 y, 24.6 \pm 3.2 kg/m²), ingesting in random order, either 4.3 \pm 0.0 g or 8.6 \pm 0.0 g EAA, separated by 7 d. In DEF, measures followed 5 days of controlled energy deficit (30 \pm 4 %) in 19 healthy adults (22.9 \pm 5 y, 25.4 \pm 2.7 kg/m²), ingesting either 7.8 \pm 0.9 g or 23.5 \pm 2.6 g EAA, in random order, separated by 14 d.

RESULTS: Peak EAA concentrations were 36% higher in DEF HIGH compared to BAL HIGH (2219 \pm 470 vs. 1634 \pm 320 μ mol/L; p<0.05), but not for the low doses. Peak EAA concentrations were higher (p<0.05) in HIGH doses for both energy states compared to LOW doses. Independent of EAA dose, postprandial MPS

for BAL (0.78 \pm 0.36 %/h) and DEF (0.58 \pm 0.15 %/h) were 81% and 26% greater than postabsorptive MPS for BAL (0.43 \pm 0.18 %/h) and DEF (0.46 \pm 0.24 %/h), respectively (energy-by-fed state, p<0.05). Postprandial MPS was 25% lower in DEF than BAL (energy-by-state, p<0.05).

CONCLUSION: Ingesting roughly triple the dose of EAA in DEF than BAL (23.5 g vs. 8.6 g) resulted in marked differences in peripheral concentrations; yet the anabolic stimulus was similar. The reduction in postprandial MPS during DEF, despite ingesting 2-3 times the amount

of EAA compared to BAL, suggests that muscle is not the primary target for the greater rise in peripheral EAA.

Supported by USAMRDC; authors' views not official U.S. Army or DoD policy.

1876 May 28 2:15 PM - 2:30 PM

Leucine Supplementation Does Not Attenuate Metabolic Or Functional Declines Following 7-days Of Unilateral Lower-limb Immobilisation.

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(No relevant relationships reported)

Unavoidable periods of physical inactivity (i.e. illness/injury) lead to muscle atrophy and functional declines, which likely stem from alterations in both anabolic signaling processes and oxidative metabolism. Preventing such declines is important to reduce the risk of re-injury and preserve musculoskeletal health across the lifespan.

PURPOSE: To determine the effectiveness of high-dose leucine supplementation to preserve muscle mass, strength, and morphology following 7-days of unilateral knee immobilisation.

METHODS: Sixteen healthy, recreationally active males (23 \pm 1yrs) underwent 7-days of unilateral knee immobilisation, with (LEU; n=8) or without (PLA; n=8) thrice daily leucine supplementation (15g/d). Strength and compartmental tissue composition were assessed prior to and following immobilisation. Muscle biopsy samples obtained immediately following immobilisation were used to determine muscle fibre morphology as well as key indicators of mitochondrial function between the control (CTL) and immobilised (IMB) limbs.

RESULTS: Leg fat-free mass was reduced in the IMB leg following immobilisation (-3.6 \pm 0.5%; P<0.05) in both the LEU and PLA conditions (P>0.05), with no such alterations noted in the CTL leg (-0.6 \pm 0.5%; P>0.05). Isometric knee extensor strength declined following immobilisation (P<0.01), with a greater (P<0.05) and equivocal decline in the IMB (-27.9 \pm 4.4%) vs. CTL (-14.3 \pm 4.4%) leg in both the LEU and PLA group (P>0.05). Following immobilisation, type II fibre cross sectional area was significantly lower in the IMB vs. CTL limb (5561.49 \pm 465.97 vs. 6319.9 \pm 412.9 μ m²; P<0.05) but not in type I fibre cross sectional area (4805.5 \pm 324.3 vs. 5424.95 \pm 323.63 μ m²; P>0.05), with no differences between treatment groups (P>0.05).

A significant Group*Leg interaction was identified for mitochondrial complex I phosphorylating respiration (Pi; P<0.05). However, post-hoc analysis revealed no differences in Pi in the IMB vs. CTL limb in either the PLA (FC=1.20 \pm 0.19, P=0.06) or LEU (FC=0.87 \pm 0.27, P=0.87) group.

CONCLUSION: Leucine supplementation, even at a high-dose (15g/d), does not appear to attenuate declines in leg fat-free mass, strength, muscle morphology or mitochondrial respiration following 7-days of unilateral knee immobilisation.

1877 May 28 2:30 PM - 2:45 PM

Efficacy Of A ¹³C 'Breath Test' To Determine Protein Anabolism After Physiological Feeding And Exercise

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(No relevant relationships reported)

Dietary amino acids that are not oxidized are retained in the body to support net protein anabolism, which is important for individuals aiming to maintain or enhance lean body mass. There are limited methodologies with which to measure protein anabolism noninvasively in response to physiological stimuli (e.g. single meal feeding and exercise), which represents a challenge for research in vulnerable populations.

PURPOSE: To determine the efficacy of a novel, noninvasive stable isotope 'breath test' to measure differences in anabolism in response to a physiological anabolic stimulus. **METHODS:** Fifteen healthy men were randomized to a rested (FED; n=7; 23 \pm 5y; 77 \pm 4kg; 14 \pm 3% body fat; mean \pm SD) or post-resistance exercise (EX-FED; n=8; 22 \pm 2y; 78 \pm 10kg; 13 \pm 5% body fat) condition. Participants consumed a mixed carbohydrate (0.75g/kg body weight) complete amino acid (0.25g/kg) beverage modeled on the composition of egg protein, with a leucine content of 20mg/kg enriched to 5% with L-[1-¹³C]leucine, which is primarily metabolized within skeletal

muscle. CO₂ production was measured hourly via indirect calorimetry, and breath samples were collected every 20-30min during the 5h postprandial period to determine ¹³C₂ enrichment via isotope-ratio mass spectrometry. Dietary leucine kinetics are expressed as the cumulative percentage of ¹³C excreted (%LEU) and total exogenous leucine oxidation (OX) over 5h. Dietary net leucine balance (BAL) was determined by the difference between leucine intake and OX. **RESULTS:** %LEU was lower ($P=0.03$) in EX-FED (14.2±1.9%) vs. FED (16.3±1.2%). Similarly, OX was lower ($P<0.01$) in EX-FED (60.8±6.5µmol/kg/5h) vs. FED (70.2±5.3µmol/kg/5h), which resulted in a greater ($P<0.01$) BAL in EX-FED (90.5±6.5µmol/kg) vs. FED (81.1±5.3µmol/kg). **CONCLUSION:** We demonstrate that a novel, noninvasive breath test based on oral [¹³C]leucine ingestion can detect greater anabolism with resistance exercise in young men. Muscle protein enrichment analysis is ongoing to determine the extent to which these whole-body outcomes reflect those within skeletal muscle. Further validation will enhance the applicability of this new technique to a variety of populations experiencing growth (e.g. children) and/or atrophy (e.g. clinical populations).

1878 May 28 2:45 PM - 3:00 PM

Acute And Chronic Resistance Exercise Differentially Modulates The Skeletal Muscle Metabolome

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Acute resistance exercise (RE) is associated with acutely increased protein synthesis while repeated resistance training (RT) increases muscle growth. Although the molecular events that initiate these events are well described there is a lack of knowledge concerning the involvement of skeletal muscle metabolic pathways in the adaptive response towards RE. Yet, skeletal muscle metabolomic studies have not analysed differences in the metabolomic signature between acute RE and repeated loading of skeletal muscle by RT. **PURPOSE:** To determine myofiber diameter and the skeletal muscle metabolome after acute and prolonged RE in humans. **METHODS:** 7 male subjects (Age: 24±4 years; Height: 180±8 cm; Weight: 81±10 kg) conducted 13 RE sessions over 5 weeks. Muscle biopsies from vastus lateralis muscle were taken at rest (Rest), 45 min after the first and the last (13th) RE session. Muscle samples were analysed for changes in myofiber diameter via immunohistochemistry and metabolites by conducting untargeted metabolomics analysis on an LC-MS platform.

RESULTS: 645 metabolites were detected after RE and RT comprising different clusters of skeletal muscle metabolites. From these, 508 metabolites could be assigned to amino acids, nucleotides, lipids, carbohydrates, energy metabolism, vitamins and co-factors as well as anti oxidants. Five weeks of RT significantly increased the size of slow type I and fast/intermediate type II muscle fibres by 9+4% and 10+3% respectively. Fatty acid metabolites decreased significantly ($p<0.05$) after RT. After RE, metabolites associated with amino acid metabolism significantly increased ($p<0.05$). Specifically 3-methylhistidine increased acutely after RE likely associated with increased degradation of myofibrillar proteins after unaccustomed RE. Antioxidant metabolites were decreased ($p<0.05$) while Metabolites derived from purine nucleotide cycle were partly increased or decreased ($p<0.05$) after RE.

CONCLUSIONS: Acute unaccustomed RE and prolonged RT, associated with hypertrophy induce significant but different changes of the skeletal muscle metabolome likely reflecting the functional and structural adaptation of the skeletal muscle environment. Supported by Grant from Federal Institute of Sports Science: ZMVI4-2516B10106

1879 May 28 3:00 PM - 3:15 PM

Mtorc1 Sensitivity To Amino Acids In Skeletal Muscle And Myotubes Derived From Young And Older Men

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(No relevant relationships reported)

Ageing is associated with a progressive loss of muscle mass termed sarcopenia, increasing morbidity and mortality. Although multifactorial in nature, dysregulated sensing of amino acids (AAs) after nutrient ingestion, coupled with blunted mTORC1 activation and muscle protein synthesis (MPS), is undoubtedly a major contributing factor in the development and progression of sarcopenia. However, it is unknown whether this is a result of poor AA delivery to the muscle or diminished AA sensing intrinsic to aged muscle cells. Exercise has been shown to increase the sensitivity of

muscle to AAs, and conversely, reductions in physical activity appear to drastically impair this response. Since there is typically a reduction in habitual physical activity in the elderly, the impaired muscle growth response to AAs may be a consequence of a lack of physical activity rather than ageing. **PURPOSE:** To determine the roles that age and physical activity levels play in the activation of anabolic pathways within skeletal muscle and myotube cultures in response to AAs. **METHODS:** A cross-sectional study was used to compare mTORC1 signaling in response to ingestion of whey protein in 7 young active (Y, 23±2 yrs), 8 older active (OA, 71±4 yrs) and 3 older inactive (OI, 71±5 yrs) men. To determine if mTORC1 sensitivity is intrinsically regulated and remembered by skeletal muscle cells, myoblasts were isolated from biopsies from these participants and differentiated to form myotubes. Myotube cultures were then deprived of serum and AAs, re-stimulated with AAs, and subsequently lysed temporally for mTORC1 analysis. **RESULTS:** Our preliminary data indicates that phosphorylation of ribosomal protein s6 (RPS6), a downstream mTORC1 substrate, was increased in myotube cultures from Y and OA men with a reduced response in OI men ($Y=7.2+7.3$, $AO=9.8+4.5$, $IO=6.0+5.6$ -fold). We are currently analysing muscle tissue from these same individuals to understand if mTORC1 signaling is comparable between biopsy tissue and myotube cultures. **CONCLUSION:** Sustained physical activity levels in older individuals and regular structured exercise may diminish age-related mTORC1 desensitisation of skeletal muscle in response to AA ingestion in cultured myotubes.

D-17 Clinical Case Slide - Medical Issues I

Thursday, May 28, 2020, 1:30 PM - 3:30 PM
Room: CC-2005

1880 **Chair:** Pierre L. Viviers, FACSM. Stellenbosch University, Stellenbosch, South Africa.
(No relevant relationships reported)

1881 **Discussant:** Rebecca G. Breslow. Brigham and Women's Hospital, Boston, MA.
(No relevant relationships reported)

1882 **Discussant:** Heather Gillespie, FACSM. Maine Medical Partners Orthopedics and Sports Medicine, South Portland, ME.
(No relevant relationships reported)

1883 May 28 1:30 PM - 1:50 PM
Abdominal Pain- Non-athlete
Gary James Duncan, Megan Zaworski. OhioHealth Riverside Family Practice Center, Columbus, OH.
(No relevant relationships reported)

HISTORY: A 48-year-old former pizza shop worker presents with >2 years of intermittent abdominal pain with extensive GI work up. Patient reports that pain is worse with bowel movements, tying shoes, bending over, and reaching with arms. Significant history of alcohol and cigarette use. He feels as if he is bruised or experienced a "Charlie horse" after these ~1 minute episodes occur.

PHYSICAL EXAMINATION: Tenderness of right lower chest wall and right upper quadrant without guarding or rebound. Negative McBurney's point and Murphy's sign. Intermittent abdominal distention over the course of disease. Patient brought video showing abnormal chest wall movement to more recent appointment.

DIFFERENTIAL DIAGNOSIS: 1. Slipping Rib Syndrome 2. GERD 3. Intercostal/Oblique muscle spasm **TEST AND RESULTS:** CT abdomen pelvis 9/30/19 No bowel obstruction or acute renal pathology. Mild fluid and air to distention of small-bowel loops without obstruction. The stomach is underdistended. Gastric wall thickening cannot be excluded. US Abdomen 1/24/17 Normal right upper quadrant ultrasound. EGD 7/2019 - Esophageal mucosal changes suspicious for short-segment Barrett's esophagus. Biopsied. - Normal antrum. Biopsied. - Granular gastric mucosa. Biopsied. - Normal duodenum. **FINAL WORKING DIAGNOSIS:** Slipping rib syndrome of right side **TREATMENT AND OUTCOMES:** Patient still seeing GI for possible GERD related causes. Awaiting follow up for referral to OMT clinic for manipulation. Diclofenac gel prescription for pain relief. If OMT and analgesic treatment unsuccessful, referral for surgical resection or intercostal nerve block

1884 May 28 1:50 PM - 2:10 PM

Pulmonary Embolism - Rowing

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(No relevant relationships reported)

HISTORY: A 17-year-old male club rower sustained a chest injury 2-3 weeks post-season. He presented with shortness of breath (SOB), sharp chest pain and coughing up blood. Campus urgent care Heli ported to a Trauma I ED. He was admitted, had labs drawn and a chest CT. No significant medical history. He did note over the past year, episodic lower leg/foot muscle cramping and lower back pain, exacerbated with rowing. Three-months post initial event, patient presented again coughing up blood. He self-ambulated to a local ED, was admitted and observed for 3-days. **PHYSICAL EXAM:** Urgent care examination revealed young male with SOB and hemoptysis with need for higher care evaluation. ED exam revealed, Heli ported stabilized young alert male with SOB, hemoptysis and constant 10/10, non-radiating localized chest pain. He was tachypneic/bradycardic, RR=28, O2=84% room air, HR=124, and BP=118/89. Chest auscultation unremarkable. No thigh or calf swelling. No tenderness on palpation of lower extremities. **DIFFERENTIAL DIAGNOSIS:** 1. Pulmonary emboli 2. Pneumothorax 3. Asthma 4. Acute bronchitis 5. Emphysema 6. Early onset cardiac diseases **TEST AND RESULTS:** EKG: Sinus bradycardia with sinus arrhythmia, ST elevation indicating early repolarization, pericarditis, or injury. Venous duplex US: Upper bilateral extremities was unremarkable. Chest CT w/contrast: - Right and Left lower lobe infarcts - Right pulmonary artery filling defect into right middle and lower lobes Repeat CT w/contrast: - Segmental and subsegmental right lower lobe PE. No new PE. - Decreased right lower lobe infarct. D-dimer=0.32 mcg/ml, Factor VIII clotting assay=314%, PT - 15 sec; INR - 1.15 sec **FINAL/WORKING DIAGNOSIS:** Bilateral pulmonary emboli secondary to effort thrombosis **TREATMENT AND OUTCOMES:** 1. Emergency. Urgent care IV resuscitation for blood loss and immediate Heli port to Trauma I center. In-flight resuscitation and EKG monitoring. 2. Trauma I ED with immediate IV anticoagulation, serial lab work and chest CT. Observed for 8-10 days, with improvement, sent home on percutaneous anticoagulants. 3. Second Trauma I ED presentation started on IV anticoagulation and chest CT-reflecting no changes, and observed for 3-days. Discharged and continued percutaneous anticoagulants. 4. Currently stable, on anticoagulants with no return to sport planned.

1885 May 28 2:10 PM - 2:30 PM

Acute Kidney Injury From Heat Illness - Rugby Union (7-players-a-side)

Victor Lopez Jr¹, Jordan C. Genece², Austin Prewitt³, Liliana Tasovac⁴, Freedom Salas⁵, Answorth A. Allen⁶. ¹Rugby Research and Injury Prevention Group, Inc., Hospital for Special Surgery, New York, NY. ²Rugby Research and Injury Prevention Group, Inc, Hospital for Special Surgery, New York, NY. ³Oregon Health & Science University, Portland State University School of Public Health, Portland, OR. ⁴SUNY Binghamton University, NY, Binghamton, NY. ⁵Pennsylvania State University, Schuylkill, PA. ⁶Sports Medicine Institute, Hospital for Special Surgery, New York, NY. (Sponsor: Nialah Coleman, MD, FACSM)

Email: drvictorlopezjr@gmail.com

(No relevant relationships reported)

HISTORY: A 30-year-old men's club Division I Rugby-7s winger sustained abdominal cramping and profuse sweating at tournament end. Player reported these symptoms from exertional demands of the sport. Player noted, he aided hydration throughout the tournament (Local Temp=91F) with water and electrolyte supplementation with "sports drinks." Diet included fruits, candy, and meats during tournament. Player denies difficulty urinating, yet described urine to be dark in color. No significant medical history, but noted comparable cramping events that occurred approximately 2½ months prior, as well as, 2-years ago with no medical intervention. Six National Championship tournament matches (each match lasted 14 minutes) later he advised the team doctor. **PHYSICAL EXAM:** Examination post tournament, reflected profuse diaphoresis and abdominal muscle cramping at end of tournament. Patient transferred to local ED, where exam revealed an alert player in no acute distress, mild Temp=98.3F, BP=136/89, Pulse=66, PO2=98, cool to touch and mildly diaphoretic. Player had

generalized abdominal muscle cramping. No lower or upper extremity muscle presentation. Blood was drawn and urine collected. Post-IV infusion patient noted cessation of abdominal cramping and tolerated perioral ingestion. Repeated blood labs.

DIFFERENTIAL DIAGNOSIS:

1. Acute kidney injury
2. Exertional rhabdomyolysis
3. Heat illness

TEST AND RESULTS:

Urinalysis: Yellow, +protein, +hyaline casts, +ketones, +RBC's, +UA crystals. Preliminary Blood test: BUN=29, creatinine =2.3, AST=42 and CK=1581 Repeat Blood test (post IV Fluids): BUN=27, creatinine=1.7, Glucose=42 and CK=1617

FINAL WORKING DIAGNOSIS:

Acute kidney injury (Stage 2) with rhabdomyolysis 2ndry to Heat Exhaustion

TREATMENT AND OUTCOMES:

1. Emergency. Immediate removal from play to avoid progression and transfer to ED for rapid IV bolus.
2. Serial blood work, noting elevated BUN, creatinine and CK of stage 2 AKI, with decrease post IVF, urinalysis reflected of dehydration, and monitoring
3. Discharged to self-care and advised to return if necessary, to ED with complaints of fever, inability to urinate, back pain, discolored/blood in urine, or other new symptoms.
4. Returned to sport 3-weeks post-injury with no sequelae and able to meet the demands of his sport.

1886 May 28 2:30 PM - 2:50 PM

Right Arm Numbness In An Adolescent

Rebecca King, Nathan Bucks. *WellSpan, York, PA.* (Sponsor: Mark Lavalley, FACSM)

(No relevant relationships reported)

HISTORY: A 14-year-old high school student presented to Orthopedics Urgent Care for right arm numbness and discoloration. Four days prior had noticed that her right arm would turn a dusky purple or blue color from the shoulder to her fingers with associated numbness and tingling in the entire arm. Episodes lasted only a few seconds to a minute. She would have multiple episodes a day. No specific pattern or time of day, however she thinks it may occur more frequently while wearing a backpack or if her arm is in an elevated position. Episodes resolve on their own. ROS otherwise negative.

PHYSICAL EXAMINATION: Right upper extremity without dusky appearance, appears similar to left upper extremity. Full ROM and strength at the shoulder, elbow, wrist, and fingers. Decreased sensation in the ulnar distribution of the right hand compared to the left. Strong radial pulse when right hand is lowered. Positive Adson for loss of radial pulse, positive Roos for numbness and tingling.

DIFFERENTIAL DIAGNOSIS: 1. Right upper extremity DVT 2. Thoracic outlet syndrome 3. Pancoast tumor

TEST AND RESULTS: Right upper extremity venous ultrasound normal. Right upper extremity arterial ultrasound with normal triphasic arterial waveforms with arm at patient's side and at 90 degrees abducted in the subclavian, axial, brachial, radial, and ulnar arteries. With arm raised above patient's head, abnormal monophasic waveform in the right subclavian artery.

FINAL WORKING DIAGNOSIS: Arterial thoracic outlet syndrome.

TREATMENT AND OUTCOMES: 1. Referred to pediatric vascular surgery.

2. Was referred to physical therapy, will follow up in 6 months.

1887 May 28 2:50 PM - 3:10 PM

Sudden Collapse - Field Hockey

Jill S. Moschelli. *Michigan State University, East Lansing, MI.* (Sponsor: James Dunlap, FACSM)

Email: jssadoski@gmail.com

(No relevant relationships reported)

HISTORY: 19-year-old female DI field hockey player with PMH of fainting episodes presented to the training room after having a syncope episode at the end of a game over the weekend and again at practice the day prior to presentation. In both cases, she describes having no warning before suddenly passing out. Both events were witnessed by her ATC who described her being unconscious for one minute, and then having horizontal nystagmus and a pulse of 100-130 bpm once conscious. She described lightheadedness, headache, and palpitations after each episode. She also felt groggy for one day after each event. She stated that it was very warm the day of the initial event with aggressive play, and eval by the sideline provider suggested dehydration. However, the second event occurred on a cool cloudy day during practice. Denied fever, chills, nausea, vomiting, tongue biting, bowel or bladder incontinence, visual or olfactory disturbances.

PMH

Fainting episodes that started at the age of 13.

ADHD**FH** Father has narcolepsy with cataplexy**Surgeries** Tonsillectomy and adenoidectomy

Meds Ritalin 10mg BID, Concerta 36 mg QD, and Trazadone 150mg QHS

PHYSICAL EXAMINATION:

Gen: alert, NAD
 Cardio: RRR, no murmurs
 Pulm: CTAB
 Abd: soft, non-TTP, no masses
 Ext: gait normal, moving all extremities symmetrically
 Neuro: CN II-XII intact, No focal deficits
 Skin: warm, dry, no rashes

DIFFERENTIAL DIAGNOSIS:

Vasovagal Syncope
 Epilepsy
 Electrolyte Abnormalities
 Cardiac etiology
 Narcolepsy

TEST AND RESULTS:

CBC w/ diff: WNL
 CMP: Glucose 110
 2H Glucose Tolerance Test: Neg
 Sed Rate: WNL
 Anti-nuclear Ab: Neg
 CRP: 1.1
 EEG: No epileptiform discharges identified
 ECG: NSR
 Echo: Mild regurgitation
 14 Day Event Monitor:
 HR range: 62-178 bpm
 Sinus rhythm and sinus tachycardia
 MRI Brain: No acute ischemia or mass
 CTA Head/Neck: No high-grade stenosis, dissection, or pseudoaneurysm.
 Cardiac Stress Test: Neg
 Loop Recorder placed

FINAL WORKING DIAGNOSIS: Narcolepsy with Cataplexy

TREATMENT AND OUTCOMES: Due to the extensive negative work up, athlete has been allowed to return to activity with a slow progression and monitoring.

Psychiatry is confident that narcolepsy is the likely diagnosis. Sleep study ordered to aid diagnosis, and results are currently pending.

1888 May 28 3:10 PM - 3:30 PM

Post-Operative Chest Pain - Men's Rugby

Jeffrey Wisinski. *Penn State Health, State College, PA.* (Sponsor: Peter Seidenberg, FACSM)
 Email: jwisinski@pennstatehealth.psu.edu
 (No relevant relationships reported)

HISTORY: A 20 year old male collegiate rugby athlete suffered a noncontact left lower extremity injury during practice. An MRI was obtained and showed a complete tear of the ACL, central free edge tear of the lateral meniscal body, subchondral fracture of the posterior medial tibial plateau and lateral femoral condyle, and a small loose body in the suprapatellar pouch. 19 days after the injury, patient underwent Left Knee Arthroscopy, ACL reconstruction with bone-patellar tendon-bone autograft, lateral meniscus repair, and loose body removal. Patient was discharged home on the same day after being successfully weaned off general anesthesia without difficulty. On post-op day number 1, he presented for initial physical therapy session and admitted to retrosternal chest pain with deep inspiration. He was referred to the Emergency Room.

PHYSICAL EXAMINATION: Pulse Ox: 98% on room air, BP 158/93, HR 80, Temp 36.7 C, RR 20 General: No acute distress, well appearing Cardiac: Regular Rate and rhythm, no murmurs, rubs, or gallops Chest: No tenderness with Palpation of chest wall, lungs clear to auscultation bilaterally, no wheezes, crackles, or rhonchi Lower Extremity: No pitting edema, no calf tenderness, no erythema, no warmth, Negative Homan's, incisions clean, dry, and intact, neurovascularly intact

DIFFERENTIAL DIAGNOSIS: 1. Pulmonary Embolism 2. Pneumonia with Pleurisy 3. Pericarditis 4. Myocarditis 5. Costochondritis 6. Asthma

TEST AND RESULTS: Portable CXR: Faint Parenchymal infiltrate right pulmonary apex D-Dimer: >450 CT Angiogram Chest: no pulmonary embolism, extensive infiltrate in posterior segment of right upper lobe, concerning for Pneumonia CBC: WBC 11.49, Hgb 14.4, Hct 42.6, Platelet Count 267, Lymphocytes 10.7 % CMP: Unremarkable Troponin: Negative

FINAL WORKING DIAGNOSIS: Right Upper Lobe Pneumonia

TREATMENT AND OUTCOMES: Initially placed on Augmentin 875/125 mg PO Q12H for 7 days. On post-op day number 4, pt admitted to ongoing retrosternal chest pain along with dyspnea with exertion. Evaluated by urgent care, found to be hemodynamically stable with unremarkable physical examination. Augmentin discontinued, started on Doxycycline 100 mg PO BID for 10 days and Prednisone 60 mg po daily for 7 days. Seen for follow up post-op day number 8, symptoms significantly improved

D-18 Clinical Case Slide - Running II

Thursday, May 28, 2020, 1:30 PM - 3:30 PM
 Room: CC-2016

1889 **Chair:** Kevin R. Vincent, FACSM. *University of Florida, Gainesville, FL.*
 (No relevant relationships reported)

1890 **Discussant:** Emily Kraus. *Stanford Hospital and Clinics, Woodside, CA.*
 (No relevant relationships reported)

1891 **Discussant:** Hallie Labrador. *NorthShore University HealthSystem, Gurnee, IL.*
 (No relevant relationships reported)

1892 May 28 1:30 PM - 1:50 PM

Anterior Knee Pain In A Runner

Keri L. Denay, FACSM, Vivek Kalia. *University of Michigan Medical School, Ann Arbor, MI.*
 Email: kschwide@med.umich.edu
 (No relevant relationships reported)

HISTORY: 40 yo F runner with bilateral, right, anterior, aching, intermittent, 3-10/10 knee pain. Wakes at night. Worse with going down stairs, running, fast walking. Better with rest and ibuprofen. ROS negative. PMHx: DVT, PE, depression, endometriosis, sleep apnea. PSHx: C-section, IVC filter. Meds: ibuprofen prn, citalopram, fluticasone nasal spray, Coumadin. FHx: DVT in father. SocHx: +tobacco, no alcohol or drug use; desk job; recreational runner. No recent immobilization/long travel.

PHYSICAL EXAMINATION:

BMI 38, vitals stable. Knee Exam: No malalignment, bruising, erythema, or obvious swelling; gait normal. Full AROM without pain; + patellar j sign; + patellar crepitus; 5/5 strength without pain; Neurovascularly intact. Negative patellar apprehension; equivocal patellar inhibition. positive patellar grind bilaterally. Full AROM. Negative bounce test, McMurray. Minimal tenderness of medial joint line. Palpable, firm 4cm mass in the right popliteal fossa that is mildly tender to palpation. No overlying skin changes. No ligamentous instability, calf pain, swelling, tenderness, warmth, erythema. Negative Homan's sign.

DIFFERENTIAL DIAGNOSIS:

For mass: synovial/baker's cyst, ganglionic cyst, meniscal cyst, DVT, aneurysm, muscular deformity, soft tissue mass

TEST AND RESULTS:

-2-view knee x-ray: ill-defined soft tissue sclerosis in the postero-medial right knee which could be a bone forming soft-tissue tumor, Moderate bilateral tricompartmental knee OA.

-Knee MRI: Round, lobular mass measuring 3 x 3 x 3.6 cm adjacent to the distal semimembranosus myotendinous junction. Central ossification and a thin rim of peripheral enhancement. A bone forming tumor, benign or malignant, is a possibility. -Bone tumor surgeon notified and patient seen. Felt unrelated to symptoms and likely secondary to prior trauma. CT knee and CXR. CXR normal.

-CT without contrast: Soft tissue calcified lesion medial to the patient's small Baker's cyst partially surrounds the semitendinosus tendon. Tissue sampling is recommended to exclude a matrix forming neoplasm. Knee OA.

-Sarcoma Tumor Board: benign; treat underlying knee pain.

FINAL WORKING DIAGNOSIS: Benign soft tissue calcified lesion of the knee

TREATMENT: symptomatic treatment, quit smoking, weight loss

OUTCOME: asymptomatic at 2-months

1893 May 28 1:50 PM - 2:10 PM

Left Hip Pain In A Runner

Shelby E. Johnson, Brittany J. Moore, Jay Smith. *Mayo Clinic, Rochester, MN.* (Sponsor: Karen L. Newcomer, FACSM)
 Email: johnson.shelby@mayo.edu
 (No relevant relationships reported)

HISTORY

A 44 year-old female runner presented with four weeks of migrating left anteromedial and posterolateral hip pain. Pain was gradual in onset but worsened after a 20 mile run three weeks prior. Pain was worse with running and weight-bearing activities. She tried a run the day prior to her visit but stopped at five miles due to pain. Ibuprofen

improved her symptoms. She denied weakness, paresthesias, night pain, pain with lying on her left side, or mechanical symptoms. She hoped to run in the Boston Marathon, which was 13 days after her initial visit.

PHYSICAL EXAMINATION

Patient was tender to palpation over the gluteal musculature and greater trochanteric region however this was not her typical pain. Hip range of motion and strength were full. Resisted hip abduction was painful. Stinchfield reproduced posterior buttock pain. Log roll, labral scour, FABER, FADIR, and ischiofemoral impingement maneuvers were negative. Reflexes and sensation were intact.

DIFFERENTIAL DIAGNOSIS

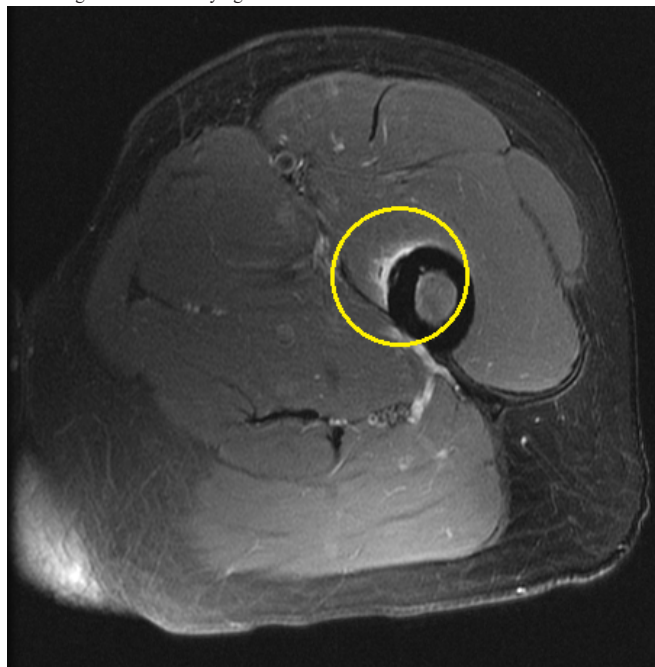
1. Greater trochanteric pain syndrome
2. Femoral acetabular impingement
3. Myofascial pain
4. Piriformis syndrome
5. Stress fracture

TESTS AND RESULTS

Hip X-ray: Mild degenerative change of bilateral hips. No fracture.

Hip MRI: Evidence of left gluteal tendinopathy and associated greater trochanteric bursitis. Increased T2 signal along the proximal femoral diaphysis. No femoral neck stress fracture.

Femur MRI: Periosteal edema along the medial proximal femoral shaft with periosteal thickening and trace underlying bone marrow edema.



FINAL WORKING DIAGNOSIS

Adductor insertion avulsion syndrome (thigh splints)

TREATMENT AND OUTCOMES

1. Partial weight-bearing with crutches with progression to full weight-bearing over two weeks as pain with walking improved.
2. Physical therapy with a return to running program and running analysis.
3. Discussed the risks of stress fracture or complete fracture if continued to run.
4. Patient ran in the Boston Marathon and finished in just over four hours.

1894 May 28 2:10 PM - 2:30 PM

Left Forefoot Pain And Discoloration- Runner

Joshua I. Pacious, Scott A. Annett. *Prisma Health–Upstate/ University of South Carolina School of Medicine Greenville, GREENVILLE, SC.* (Sponsor: Kyle J. Cassas, FACSM)

(No relevant relationships reported)

HISTORY: A 24-year-old female recreational runner with a past medical history of ADHD on Vyvanse presented to clinic for worsening left forefoot pain and great-toe numbness without antecedent trauma. She also noted blue color changes to the great toe. She presented on crutches due to an inability to bear weight on the forefoot.

PHYSICAL EXAMINATION: On inspection of the ankle and foot, there was a bluish-hue to the great toe; no swelling was evident in the foot. She was most tender over the plantar second and third metatarsal heads. Range of motion and strength were preserved. PT pulses were symmetric bilaterally, DP pulses were difficult to appreciate. The foot was cool to the touch with hyperalgesia.

DIFFERENTIAL DIAGNOSIS: 1. Vasospastic disease 2. Arterial embolization 3. Chronic regional pain syndrome

TEST AND RESULTS: Left foot AP, lateral, and oblique radiographs: --Normal. Vascular physiological ABI with maneuvers, arterial ultrasound of the bilateral legs: -No arterial disease noted except for flat toe waveforms in toes of BOTH feet. Left great toe is worse. However, pulsatility returns with toe warming implying vasospastic component. Plantar flexion and dorsiflexion did not change popliteal flow velocity. Normal ABIs. No evidence of popliteal artery disease. Left foot MRI without contrast: -Inflammatory changes in the soft tissue deep to the second MTP joint. There is an associated ganglion of the plantar plate measuring 4x2mm- although no discrete plantar plate injury is identified, ganglia can be associated with a small tear. ESR: 5. ANA: neg. RF: <15. Centromere B Ab: neg.

FINAL WORKING DIAGNOSIS: Digital vasospasm and possible second metatarsal plantar plate injury

TREATMENT AND OUTCOMES: From clinic she was immediately referred to vascular surgery, who noted that although the patient's toe waveforms were dampened in multiple digits she did show improvement with warming. This suggested vasospastic disease, and given Vyvanse's association with the same, it was discontinued. Her vasculopathic symptoms improved. Due to ongoing metatarsal head discomfort with ambulation, an MRI was obtained to for further evaluation. Results suggested a plantar plate injury, and taping was used to offload the plate. She was eventually transitioned out of the boot and into a carbon plate insole with eventual return to running.

1895 May 28 2:30 PM - 2:50 PM

Distal Thigh Pain-Running

Stephanie C. Clark, Marissa L. Dombovy-Johnson, Karen L. Newcomer, FACSM. *Mayo Clinic, Rochester, MN.*

Email: clark.stephanie2@mayo.edu

(No relevant relationships reported)

HISTORY: A 29-year-old female presented with progressive right distal thigh pain. Her pain began gradually after increasing her mileage jogging approximately three months prior to presentation. Her pain was dull, non-radiating and worse at night as well as with running. She had no recent weight loss. There was no associated numbness or tingling. Her past medical history is significant for multiple miscarriages and infertility.

PHYSICAL EXAMINATION: She had a non-antalgic gait. Inspection was negative for edema, masses, adenopathy or skin changes. There was pain with palpation of the supracondylar region of her medial right femur. Range of motion of bilateral hips and knees were full and pain free. Lower extremity strength was normal and symmetric. There was no laxity appreciated with varus/valgus stressing. Lachman and posterior drawer tests were negative.

DIFFERENTIAL DIAGNOSIS:

- Distal adductor tendinopathy
- Femoral epicondyle stress fracture
- MCL strain
- Plica syndrome
- Osteosarcoma

TEST AND RESULTS:

Knee Radiographs

•Small eccentric lytic lesion in the distal right femoral diaphysis medially with associated indolent periosteal new bone formation and minimal surrounding sclerosis
Femur MRI

- Eccentric, T1 hypointense, T2 hyperintense 1.2 x 1.3 x 2.4 cm lytic mass right femoral with a thin rim of peripheral sclerosis and faint rim of T1 hyperintensity
- Thinning of the lateral femoral cortex without definitive cortical breakthrough
- Moderate surrounding marrow and periosteal edema
- Mildly heterogeneous mass with peripherally located enhancement

CT Guided Biopsy

- Pathology positive for Langerhans cell histiocytosis

FINAL/WORKING DIAGNOSIS:

- Langerhans cell histiocytosis

TREATMENT AND OUTCOMES:

- Extended intralesional curettage for gross total resection with synthetic bone graft
- Discharged home the next day with weight bearing as tolerated, walker and Aspirin 325mg BID for 4 weeks for DVT prophylaxis
- Recovery complicated by soleal DVT and hematoma requiring aspiration
- 6 week post-op started full weight bearing and nonathletic activities
- 4 month follow up with stable x-rays, pain free and cleared to resume full activities
- Plan for one year follow up with repeat radiographs and baseline MRI

1896 May 28 2:50 PM - 3:10 PM

HIP INJURY- CROSS COUNTRY

SARAH DECKER¹, GEORGE MATIC², RICHARD OKRAGLY¹. ¹TRIHEALTH, Cincinnati, OH. ²BEACON, Cincinnati, OH. (Sponsor: HENRY STIENE, FACSM)

(No relevant relationships reported)

HISTORY 18-year-old high school female cross-country runner presented with one week of left anterior hip pain. Denied a specific injury. Pain started during a late season

meet causing her to finish at a slower pace. Pain progressively worsened requiring crutches to ambulate, despite no further activity. Max mileage was 40 miles/week, had tapered to 20 miles/week prior to injury. History of stress fracture 4 years prior. Initial x-ray of left hip revealed open epiphyseal plates, no other osseous abnormalities. Inquiring about menstrual history, she had yet to reach menarche. Per the patient's mother, she had been trialed on growth hormone and is currently on estradiol patches. She has a known eating disorder for which she is not actively receiving help, despite multiple hospitalizations. PMHX Primary amenorrhea, followed by endocrinology. Lab work revealed low estradiol, LH, FSH with high alkaline phosphatase. Normal labs were thyroid studies, BMP, LFT, vitamin D and prolactin. Genetics showed 46XX. Multiple XR for bone age showed that of an 11-year-old. Cardiac work up showed sinus bradycardia on EKG and normal echo. Brain/pituitary MRI revealed normal pituitary and mild enlargement of ventricles, sulci, cerebellar folia. **PHYSICAL EXAMINATION** Patient stands 55 inches tall, weighing 61 pounds with a BMI of 14. She appears much younger than stated age. Hair is full, though fine. Breast tissue is not appreciated. On left hip exam, there is TTP along flexor tendon, lateral hip, and piriformis. She has pain with external rotation, weakness and pain with hip flexion, abduction, and adduction against resistance. She is unable to do a single leg hop due to groin pain. She is neurovascularly intact. **DIFFERENTIAL DIAGNOSIS** 1. Femoral neck stress fracture 2. Primary amenorrhea 3. Hip flexor strain 4. Relative Energy Deficiency in Sports syndrome 5. ASIS avulsion fracture **TESTS/RESULTS** MRI left hip 1. Partial thickness tear at attachment of left iliopsoas tendon to lesser trochanter with intramuscular hematoma 2. Minimal partial thickness tear of the left common hamstring origin **FINAL DIAGNOSIS** 1. Partial tear of left iliopsoas tendon and hamstring 2. RED-S **TREATMENT/OUTCOMES** 1. Shut down from all activities 2. Weightbearing as tolerated 3. Referral to gynecology for transvaginal ultrasound 4. Referral to Eating Recovery Center

1897 May 28 3:10 PM - 3:30 PM
Hip Injury - Distance Runner
 Jaimi Weber. *University of Minnesota, Minneapolis, MN.*
 (Sponsor: Suzanne Hecht, FACSM)
 Email: jweber@umn.edu
 (No relevant relationships reported)

HISTORY: 17yo F cross-country runner with hx of 2 bone stress injuries (BSI) of L femoral neck, presents with continued deep anterior L hip pain since 4/2019. No back or radicular pain. Initial BSI (11/2018) was inferomedial femoral neck and was treated with limiting impact activities & PT. Second BSI (4/2019) was superolateral femoral neck. Training volumes at that time were an avg of 35-40 mi/wk. No disordered eating or restrictions. Adequate calcium intake from dietary sources. Taking calcium supplement, and recently stopped vitamin D supplement.

PMH: Menarche at 15 yo and regular until 2 months prior to initial visit. They remained regular but were lighter. No other significant PMH.

FHX: Mother- Hashimoto's & osteopenia. MGM- osteoporosis

PHYSICAL EXAM: BMI 22. Well developed. No thyromegaly. Heart RRR. Lungs CTAB. L hip: NTTP over ant or lat hip. jt line. FROM and strength. Neg FADIR, FABER and single leg hop.

DIFFERENTIAL DIAGNOSIS:

1. Recurrent or delayed healing BSI of L femoral neck
2. L femoral neck fracture
3. Femoral Acetabular Impingement with hip labral tear

TESTS/RESULTS: Normal TSH, CMP, Mg, Phos, & Ca. Celiac screen negative. FT3 2.8 pg/mL. DEXA: Total body less head Z-score = Total body less head -0.9. L hip XR: Normal. MRI 9/2019- grade 2 femoral neck BSI wo significant change compared to MRI obtained 5 weeks prior.

FINAL DIAGNOSIS: Inferomedial femoral neck (Grade 2 BSI) with delayed healing

TREATMENT/OUTCOMES:

1. NWB x 4 wks and then partial WB
2. No impact activities
3. PT
4. Bone stimulator
5. Ortho consult re: surgical intervention
6. Repeat imaging to monitor healing
7. Sports psych consult, initiated by mom & pt
8. Nutrition counseling to assess for underfueling.

D-19 Clinical Case Slide - Upper Extremity

Thursday, May 28, 2020, 1:30 PM - 3:10 PM
 Room: CC-2022

1898 **Chair:** George Guntur Pujalte, FACSM. *Mayo Clinic, Jacksonville, FL.*
 (No relevant relationships reported)

1899 **Discussant:** Jason L. Zaremski, FACSM. *University of Florida, Gainesville, FL.*
 (No relevant relationships reported)

1900 **Discussant:** Erik S. Adams, FACSM. *Midwest Sports Medicine Institute, Bozeman, MT.*
 (No relevant relationships reported)

1901 May 28 1:30 PM - 1:50 PM
Shoulder Pain In A High School Football Player
 George Ghata, Brian Coleman, Jim Barrett. *University of Oklahoma Health Science Center, Oklahoma City, OK.*
 Email: george.ghata@gmail.com
 (No relevant relationships reported)

HISTORY:

15 year old presents to clinic accompanied by father with right anterior shoulder pain for 6 days. He injured it during football practice doing contact drills. He lowered his head and got hit in the anterior aspect of his right shoulder by an opponent's helmet. Initially he couldn't even raise his arm up. He states that his motion has mildly improved but continues to have pain and points anterior and lateral when describing his pain. Denies significant swelling, bruising, paralysis, or paresthesias, or previous injuries to his shoulder. Pain is 4/10. Describes it as a shooting type pain worse with movement and better with ice and holding his arm still. No feelings of instability.

PHYSICAL EXAMINATION:

On examination of his right shoulder there is slight fullness appreciated over the proximal arm. He has mild tenderness over the coracoid anteriorly as well as over his lateral deltoid. Actively he will flex to 130 degrees, external rotation 0 degrees, shoulder adduction 30 degrees and internal rotation just past his iliac crest all of which give him some pain. He does have some mild pain with resisted elbow flexion anteriorly. 5-/5 strength on external rotation, internal rotation and Jobe's.

DIFFERENTIAL DIAGNOSIS:

- Subacromial Impingement
- Rotator Cuff Tear
- Scapular Fracture

TEST AND RESULTS: AP External Rotation and Axillary views were obtained which showed lucency over the base of the coracoid process consistent with fracture.

FINAL WORKING DIAGNOSIS:

Fracture of the base of the right coracoid process

TREATMENT AND OUTCOMES:

1. Placed in a shoulder sling and was instructed to not do any lifting with that arm.
2. Seen 2 weeks later with significant improvement in pain and was able to move arm with still some mild discomfort over the anterior shoulder.
3. Followed up 6 weeks post injury and had no pain with range of motion and had symmetrical strength.
4. Blue Theraband with Jobe's exercises started and was allowed back to play in a graded RTP fashion with follow up as needed.

1902 May 28 1:50 PM - 2:10 PM

Elbow Pain - CrossFit

Ahmad Al-Awadi, Daniel P. Montero, George G.A. Pujalte, FACSM. *Mayo Clinic, Jacksonville, FL.* (Sponsor: George G.A. Pujalte, FACSM)
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 (No relevant relationships reported)

HISTORY: A 29-year-old male CrossFit and surfing instructor with a history of left ulnar shaft fracture treated nonoperatively presented with a 9 month duration of chronic, intermittent, left, sharp and burning elbow pain since injuring himself weight lifting. Bicep flexion and thumb rotation caused pain radiating to the elbow. He endorsed numbness of the left hand that led to an ER visit 9 months ago. His tingling

resolved prior to our visit and he denied shoulder or neck pain. He has been seen previously by a Hand Specialist, was offered a steroid injection, and presented to us for further evaluation.

PHYSICAL EXAMINATION: The patient exhibited no obvious atrophy of the forearm, but trace atrophy at the left medial triceps. He had full flexion and extension equal bilaterally, with slightly decreased supination on the left as compared to the right side. He was tender to palpation over the distal biceps, but nontender in the antecubital fossa. There was mild crepitus with resisted supination and pronation on the lateral epicondylar region. Radial head was minimally tender to palpation. He had elbow pain with resisted elbow flexion in neutral and supination more so than pronation. No skin changes were appreciated and no obvious elbow effusion. Distal neurovascular exam was grossly intact.

DIFFERENTIAL DIAGNOSIS:

1. Distal biceps tear
2. Bicipitoradial bursitis
3. Ulnar shaft fracture
4. Radial head fracture
5. Osteochondritis dissecans of the capitulum

TEST AND RESULTS: Elbow MR arthrogram (obtained 3 weeks ago) demonstrated a very small partial thickness tear of the ulnar collateral ligament, minimal radial cartilage loss, and a partial thickness tear of the distal biceps with prominent bicipitoradial bursitis.

FINAL/WORKING DIAGNOSIS:

Left partial thickness distal biceps tear AND associated bicipitoradial bursitis

TREATMENT AND OUTCOMES:

1. Patient elected to avoid steroid injections and pursue conservative management involving physical therapy and topical NSAIDs
2. Pain continued intermittently. Further work up 1 year later included CT elbow showing mild left ulnohumeral joint osteoarthritis with small ossific joint loose bodies and healed proximal left ulna shaft and coronoid process fractures
3. Elbow pain may be subsequent to malalignment from an old Monteggia fracture

1903 May 28 2:10 PM - 2:30 PM

Left Elbow Pain In An Elite Basketball Player

Ryan Robin¹, Elena J. Jelsing², Nancy M. Cummings², ¹Mayo Clinic, Rochester, MN. ²Mayo Clinic, Minneapolis, MN.
(No relevant relationships reported)

HISTORY: A 32 year old, right handed, female professional basketball player presented two weeks following injury to the left elbow. Her history is significant for various lower extremity musculoskeletal injuries but no previous elbow or shoulder complaints. She presented two weeks following an in-game injury, in which she was "tied up" with another player and felt a hyperextension and valgus movement at the elbow. She felt immediate pain at the medial elbow. Initially there were paresthesias in the ulnar distribution but these resolved shortly. She continued playing through the discomfort for two weeks.

PHYSICAL EXAMINATION: On inspection, there was a trace effusion about the left elbow. There was tenderness to palpation over the flexor pronator mass, medial epicondyle, and sublime tubercle. Extension lacked 5 degrees of range of motion. Flexion was normal at 130 degrees. Strength testing was normal, although there was pain with resisted wrist flexion and pronation. There was no pain with wrist or finger extension or elbow supination. A moving valgus stress test reproduced pain. There was no obvious laxity. Tinel's test over the ulnar nerve was negative.

DIFFERENTIAL DIAGNOSIS: 1. Medial epicondylitis 2. Ulnar collateral ligament sprain or tear 3. Ulnar neuropathy 4. Valgus extension overload syndrome

TEST AND RESULTS: Left elbow X-ray: Unremarkable; Left elbow ultrasound: Full-thickness proximal UCL tear with significant (2.7mm) humeroulnar joint space opening with valgus stress test; Left elbow MRI: Full-thickness tear of the UCL at its humeral attachment with associated edema and inflammation extending into the adjacent flexor digitorum superficialis muscle and partially encasing the ulnar nerve within the cubital tunnel

FINAL WORKING DIAGNOSIS: Left ulnar collateral ligament full thickness tear

TREATMENT AND OUTCOMES: 1. The patient underwent PRP to the UCL tear 2. Post injection rehabilitation started with 6 weeks of rest, protection and range of motion. Pain resolved. 3. Follow up ultrasound at 6 weeks demonstrated interval healing of the full-thickness proximal UCL tear with no significant humeroulnar joint opening on valgus stress testing (0.7mm). 4. Continued PT through 16 weeks post injection and remained pain free with a normal elbow examination throughout the following season without limitation.

1904 May 28 2:30 PM - 2:50 PM

Pediatric Elbow Pain - Baseball

Marcus I. Ng, North Shore University Hospital, Manhasset, NY.
(No relevant relationships reported)

HISTORY:

A 12-year-old RHD developed sudden onset right elbow pain after pitching in a game in the Dominican Republic. He did not have any associated numbness, tingling, or

weakness of the affected extremity. Patient states that he plays primarily as pitcher for his team, and had a sudden sharp pain with a "pop." During the baseball season, patient plays 3 games a week, usually all on the same day. He estimates that he throws at least 100 pitches per game, including warm-up pitches, but is not completely sure because his coaches do not keep strict pitch counts.

PHYSICAL EXAMINATION:

Right elbows without gross deformities, no ecchymosis or crepitus. There is TTP of the medial epicondyle with none in lateral epicondyle, olecranon process, RC joint, or flexor/extensor insertions. Pain with resisted flexion and pronation. Elbow ROM 20-110 degrees, with supination and pronation of 80 degrees. Milking test was positive. Moving valgus stress test was positive, though no varus or valgus laxity appreciated. Sensation was grossly intact to touch along median, ulnar, radial, and axillary distribution. 2+ radial and brachial pulse. Strength was full.

DIFFERENTIAL DIAGNOSIS:

1. Medial epicondylitis
2. Fracture of medial epicondyle
3. UCL injury / Little League Elbow Syndrome

TEST AND RESULTS:

3 views of the right elbow:

— Widening of the medial apophysis to 4.5mm.

— Small ossific fragment at the inferior aspect of the right medial epicondyle apophysis compatible with avulsion injury.

FINAL/WORKING DIAGNOSIS:

Avulsion fracture of the medial epicondyle with apophysitis

TREATMENT AND OUTCOMES:

1. Immobilization with forearm sugar tong splint for 1 week.
 2. Patient returned to Dominican Republic and was placed in long-arm cast by his doctor for 4 weeks.
 3. Cast removed 6 weeks after injury with no pain elicited on exam. Repeat XR of the elbow showed near resolution of apophyseal widening and healed avulsion fracture.
 4. Started PT with emphasis on ROM and joint stabilization with graduated progression to overhead thrower's program.
 5. Re-evaluated after 6 weeks of PT with no pain even with overhead throwing.
- Patient cleared to return to regular baseball activity with strict adherence to pitch count restrictions per Andrews Institute.

1905 May 28 2:50 PM - 3:10 PM

Wrist Injury - Track

Kelly Estes, Washington University, St. Louis, MO.
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(No relevant relationships reported)

History:

A 19 yo M division II decathlete presented to an orthopedic injury clinic with left wrist pain. Just prior to arrival, he had tripped while hurdling, fell, and landed to somehow injure his wrist. He was uncertain of the exact positioning of his wrist to cause the injury. He complained of ulnar-sided wrist pain. His pain was worse with wrist movement. He had concerns about limitations in his range of motion. He denied numbness, tingling, or prior wrist injuries.

Physical Exam:

A focused exam of the left wrist was done. There was no swelling, bruising, or deformity. His active range of motion of the wrist was full in flexion, extension, and pronation. His supination was restricted to zero. Normal motion at the hand and fingers. Normal composite with hand grip. Tenderness at the fovea, triquetrum, ECU. Passive compression of the carpus against the head of the ulna with the wrist in ulnar deviation caused pain. Intact radial, ulnar, and median nerve. 2+ radial pulse. Sensation was intact to light touch.

Differential Diagnosis:

- 1 Acute Fracture - Triquetrum, Lunate, Pisiform
- 2 Bone Contusion
- 3 TFCC injury
- 4 Lunotriquetral Ligament Injury
- 5 Ulnocarpal Impaction Syndrome

Test and Results:

Three view XR of the left wrist: normal alignment, no fracture.

Treatment and Outcomes:

Patient was placed in a cock-up wrist brace, instructed to rest from left upper extremity weight-bearing, and return in 1-2 weeks for repeat exam and XR. At that time his exam was unchanged, continued with ulnar-sided pain and mechanical restriction with supination to zero. MRA of the left wrist was done that showed a displaced, bucket handle tear of the left triangular fibrocartilage disc with flipped fragment within the volar recess of the distal radioulnar joint. Bone contusions were also present in the triquetrum and the lunate. The patient was referred for hand surgery. There is currently plans for arthroscopic assessment and TFCC repair. Possible debridement. Possible fovea repair.

Final/working diagnosis:

Displaced, bucket handle TFCC tear

D-20 Rapid Fire Platform - Wearables

Thursday, May 28, 2020, 1:30 PM - 2:50 PM
Room: CC-Exhibit Hall

1906 **Chair:** Scott E. Crouter, FACSM. *The University of Tennessee Knoxville, Knoxville, TN.*
(No relevant relationships reported)

1907 May 28 1:30 PM - 1:40 PM

Tracking Calories: Validity Of Wearable Activity Monitors

Jessica M. Wade, Kayla M. Kowalczyk, Victoria Lynch, Bianca De Lucia, Jonathan Hudak, Alicja B. Stannard. *Sacred Heart University, Fairfield, CT.*
(No relevant relationships reported)

The use of commercially accessible activity monitors has increased over the past few years. Assessing the accuracy of these devices is necessary to inform recreational consumers about the validity of these products. **PURPOSE:** To assess the validity of four activity monitors (Monitor 1, Monitor 2, Monitor 3, and Monitor 4) for energy expenditure (EE) data. **METHODS:** Twenty-one subjects (8 male and 13 female), with an average age of 20.2 years performed three exercise protocols: walking at 3.0 mph, running at 6.0 mph, and a HIIT workout for ten minutes each. Each exercise bout was followed by a seated rest period until subjects returned to pre-exercise VO_2 values. EE measured in kcal was collected from the Parvo metabolic cart and compared with the EE from four activity monitors. EE from activity monitors was recorded from apps in kilocalories (kcal) upon completion of the testing. Descriptive statistics were performed for all variables. Coefficient of determination (R^2) was used to assess the validity of EE in kcal for all devices. **RESULTS:** Monitor 3 was the most accurate device with an R^2 of 0.68 for walking, 0.62 for HIIT and 0.59 for running. Monitor 1 showed the weakest correlations for the running (0.27), and the HIIT (0.34) protocols but was comparable to Monitor 3 for walking (0.64). Monitor 2 was the least accurate for walking ($R^2 = 0.246$) and showed low validity for running and HIIT (0.36 and 0.47 respectively). Monitor 4 was most accurate for higher intensity activities such as running (0.68) and HIIT (0.67). **CONCLUSION:** Monitor 3 was consistently the most accurate out of tested devices. However, results of this study demonstrate inaccurate assessment of EE by all wearable devices. None of the activity monitors met the correlational standard of 0.7. Future research should continue to assess the validity of these devices to provide accurate information on various modalities and exercise intensities to recreational consumers.

1908 May 28 1:40 PM - 1:50 PM

Validity Of Wrist-worn Activity Trackers

Bianca J. De Lucia, Victoria E. Lynch, Kayla M. Kowalczyk, Jessica M. Wade, Jonathan R. Hudak, Alicja B. Stannard. *Sacred Heart University, Fairfield, CT.*
(No relevant relationships reported)

The use of physical activity monitors has increased dramatically in the past decade. Wrist-worn activity monitors are often used to monitor heart rate (HR) for exercise intensity. Assessing the validity of these devices is essential for accurate exercise prescription and user safety. **PURPOSE:** The objective of this study was to assess the validity of three common wrist-worn physical activity monitors for measuring HR during three modes of exercise. **METHODS:** Twenty-one participants (seven males, fourteen females) completed the study. Inclusion criteria for participation were: ≥ 18 years of age, have no history of cardiovascular or chronic disease (assessed by PAR-Q+), and have the ability to run for 10 minutes at 6mph. HR data was recorded for three common physical activity monitors (AM1, AM2, AM3) during 10 minutes of walking at 3mph, running at 6mph, and High Intensity Interval Training (HIIT) session consisting of a body weight series of exercises. HR data was collected every minute and compared against gold standard chest strap HR monitor to assess validity. Descriptive statistics were performed for all variables. R^2 values were calculated for each device and each mode of exercise. **RESULTS:** AM1 was the most accurate device with R^2 of 0.733 for running and 0.678 for walking. AM2 data showed moderate R^2 for running (0.54) and walking (0.44). AM3 HR data was unreliable. HIIT condition was the least accurate for each monitor (R^2 range 0.098-0.124). **CONCLUSION:** These results demonstrate that the accuracy of the devices for tracking HR increases with increasing intensity of steady-state activities. HR data during HIIT was unreliable possibly due to excessive movements. Assessed physical activity monitors in this study are not accurate for tracking HR during walking, running, and HIIT particularly if used for patient monitoring. The cheapest monitor (AM3) had a very weak correlation; consumers should consider more expensive monitors for more accurate HR readings during steady-state activities. More research needs to be done to further explore the accuracy of activity monitors for a wider range of modalities and intensities.

1909 May 28 1:50 PM - 2:00 PM

Validation Of A Wrist-mounted Heart Rate Monitor During Maximal Graded Exercise Testing

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(No relevant relationships reported)

The electrocardiogram (ECG) serves as the gold standard of heart rate (HR) monitoring but is rarely used outside of a clinical environment. Newly developed wearable technology is more usable outside of a clinical setting, but has not been validated against this gold standard. **PURPOSE:** The purpose of this study is to determine the validity of a wrist-mounted photoplethysmography (PPM) device used for measuring HR during incremental treadmill exercise using ECG as the criterion HR measurement. **METHODS:** Twenty-two subjects (13 men, 9 women; 35.8 ± 6.3 yr, 14.6 ± 7.5 % body fat, $\text{VO}_{2\text{max}}: 55.5 \pm 0.49$ ml·kg⁻¹·min⁻¹) performed a Bruce treadmill protocol graded exercise test. HR was recorded at rest and at the end of each minute with the Mio Alpha PPM device and ECG simultaneously. HR was compared between methods across the entire testing session (rest and exercise values) and separately for each exercise test stage using paired-samples *t*-tests and the Bonferroni correction. Validity coefficients were determined using the Pearson correlation. **RESULTS:** HR across the entire intensity range (rest to maximal exercise) exhibited a significant correlation between methods ($r = 0.97$, $p < 0.001$) and was similar between ECG and Mio after the Bonferroni correction was applied, requiring $p < 0.008$ (overall mean HR: ECG = 124 ± 39 b·min⁻¹, Mio = 123 ± 37 b·min⁻¹, $t_{339} = -2.504$, $p = 0.013$). Significant correlations were observed at rest and each exercise test stage, with *r* values ranging from 0.67 to 0.96 (all $p < 0.001$). HR was similar between methods at rest and each exercise test stage except for stage 4 (ECG = 168 ± 13 b·min⁻¹, Mio = 164 ± 14 b·min⁻¹, $p = 0.004$). **CONCLUSIONS:** Correlational analyses indicated a strong agreement between HR methods overall, as well as individually at rest and during each exercise test stage. However, mean comparisons observed a significant difference between methods at stage 4 and mean differences between methods became larger as intensity increased. From a practical standpoint, the mean difference between methods did not exceed 3 b·min⁻¹ except for stage 5. Therefore, a PPM device seems valid for HR monitoring during low-to-moderate-intensity but not high-intensity treadmill exercise.

1910 May 28 2:00 PM - 2:10 PM

Validation Of Player Tracking Sensors For Measuring Sprint Speed With Collegiate Ice Hockey Players

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Commercially available player tracking sensors (PTS) have been used to monitor athlete player metrics during practices and games in a variety of sports. Specifically, PTS have been used to monitor athlete performance during ice hockey practices and games. Internal metrics stemming from heart rate values appeared plausible and valid, but external metrics (distance, speed, acceleration) were sporadic and counterintuitive. For instance, goalie distances were greater than skaters, and sprint values did not appear to register in real time. This could be due to the mechanics of skating differing from common bipedal locomotion. **PURPOSE:** To determine the validity of a PTS for measuring sprint speed with male collegiate hockey players. **METHODS:** A total of 15 NCAA Division I male hockey players (21.86 ± 1.04 yr, 175.86 ± 6.78 cm, 80.58 ± 4.44 kg) participated in the study. Each participant had a player profile created in the PTS system, which included each player's height, body mass, date of birth, and level of training. Participants then wore a PTS strap, at the level of the xiphoid process, with an attached sensor that corresponded to their individual player profile. Participants performed two sprints of 15.24 meters and two sprints of 35.05m with five minutes of rest between each sprint. Sprints were performed in three conditions: indoor running, outdoor running, on-ice skating. The 15.24m (blue line to blue line) and 35.50m (red line to the far blue line) distances were chosen to simulate common landmarks on a hockey rink. Wireless infrared photocell timing gates (TG) were used to determine sprint times and allow for manual calculation of speed. Speed values from the PTS and TG were compared using paired samples *t*-tests, and an alpha level of 0.05, 2-sided was set *a priori* as a significance level. **RESULTS:** For indoor and outdoor sprinting, the PTS overestimated speed at both distances ($p < .001$). However, on-ice sprints resulted in PTS underestimating speed at both distances compared to TG ($p \leq .001$). **CONCLUSIONS:** The PTS is not accurate for measuring sprint speed during indoor running, outdoor running, or on-ice

skating. The inconsistency in speed values needs to be taken into consideration when using the system for player monitoring, because the speed values could also affect other external performance metrics provided by PTS.

1911 May 28 2:10 PM - 2:20 PM
ESTIMATING ENERGY EXPENDITURE USING ACCELEROMETERS DURING HIGH INTENSITY INTERVAL TRAINING.

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 (No relevant relationships reported)

Accelerometers are objective monitors that can be used to estimate energy expenditure (EE) during steady state exercise. However, high intensity interval training (HIIT) has received increasing attention because of its similar benefits to longer duration, steady state, less intense exercise. The accuracy of accelerometer-estimated EE during HIIT has yet to be examined. **PURPOSE:** The purpose of this study was to discern the differences between criterion-measured EE and accelerometer-estimated EE (kCals) during a HIIT session. **METHODS:** Nine participants (mean age=20.4 yrs, Body Mass Index=24.7 kg/m², males=8), completed a preliminary session, to determine treadmill speed at 95% HR max, and a HIIT session within 2 weeks of each other. For the HIIT session, each participant wore an ActiGraph GT3X+ accelerometer on their right hip while EE was measured using portable indirect calorimetry (Oxycon Mobile). The HIIT session comprised of 5 bouts: each bout included a 45-second exercise event and 90-second rest event. Data analysis was conducted using custom R scripts and paired T-tests to determine significant differences between criterion measure and accelerometer estimates of EE during the HIIT session. **RESULTS:** On average, the accelerometer underestimated total EE (92.76±0.33 kCals) compared with the criterion measure (108.73±3.99 kCals) for the entire HIIT session by 15% (p=0.0507). During exercise events, accelerometer estimated EE (8.99±1.99 kCals) was greater than criterion measured EE (7.10±1.82 kCals; p<0.001). During rest events, accelerometer estimated EE (9.56±2.86 kCals) was less than criterion measured EE (14.64±2.81; p<0.001). **CONCLUSION:** Compared with the criterion measure of indirect calorimetry, the accelerometer underestimated total EE for the HIIT session due to the underestimation of EE during rest events. Future studies should further investigate the accelerometer's underestimation in larger more diverse samples to develop an algorithm that better predicts total EE during interval training.

1912 May 28 2:20 PM - 2:30 PM
Estimates Of Exercise Energy Expenditure From Two Optical Heart Rate Bands

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 (No relevant relationships reported)

Introduction: There are many watches on the market today that use optical sensors to measure heart rate (HR) in order to estimate exercise energy expenditure (ExEE). It has been shown that wrist movements can interfere with the HR measurements obtained from these watch based sensors which in turn may alter ExEE estimates. The Polar OH1 (OH1) and the Wahoo TICKR FIT (TICKR) eliminate interference by using an elastic armband to hold the sensor in place on the either the forearm or just below the elbow. **PURPOSE:** The purpose of the study was to compare the ExEE values from the OH1 and the TICKR to actual ExEE as measured by indirect calorimetry (IDC) during specific bouts of exercise.

METHODS: Eleven females and 9 males (26.1 ± 7.0 and 23.8 ± 3.2 yrs old, respectively) were fitted with each armband. The sensors were placed on the forearms according to the manufacturer instructions. The exercise bouts consisted of 5 min walking stages (3.5 mph at 0% and 5% grade) and 5 min running stages (5.5 mph at 0% and 5% grade). There was a 3 min of rest between each bout. Actual ExEE was measured via IDC.

RESULTS: There were no significant differences between devices during the walking stage at 0% grade. There were significant differences between devices for the walk with 5% grade, with the OH1 overestimating compared to the TICKR and IDC (11.2 ± 3.6 and 11.7 ± 3.4 kcal, respectively). There were significant differences between devices for the run at 0% grade, with the OH1 overestimating compared to the TICKR and IDC (14.6 ± 4.0 and 16.2 ± 3.9 kcal, respectively). There were significant differences between devices for the run at 5% grade with the OH1 overestimating compared to the TICKR and IDC (18.3 ± 3.8 and 15.0 ± 3.7 kcal, respectively).

CONCLUSIONS: The Polar OH1 overestimates ExEE as exercise intensity increases when compared to IDC. The ExEE estimates from the Wahoo TICKR FIT are similar to ExEE as measured by IDC at all intensity levels. Caution should be used when tracking ExEE when using the OH1 at higher exercise intensities.

1913 May 28 2:30 PM - 2:40 PM
Validation Of Two Wearable Chest Straps For Heart Rate Monitoring During Mountain Biking

Jacquelyn V L Sertic, Bryson Carrier, Peyton C. Cater, Brenna Barrios, Robert W. Salatto, James W. Navalta, FACSM.
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 (No relevant relationships reported)

The Suunto chest strap claims to "monitor [HR] with precision" and "send accurate [HR] information to your compatible Suunto [product]". Previous research has shown the HR feature of the Suunto to be valid during running. However, there appears to be little, if any, research determining whether the Suunto is a valid measure of HR during mountain biking. **PURPOSE:** This study aimed to determine the validity of the HR feature of the Suunto chest strap during mounting biking activity as compared to the criterion, the Polar H7. **METHODS:** Sixteen apparently healthy volunteers (males = 8, females = 8, 24.69 ± 4.44 yrs, 171.45 ± 8.9 cm, 74.23 ± 21.07 kg) rode mountain bikes on a beginner-level mountain biking trail at the McCullough Hills Trailhead in Henderson, NV. Participants concurrently wore both HR monitors on the chest while biking one mile away from the trailhead and one mile to return to the trailhead. The Polar H7 and Suunto second-by-second HR data were compared using mean absolute percent error (MAPE), a Bland-Altman analysis with limits of agreement (LoA), and an intraclass correlation (ICC). Prior to testing, the benchmark for validity was established as a MAPE < 10% and an ICC > 0.7 (p < 0.05), with the lower limit of the ICC 95% confidence interval (CI) set at > 0.7. **RESULTS:** The lower and upper LoA were -13.89 and 13.08, respectively. The MAPE value from the Suunto produced a forecast of 3.944. The Suunto demonstrated an ICC = 0.973 (95% CI = 0.972, 0.974, p < 0.001). **CONCLUSIONS:** The data indicate that there is a good level of agreement between the Polar H7 and the Suunto, suggesting that the Suunto is a valid measurement of HR during mountain biking.

1914 May 28 2:40 PM - 2:50 PM
Generational Differences Of Consumer Wearable Devices For Estimating Physical Activity Outcomes

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 (No relevant relationships reported)

Consumer activity monitors (CAMs) are commonly validated for estimating physical activity outcomes [e.g. energy expenditure (EE)] when a new model is released. It is unclear if this is a needed practice and if prediction algorithms change when a new device generation is released. **Purpose:** To compare step and EE estimates for different generations of wrist-worn CAMs from the same manufacturer [Apple Watch Series 2 (AW2) and 4 (AW4), Fitbit Charge 2 (FC2) and 3 (FC3), and Garmin Vivofit (VF) and Vivofit 4 (VF4)]. **Methods:** Nineteen participants (mean±SD; age, 25.1±5.0 y) completed seven structured activities (six min each) that ranged from sedentary to vigorous intensities. Each participant wore four CAMs (two different models from the same brand on each wrist) and a Cosmed K5 for measured EE. The devices were randomized by combination (e.g. Fitbit-Garmin), placement (proximal vs. distal), and side (left vs. right). Total EE was obtained for the entire activity protocol, including transitions (average total time, 48 min). The primary analysis included the comparison of the estimates of steps and EE between generations within a brand. A secondary analysis included comparing the EE estimates from each device against the K5. Paired t-tests were used to compare steps and EE between different generations within a brand. Repeated measures ANOVAs were used to compare estimated gross EE from devices and measured EE from the K5. **Results:** There was no significant placement effect (proximal versus distal), thus, data from both placement locations was pooled together for each device for analysis. Table 1 shows the overall findings.

Conclusion: It is not recommended to interchange EE estimates from different CAM brand generations. However, the step estimates had an acceptable difference of ≤5% and could be interchanged across CAM generations. Future studies should explore if the observed differences are due to changes in hardware or software between generations.

Table 1. Mean \pm standard deviation for total Kcals and steps for each device.

Device	Steps	Total Kcals	Total K5 Kcals
AW4	3001.4 \pm 525.1	242.6 \pm 72.0**	298.6 \pm 77.7
AW2	3074.7 \pm 563.6	223.6 \pm 62.2*	
FC3	3577.1 \pm 525.4*	296.6 \pm 135.6	292.3 \pm 72.4
FC2	3450.9 \pm 292.4	272.9 \pm 56.7	
VF4	3288.9 \pm 380.4*	161.1 \pm 33.2**	280.0 \pm 65.9
VF	3144.8 \pm 368.0	303.6 \pm 141.1	

*Statistically significant generational difference, $p < 0.05$.**Statistically significant difference between the device and K5, $p < 0.05$.**D-37 Thematic Poster - Genetic Predictors of Performance Across the Globe**

Thursday, May 28, 2020, 3:45 PM - 5:45 PM

Room: CC-2000

1968 Chair: Brian A. Irving, FACSM. Louisiana State University, Baton Rouge, LA.

(No relevant relationships reported)

**1969 Board #1 May 28 3:45 PM - 5:45 PM
Nomograms For Predicting And Identifying Polygenetics Models Of Power Performance In Chinese Elite Athletes**Ruoyu Yang¹, Xunzhang Shen². ¹Shanghai University of Medicine & Health Sciences, Shanghai, China. ²Shanghai Research Institute of Sport Science, Shanghai, China.
Email: yangry@sumhs.edu.cn

(No relevant relationships reported)

Based on the single nucleotide polymorphism (SNP) of elite power performance athletes, combined with other related phenotypic indicators, models for predicting and identifying the power performance of Chinese elite athletes was established, and the models were visualized by the method of nomogram.

PURPOSE: To explore the relationship between power performance and SNP of Chinese elite athletes and to create polygenic models for predicting and identifying elite power performance. **METHODS:** 103 elite athletes (age=24.3 \pm 3.2 years; height=174.9 \pm 8.4cm; body mass=66.3 \pm 14.0kg; body mass index (BMI)=21.5 \pm 3.4) which were all Chinese were divided into power group (n=60) and endurance group (n=43) by their sport event. Best standing long jump (SLJ) and standing vertical jump (SVJ) were collected. Saliva samples were collected to test and 20 SNPs were genotyped by SNaPshot. test was used to compare the genotype distribution and allele frequency between groups. Predicting and identifying models were established by multivariate logistic regression analysis. Nomograms were created to visualize. **RESULTS:** ACTN3(rs1815739), ADRB3(rs4994) and PPARGC1A(rs8192678) were significant both in genotype distribution and allele frequency between groups ($P < 0.05$). The predicting model was consisted of ACTN3(rs1815739) (OR=2.448, 95% CI: 1.277-4.693), ADRB3(rs4994) (OR=3.546, 95% CI: 1.360-9.245) and PPARGC1A(rs8192678) (OR=2.159, 95% CI: 1.109-4.207), the AUC of which was 0.736. The identifying model was consisted of BMI (OR=1.217, 95% CI: 1.005-1.473), SVJ (OR=1.092, 95% CI: 1.040-1.146), ACTN3 (OR=2.127, 95% CI: 1.006-4.497), ADRB3 (OR=5.029, 95% CI: 1.451-17.427) and PPARGC1A (OR=2.370, 95% CI: 1.070-5.250), the AUC of which was 0.854. Based on the two models, nomograms were created to visualize the results. **CONCLUSION:** Two models can be both used for talent identification in Chinese athletes, among which the predicting one can be used in adolescent athletes to predict the development potential of power performance and the identifying one can be used in elite athletes to distinguish and evaluate power athletic status. It can be applied quickly and visually by using the method of nomogram.

Supported by key basic research grants from Science and Technology Commission of Shanghai Municipality, GrantNo.16JC1400500.

**1970 Board #2 May 28 3:45 PM - 5:45 PM
Kcnj11 Gene Polymorphism And Endurance Performance Status In Hispanics: A Replication Study**Miguel A. Rivera¹, Thomas D. Fahey², Juan A. Lopez-Taylor³, Juan L. Martinez⁴. ¹University of Puerto Rico School of Medicine, San Juan, PR. ²California State University - Chico, Chico, CA. ³University of Guadalajara, Guadalajara, Mexico. ⁴Hospital Civil de Culiacán, Culiacan, Mexico.

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(No relevant relationships reported)

Previous reports from our laboratory had shown significant associations between the potassium inwardly-rectifying channel, subfamily J, member 11 (KCNJ11) gene Glu23Lys variant and cardiorespiratory endurance performance (CRE) phenotypes (Padr6 et al. (2003), MSSE, 35(S1), 377; Gonz6lez et al. (2003), MSSE 35(S1), 378; Ortiz et al. 2005, MSSE 37(S1), 165). The KCNJ11 gene, is expressed in several tissues, including cardiac and skeletal muscle, where it is involved in the coupling of cell metabolism to cell electrical activity. **PURPOSE:** To replicate the study Ortiz et al. 2005, MSSE 37(S1), 165) and validate the findings of Padr6 et al. (2003), MSSE, 35(S1), 377; Gonz6lez et al. (2003), MSSE 35(S1), 378, by testing the association between the KCNJ11 gene Glu23Lys variant and CRE performance level in Hispanic male marathon runners (MR) using a good-sized sample size. **METHODS:** The subjects (n=1778) were adult Hispanic male MR that completed a 42-km road race. Fast-MR (cases; n=884) were finishers in the top third percentile. Slow MR (controls; n=894) were finishers in the lowest third percentile of their respective ages. A whole blood sample provided for the extraction of genomic DNA. The polymerase chain reaction was used to amplify the KCNJ11 gene Glu23Lys variant. Both case and control groups observed genotype frequencies met Hardy-Weinberg equilibrium expectations (χ^2 , $P \geq 0.05$). **RESULTS:** The main finding showed a statistically significant ($p \leq 0.05$) association between the KCNJ11 gene Glu23Lys variant and CRE performance level. Fast-MR (cases) showed a significant over-representation of the KCNJ11 gene Glu23Lys variant compared to slow-MR (controls), 67.4% vs. 51.5%, ($p \leq 0.05$). **CONCLUSION:** The study replicated and validated previous findings of an association between the KCNJ11 gene Glu23Lys variant and cardiorespiratory endurance.

**1971 Board #3 May 28 3:45 PM - 5:45 PM
Association Between The Mct1 T1470a Polymorphism And Athletic Status In Asian And European Climbers**Mika Saito¹, Michał Ginst², Myosotis Massidda³, Paweł Cieszczyk⁴, Takanobu Okamoto¹, Takanobu Okamoto¹, Mikako Sakamaki-Sunaga¹, Pitor Majcher², Koichi Nakazato¹, Naoki Kikuchi¹. ¹Nippon sport science university, Tokyo, Japan. ²Medical University of Lublin, Lublin, Poland. ³University of Cagliari, Cagliari, Italy. ⁴University of Physical Education and Sport, Gdansk, Poland.

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PURPOSE: To investigate the association between the MCT1 T1470A polymorphism and athletic status in Asian and European climbers.

METHODS: One-hundred and ninety climbers (93 Asian: 93 Japanese; 97 European: 94 Polish, 1Ukrainian, 1Russian, 1French) and 825 controls (204 Asian and 621 European) were genotyped for the MCT1T1470A genotype (rs1049434) polymorphism using the TaqMan[®] Assay. Sports climbing included some discipline in the form of bouldering and lead climbing. Therefore, we assigned them to bouldering or lead climbing groups within each ethnic group based on self-reported achievement. We assigned 72 boulderers and 21 lead climbers among the Asian climbers and 65 boulderers and 32 lead climbers among the European climbers.

RESULTS: There were no significant differences in the MCT1 genotype and allele frequency between Asian climbers and controls (genotype: $p = 0.192$, allele frequency: $p = 0.246$). Meanwhile, the frequency of the T allele was significantly higher in climbers than in controls among the European subjects ($p = 0.029$). In addition, the frequency of the TT genotype tended to be higher in climbers than in controls among the European subjects ($p = 0.073$). The odds ratios of the T allele were 1.24 (95% confidence interval (CI): 0.86-1.80) and 1.47 (95% CI: 1.07-2.00) in Asian and European climbers, respectively. The frequency of the T allele tended to be higher in boulderers than in lead climbers among the Asian subjects ($p = 0.083$). Conversely, the frequency of the T allele tended to be higher in lead climbers than in boulderers among the European subjects ($p = 0.089$).

CONCLUSIONS: Our results suggest that climbers have a greater frequency of the T allele of the MCT1 T1470A polymorphism compared with that in controls among Asian and European individuals, respectively. The MCT1 genotype is associated with climbing status in European individuals, and the same trend is observed in an Asian cohort. We need a greater sample size to confirm the association between gene polymorphisms and athletic status in climbers.

1972 Board #4 May 28 3:45 PM - 5:45 PM

Cmv Serostatus Has A Negative Effect On Cardiorespiratory Fitness And Insulin Sensitivity In Sedentary African-americans

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(No relevant relationships reported)

PURPOSE: Investigate the effects of Cytomegalovirus (CMV) serostatus on measures of physical (VO₂max) and metabolic (Insulin Sensitivity) fitness in healthy adults before and after a 20-week exercise intervention.

METHODS: Serum samples from a subsample (n=120) of the HERITAGE study (Bouchard et al., MSSE 1995) were analyzed for CMV serostatus. This subset was selected from the 60 men and 60 women with the greatest VO₂ max increase in response to the 20 week intervention and included Caucasians (n=82) and African Americans (n=38). Baseline VO₂max was assessed using a stationary cycle ergometer test and insulin sensitivity was measured using a 3-hour intravenous glucose tolerance test before and after the training program.

RESULTS: Caucasians had a lower prevalence of CMV seropositive status than African-American (33% vs. 68%, p<0.01). In Caucasians, CMV serostatus was not associated with baseline aerobic capacity or insulin sensitivity. In African-Americans, CMV seropositive status was associated with impaired aerobic capacity pre- (2.39 ± .53 L/min vs 1.84 ± .67 L/min; p=.020; CMV seropositive vs CMV seronegative) and post-intervention (2.44 ± .75 L/min vs 3.03 ± .59 L/min; p=.028). Significant effects of CMV serostatus persisted after controlling for age, sex, body weight, and body fat percentage (p=.047, p=.047; pre- and post-intervention resp.). African-American CMV seropositive participants also had higher insulin responses to an IVGTT both pre- (1971.64 ± 1173.31 10 min.mU⁻¹mL⁻¹ vs 849.16 ± 456.67 min.mU⁻¹mL⁻¹; p=.014) and post-intervention (1873.88 ± 1212.65 min.mU⁻¹mL⁻¹ vs 909.18 ± 432.38 min.mU⁻¹mL⁻¹; p=.038). CMV serostatus still had significant effects on insulin sensitivity after controlling for age, sex, and aerobic capacity (p=.011, p=.016; pre- and post-intervention, resp.).

CONCLUSIONS: In sedentary African American adults, CMV serostatus is significantly associated with lower VO₂max and insulin sensitivity even while controlling for variables known to mediate fitness and glucose sensitivity, and the associations persisted after exposure to 20 weeks of a standardized exercise program. We conclude that CMV status is another personal characteristic that needs to be taken into account in the assessment of cardiorespiratory fitness and insulin sensitivity in this population.

1973 Board #5 May 28 3:45 PM - 5:45 PM

ASSOCIATION BETWEEN POLYMORPHISMS IN THE CARNOSINASE GENES AND THE PERSONAL BEST TIME OF BRAZILIAN SPRINTERS

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Naturally found in some meats, carnosine is a physico-chemical buffering agent that has been shown to have positive effects on high intensity exercises. Because carnosine is readily degraded by highly active carnosinase enzymes, it has been postulated that only individuals with a low carnosinase activity and protein content could show the presence of carnosine in plasma (carnosinemia), which may be beneficial for athletes engaged in high intensity activities. Of note, two carnosinases have been identified: the serum carnosinase (CNDP1) and the tissue carnosinase (CNDP2).

PURPOSE: Explore whether the presence of polymorphisms in the *CNDP1* and *CNDP2* genes is associated with the performance of short (100 m), medium (200 m) and long (400 m) running sprints.

METHODS: A cohort of top-level Brazilian sprinters (men) had their genotypes determined for the *CNDP1* rs2887 and *CNDP2* rs3764509 polymorphisms, and the personal best times for the 100 m (n = 31), 200 m (n = 35) and 400 m (n = 39) compared between genotypes. Based on previous studies, the A/A genotype instead of G/G and G/A genotypes (*CNDP1* rs2887) and the G/G genotype instead of C/C and C/G genotypes (*CNDP2* rs3764509) were considered optimal for power performance. Athlete's personal records were acquired using the International Association of Athletics Federations database, available online at <https://www.iaaf.org/>. Genotyping of both polymorphisms was conducted using a pre-designed specific TaqMan® SNP Genotyping Assay according to the manufacturer's instructions. Student's t-test was used to compare the personal best times between genotypes. The significance level was established at P < 0.05.

RESULTS: No differences were found between polymorphisms and personal best times for the 100 m (overall mean ± SD: 10.66 ± 0.38 s, P > 0.930). However, athletes with the *CNDP1* A/A genotype (21.12 ± 0.41 s versus 21.78 ± 0.72 s, P = 0.027) or

CNDP2 G/G genotype (21.19 ± 0.80 s versus 21.78 ± 0.67 s, P = 0.044) had faster personal times for the 200 m. In addition, athletes with the *CNDP2* G/G genotype showed a trend of faster personal times for the 400 m (47.19 ± 1.29 s versus 48.39 ± 1.55 s, P = 0.051).

CONCLUSION: The homozygous genotype for the mutant allele in both polymorphisms (*CNDP1* rs2887 and *CNDP2* rs3764509) was associated with 200m sprinting performance in elite athletes.

1974 Board #6 May 28 3:45 PM - 5:45 PM

Vegf Rs2010963 Genotype And Performance Of Elite Middle-long Distance Swimmers In China

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Vascular endothelial growth factor is essential to induce the full spectrum of VEGF angiogenic responses to aerobic training.

PURPOSE: The study aimed to examine the association of the VEGF rs2010963 genotype with the performance of elite middle-long distance swimmers.

METHODS: The distributions of the VEGF rs2010963 genotype and allele were examined in a general population (122) and a group of elite middle-long distance swimmers (120) in China by using PCR-RFLP and TOF.

RESULTS: Compared with the general population, the elite middle-long distance swimmers had a higher frequency of the GG genotype (Total: 42.37% VS 29.51%, P<0.05). The middle-long distance swimmers had a higher frequency of the G allele than the general population (64.83% VS 52.46%, P<0.05). The elite MLD swimmers had a lower frequency of the CC + CG genotype compared with the general population (57.62% VS 70.49%).

CONCLUSIONS: The VEGF rs2010963 polymorphism was associated with the performance of elite middle-long distance swimmers in China. The SNP rs2010963 could be used as a biomarker for selecting middle-long distance swimmers in China.

D-38 Thematic Poster - Implementation Science in Exercise Oncology

Thursday, May 28, 2020, 3:45 PM - 5:45 PM
Room: CC-2007

1975 Chair: Heather J. Leach. Colorado State University, Fort Collins, CO.

(No relevant relationships reported)

1976 Board #1 May 28 3:45 PM - 5:45 PM

A Qualitative Investigation Of Fitness Professionals' Perceived Barriers And Enablers To Community-based Cancer Exercise Programming

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Access to community-based interventions is valuable for promoting regular exercise participation in cancer survivors. Although cancer survivors perceived exercise barriers have been consistently investigated, fitness professionals' perceptions of the barriers and enablers to offering community-based exercise programming targeting cancer survivors has yet to be systematically explored. **PURPOSE:** The primary purpose of this study is to qualitatively investigate health and fitness professionals' perceptions of barriers and enablers to offering community-based exercise programs targeting cancer survivors at their fitness and/or community centers. **METHODS:** A mixed-method qualitative case study approach incorporating web-based survey and semi-structured interview components was used to evaluate the fitness professionals' programming perceptions. A total of 82 community-based health and fitness professionals were contacted about the web-based survey. A total of 7 subjects volunteered to participate in a follow-up semi-structured interview based on their consent to participate in the further interview as indicated on the initial survey. **RESULTS:** A total 12 survey responses (14.6%) were completed online and 7 of 12 (58.3%) of the individuals completed the semi structured interviews. Data analysis using content analysis

and the constant comparative method process revealed 3 primary domains with 11 underlying themes: 1. Program Barriers: a. Education and Awareness; b. Physician Referral; c. Cost, and d. Care Along the Cancer Continuum; 2. Program Enablers a. Champion Advocacy, b. Sponsor/Funding, c. Personnel, and d. Propositional Solutions; and 3. Program Perceptions a. Social Support, b. Gym Atmosphere, and c. Cancer Specific Modifications. **CONCLUSIONS:** Findings from this mixed method, qualitative study identified multiple domains and themes articulating health and fitness professionals' perceptions of key barriers, enablers, and programmatic aspects in offering community-based exercise cancer programming. These results have important implications for guiding the design and delivery of community-based exercise programs for cancer survivors and represent a meaningful advance in developing a clinic-to-community translational model of exercise-based supportive cancer care.

1977 Board #2 May 28 3:45 PM - 5:45 PM
Seven-day Exercise-based Prehabilitation For People With Non-small Cell Lung Cancer: A Systematic Review And Meta-analysis

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PURPOSE: Exercise based prehabilitation (EBPP) for people with non-small cell lung cancer (NSCLC) can reduce postoperative complications, however the four-week intervention period may negatively affect tumour growth, condition deterioration and programme adherence. It is unclear whether shorter 7-day EBPP can improve fitness to reduce postoperative complications. Therefore, the aim was to determine whether 7-day EBPP can increase six-minute walk distance (6MWD), improve peak expiratory flow (PEF) and improve postoperative outcomes. **METHOD:** Electronic databases (PubMed, Scopus, Medline, Web of Science and Cochrane Library), were systematically searched. Reference lists of relevant papers were also searched. Study selection was performed independently in a non-blinded manner. Only randomised controlled trials (RCTs) were included, with people with NSCLC undergoing 7-day EBPP, including at least one of pre- to post-EBPP change in 6MWD or PEF and at least one of: pulmonary complications (PC), length of stay (LoS) or length of antibiotic use. Review Manager was used to analyse risk of bias (RoB), risk ratio (RR) and mean difference (MD). **RESULTS:** 6 studies, with 346 participants, were included and presented a high RoB. Reporting of exercise performed, progression and adherence were limited. All studies used combined leg and arm ergometry aerobic training for 15-30 minutes, at a perceived exertion of "somewhat hard", 1-2 times daily. One study implemented resistance training. All studies included respiratory muscle training (20 min or 12-30 breaths). Pooled data suggested that compared to standard care, 7-day EBPP significantly increased 6MWD (20.6 m; 95% CI: 13.6 to 27.6; $p < 0.00001$) and PEF (20.8 L·min⁻¹; 95% CI: 15.5 to 26.0; $p < 0.00001$) in three studies and significantly reduced LoS (-2.7 days; 95% CI: -3.6 to -1.1; $p < 0.00001$) in four studies, significantly reduced the risk of developing a PC (RR 0.39; 95% CI: 0.25 to 0.62; $P < 0.0001$) in all studies and significantly reduced antibiotic use (1.2 days; 95% CI: -2.1 to 0.3; $p < 0.01$) in two studies. **CONCLUSION:** Low quality evidence suggests that 7-day EBPP may significantly increase 6MWD & PEF and significantly reduce PPC, LoS & antibiotic use. Future RCTs should apply greater methodological quality and record and report details of their intervention.

1978 Board #3 May 28 3:45 PM - 5:45 PM
Integrated Knowledge Translation To Inform Implementation Of Exercise Counselling And Referral Of Cancer Survivors

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There is limited evidence supporting successful implementation of exercise-programming for cancer survivors into cancer clinical care pathways. We designed and launched a five-year hybrid effectiveness and implementation study to evaluate the relative benefit from an Alberta wide clinic-to-community based cancer and exercise model of care - the Alberta Cancer Exercise (ACE) program, and to evaluate the implementation of ACE into clinical cancer care. **PURPOSE:** To determine Health Care Provider (HCP) preferences, barriers and facilitators towards exercise counselling and referral of survivors to ACE at the Cross Cancer Institute (CCI), Edmonton, Alberta, and to test the feasibility of in-clinic, HCP-informed implementation tools. **METHODS: Stage I:** A theory-informed electronic questionnaire was distributed to HCPs at the CCI, of which N=47 responded (Aug-Oct 2017). A subsequent focus group N= 7 (May 2018) of CCI HCPs was held to probe into questionnaire findings and to determine actionable strategies. **Stage II:** Responses were mapped to the Capability Opportunity Motivation Behavior model. Tools were developed to specifically target the needs of HCPs in the head and neck cancer (HNC) tumor

group. Tool packages were distributed to HCPs (N=9) for in-clinic use for 4 weeks, corresponding to ACE recruitment for Spring programming (March-April 2019). Referral of HNC survivors to ACE programming was tracked. **RESULTS: Stage I:** Across all disciplines, only 17% of HCPs reported performing exercise counselling with survivors. The most common HCP identified barrier to exercise counselling was time, followed by a lack of knowledge regarding appropriate exercise. The most common facilitator was the 'interdisciplinary team', including access to physical therapy services. **Stage II:** Tool-based implementation strategies were developed and involved an educational package and exercise screening algorithm that was distributed to HCPs. A total of N=14 HNC survivors were referred, representing more than double the average number of previous HNC referrals (N=6) per session. HCPs reported the implementation tools to be 'somewhat' to 'very helpful'. **CONCLUSIONS:** HCP-identified implementation tools can enhance exercise-counselling and referral practices, and improve referral to community-based exercise programming.

1979 Board #4 May 28 3:45 PM - 5:45 PM
Tailoring Exercise Programming To Optimize Recruitment, Adherence And Completion Among Survivors With Brain Tumours

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The Alberta Cancer Exercise (ACE) study is a 5-year study evaluating the benefit from, and implementation of, an Alberta wide clinic-to-community-based cancer and exercise model of care. The ACE program uses an integrated knowledge translation approach engaging survivors and clinicians as active participants in the research project. Shared decision-making is used to adapt the ACE program to the local context and tailor programming to meet the needs of survivors within specific tumor groups. **PURPOSE:** To demonstrate how an integrated knowledge translation approach can identify the need for tailored exercise programming to optimize adherence and outcomes. **METHODS:** The results of 52 patients with brain tumours enrolled in ACE from January 2017 to March 2019 were explored. Survivor and clinician feedback was obtained to inform strategies to optimize adherence and completion outcomes. **RESULTS:** Findings show that completion (69%) and adherence rates (47%) were lower in the brain tumor group when compared with overall ACE rates (91% and 79% respectively). The primary reason reported for non-completion of the program was related to disease progression. Participant reported reasons for missed sessions included medical appointments and symptoms (feeling too ill or fatigued). Survivors with brain tumors (n=36) who were able to complete the 12-week program realized fitness benefits similar to ACE participants from other tumour groups. Statistically and clinically significant improvements were seen in 6MWT (59 metres; 13%; $p = 0.004$), upper body strength (25 lbs; 30%; $p < 0.005$) and lower body strength (38 lbs; 27%; $p = 0.04$). Of note, attendance to sessions was higher (70%) in sites offering tailored programming and flexibility in scheduling. Clinicians identified the need for earlier introduction of ACE programming as a means to attenuate declines in function during adjuvant cancer treatments. **CONCLUSIONS:** An integrated knowledge translation approach was used to identify strategies to improve study completion, exercise adherence and survivor outcomes. A sub-study is currently underway to evaluate the benefit of early intervention, tailored exercise programming and flexible scheduling for survivors with brain tumors. Supported by: Alberta Innovates and Alberta Cancer Foundation

1980 Board #5 May 28 3:45 PM - 5:45 PM
Exercise Counselling To Promote Exercise Behaviour Change In Individuals With Prostate Cancer

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Exercise is an effective strategy to enhance survivorship, quality of life and physical function in individuals with prostate cancer. However, the majority of men with prostate cancer are not sufficiently active. To assist in the adoption and maintenance of recommended exercise behaviours, the Prostate Cancer Supportive Care (PCSC) program implemented an exercise clinic using a standardized delivery protocol that included group education and individualized exercise counselling delivered by an exercise physiologist. **PURPOSE:** The primary aim of this study was to evaluate the feasibility of the delivery of the exercise clinic and to understand the preliminary effect of this clinic in changing exercise behaviours at 3-months. **METHODS:** A retrospective chart review was performed on data collected from attendees of the Vancouver PCSC Program Exercise Clinic (version 2.0 protocol) from June 11 2018 to April 10 2019 at four appointments, namely education session, exercise clinic

session 1 (in-person), exercise clinic session 2 (telephone follow-up) and exercise clinic session 3 (3-month in-person follow-up session). Feasibility was defined a priori as >60% attendance, <30% attrition, and >75% session timing, intervention delivery fidelity and intervention component fidelity. Self-reported aerobic and resistance exercise levels were evaluated at each session. **RESULTS:** A total of 34 individuals were evaluated. Feasibility targets were met for attendance (81%), attrition (19%), intervention fidelity (90%) and in-person session timing (90%). There was intervention component fidelity in 38 of 39 components. Weekly moderate-to-vigorous aerobic exercise levels increased at 3-months by 83±198 mins to a mean of 202.6±147.3 mins with a moderate effect (ES 0.54, 95% CI 0.3-0.5). Resistance exercise increased by 2.0±3.1 sessions to a mean of 3.2±2.9 sessions with a large effect (ES 0.77, 95% CI 0.3-1.3). **CONCLUSION:** This intervention was feasible to deliver to individuals with prostate cancer in a real-world clinical setting by exercise physiologists. The exercise counselling intervention elicited a moderate effect, showing improvements in aerobic and resistance exercise levels at 3-months. Future work should explore if this behaviour change can be sustained longer-term.

1981 Board #6 May 28 3:45 PM - 5:45 PM
Community-based Exercise For Health Promotion And Secondary Cancer Prevention: A Hybrid Effectiveness-implementation Study

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PURPOSE: Cancer care has expanded from a disease-focused, survival-oriented model to an approach that now considers how survivors can live well in the aftermath of intensive therapy. Research evidence supports the benefit of exercise during and following cancer treatments for cancer-related symptoms, physical fitness, and health-related quality of life. To move efficacy evidence into practice, we designed and launched the Alberta Cancer Exercise (ACE) program, a 5-year study to evaluate the relative benefit from implementing a clinic-to-community-based exercise and cancer model of care.

METHODS: A hybrid effectiveness and implementation trial design is evaluating the effectiveness of community-based exercise, and collecting data on implementation of the program. ACE opened in January 2017 and is now offered across seven cities (18 sites) in Alberta, Canada. Participants are adult survivors from all tumour groups and stages, at any time point since diagnosis, up to 3 years post treatment completion. Survivors take part in a minimum of 60 minutes of mild-to-moderate intensity full body exercise twice weekly for a 12-week period. The primary effectiveness outcome is the proportion of participants meeting physical activity guidelines at 1-year follow-up. The Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) framework is being used to capture individual-level and organizational-level impact of ACE.

RESULTS: 1506 Albertan survivors have entered ACE and 1109 have completed the 12-week intervention. Completion rates for 12, 24 and 1-year follow-ups are 91%, 84% and 79% respectively. Post-intervention, statistically significant benefits were found for fitness and patient-reported outcomes such as the 6 minute-walk test distance (+36m; p<0.001), lower leg strength (+34 lbs; p<0.001) and symptoms of fatigue (+2.56 points; p<0.01). Of the 631 participants who have completed the 1-year follow-up, the number of participants meeting 150 minutes of moderate intensity exercise per week increased from 28.4% to 35.5% (p<0.01).

CONCLUSIONS: Results support high interest in, and benefit from ACE among Albertan survivors. While statistically and clinically significant benefits were found short-term, further efforts are needed to support long-term exercise behaviour change.

1982 Board #7 May 28 3:45 PM - 5:45 PM
Community-based Exercise Programs For Cancer Survivors: Using The Consolidated Framework For Implementation Research To Identify Barriers And Facilitators To Program Implementation

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PURPOSE: Exercise is recommended as an intervention to reduce the side effects of cancer treatment both during treatment and beyond. New ACSM guidelines for cancer survivors have been recently published, alongside a recommendation for all oncology clinicians to 'Ask, Advise and Refer' to appropriate exercise programs. Based on

this, there is a need to understand how to best translate exercise oncology programs from research into community-based settings. The purpose of this scoping review is to describe the characteristics of existing exercise programs for cancer survivors conducted outside of a research laboratory (i.e., home- or community-based settings) mapped to a common implementation science framework in order to identify potential strategies for future implementation interventions.

METHODS: A systematic search of published literature was conducted for exercise programs or interventions including individuals diagnosed with cancer either undergoing treatment or who have completed treatment in which participants exercise at home, or in a community-based setting. Data were extracted using the Oxford Implementation Index and coded under the five domains of the Consolidated Framework for Implementation Research.

RESULTS: A total of 46 publications describing 30 individual programs from around the world were identified. Only 11 publications had the specific goal of reporting on program implementation and development. Most programs included both aerobic and resistance exercise, targeting either breast cancer survivors, or any cancer. A variety of intervention and individual characteristics were described. Reporting of implementation factors related to the inner and outer setting and implementation process were minimal. Partnerships with oncology clinicians appears to be a key facilitator to implementation success.

CONCLUSIONS: This scoping review summarizes the implementation characteristics of existing programs that have been reported in the literature and can serve as a resource for those developing future community-based exercise oncology programs. Findings support the need for implementation science to inform best practices for program implementation.

D-39 Thematic Poster - Physical Activity and Aging

Thursday, May 28, 2020, 3:45 PM - 5:45 PM
 Room: CC-2009

1983 Chair: David X. Marquez, FACSM. University of Illinois at Chicago, Chicago, IL.

(No relevant relationships reported)

1984 Board #1 May 28 3:45 PM - 5:45 PM
Effect Of High Intensity Power Training On Blood Pressure In Type 2 Diabetes: Great2Do Trial

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 (No relevant relationships reported)

Hypertension is a cardiovascular disease risk factor which can be modified by exercise. The effect of high intensity power training on ambulatory blood pressure (ABP) in older adults with type 2 diabetes (T2D) has never been studied. **PURPOSE:** To determine if high intensity power training (PRT) can reduce ABP in older adults

with T2D. **METHODS:** One hundred three participants (51% male, 67.9±5.5 yrs, 100% T2D, 24hr SBP: 132±13 mmHg, 24hr DBP: 73±7 mmHg, 55% ABP hypertensive (141/83 mmHg)) were randomized into 3 times/week of PRT or low-intensity, non-progressive sham exercise (SHAM) for 12 months. Ambulatory blood pressure monitors were fitted to the non-dominant arm and worn continuously for 24 hours at baseline, 6- and 12-month timepoints. Sleep and waking times were logged by participants and used for analyses. Systolic (SBP) and diastolic (DBP) blood pressures during awake, asleep and overall 24-hr period were similar for both groups.

RESULTS: There was no significant effect of time or group on any measure of ABP in older adults with T2D over 12 months. However, a fully adjusted model including baseline ABP hypertensive status (defined as baseline 24hr ABP of SBP ≥ 130 or DBP ≥ 80) revealed significant reductions in ABP domains over time in hypertensive vs. normotensive participants regardless of group assignment [mean difference (p-value): 24hr SBP, -4.1 vs 4.2 (p<0.01); 24hr DBP, -5.0 vs 0.9 (p<0.01); Awake SBP, -7.9 vs 5.8 (p<0.001); Awake DBP, -5.8 vs 1.3 (p<0.01); Sleep SBP, -3.5 vs 6.2 (p<0.05); Sleep DBP, -2.6 vs 2.5 (p=0.09)]. **CONCLUSION:** Overall, there was no change in ABP following 12 months of high or low intensity exercise training in older adults with

T2D. However, in those with hypertension at baseline, both PRT and SHAM exercise were associated with clinically meaningful and significant reductions in ABP domains over 12 months. The mean difference of -8 mmHg in Awake SBP after 12 months of exercise in hypertensive individuals with T2D is particularly noteworthy. Extrapolating from meta-analyses of anti-hypertensive medication effects, a difference of this magnitude may be associated with major cardiovascular disease risk reduction.

1985 Board #2 May 28 3:45 PM - 5:45 PM
Neuromotor Characteristics Of Older Men With Sarcopenia

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Reported Relationships: S.A. Horan: Other (please describe); Supported by a Physiotherapy Research Fellowship from the Health Innovation, Investment, and Research Office, Queensland Health.

Skeletal muscle mass increases over the first three decades of life, declines steadily through middle age, and more rapidly in older age. Sarcopenia describes a condition of significant loss of muscle mass in conjunction with reduced strength and function. While the changes in mass, strength and function across the lifespan are well-documented, little is known of the underlying neuromotor changes. **PURPOSE:** To examine the neuromotor mechanisms that underpin changes in muscles mass and function in older men with sarcopenia. **METHODS:** Twenty four older men (74.4 ± 5.0yrs) were recruited for testing. Muscle and fat mass were determined by DXA (Norland XR-800, USA). Functional performance was assessed via isometric knee extension strength, timed-up-and-go (TUG), 5-times sit-to-stand (5TSTS), self-selected gait speed, and hand grip strength. Neuromotor function was assessed using electrical stimulation of the tibial nerve (Digitimer D57AH, UK) and recording of EMG activity and torque during a graded plantar flexion contraction protocol. Measures included Level of Voluntary Activation (LoVA; 20%, 40%, 60% 80%, and 100% of MVC), resting and superimposed twitch (SIT), ankle torque, and EMG activity of the plantar and dorsi flexor muscles. **RESULTS:** Six older men were classified as sarcopenic based on DXA-derived measures of appendicular lean mass and height (<7.25kg/m²). Differences in LoVA and SIT were observed between older men and sarcopenic men at the 60% (LoVA: OM=85.5 ± 5.5% SM=77.3 ± 11.7%, p<0.05; SIT: OM=2.0 ± 1.0% SM=3.6 ± 2.8%, p<0.05) and 80% (LoVA: OM=95.8 ± 2.4% SM=92.4 ± 3.3%, p<0.05; SIT: OM=0.5 ± 0.3% SM=1.2 ± 0.8%, p<0.05) contraction intensities. Significant differences in knee extension strength were observed between older men and sarcopenic men (OM=512.2 ± 125.2N SM=328.6 ± 74.4N, p=0.03), however no other differences in functional performance measures were observed. **CONCLUSIONS:** These preliminary findings suggest that there are underlying neuromotor changes in men with sarcopenia, particularly during submaximal muscle contractions. Interestingly, men with sarcopenia were still able to maintain a similar level of functional ability compared to older healthy men. Future work will examine neuromotor characteristics in response to fatigue.

1986 Board #3 May 28 3:45 PM - 5:45 PM
The Effect Of Muscle Quality On Isokinetic Acceleration Time In Obese Older Men

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(No relevant relationships reported)

Recent modeling studies have suggested that increases in intramuscular fat may have a deleterious effect on skeletal muscle function. An increase in intramuscular fat is characteristic of aging, which is exacerbated with obesity. **PURPOSE:** The purpose of this study was to determine the influence of obesity-altered muscle quality on isokinetic acceleration time (AT) during a fast velocity in older men. **METHODS:** Twenty-two normal weight healthy older men (ONW) (age: 69.4 ± 2.1 yrs; BMI: 23.3 ± 1.5 kg/m²) and 20 age-matched obese older men (OB) (age: 69.0 ± 2.4 yrs; BMI: 34.0 ± 3.8 kg/m²) completed one visit. Body fat percentage (%BF) was assessed with a dual energy X-ray absorptiometry scan (ONW: 24.4 ± 6.3 %; OB: 37.0 ± 3.9 %). Panoramic B-mode US imaging was used to determine subcutaneous fat corrected echo intensity (EI) as a surrogate for intramuscular fat infiltration. The EI values included the average of all superficial quadriceps muscles (vastus lateralis, vastus medialis, and rectus femoris) at 50% of femur length. Each participant performed three maximal concentric isokinetic contractions at 240 deg · sec⁻¹ on a calibrated isokinetic dynamometer. The trial with the shortest AT from the onset of the contraction to the target velocity (load range) was used for all analyses. Independent samples *t*-tests were used to determine differences between the groups for age, BMI, %BF, EI, and AT. **RESULTS:** There was no group differences in age (*P*=0.586) or AT (ONW: 133.8 ± 26.4 ms vs. OB 130.8 ± 40.0 ms, *P*=0.774). However, BMI (*P*≤0.001), %BF (*P*≤0.001), and EI (ONW: 95.2 ± 13.3 AU vs. OB: 115.4 ± 15.8 AU, *P*≤0.001)

were different between groups. **CONCLUSIONS:** Quadriceps muscle quality was poorer in the OB older men, however there were no differences in AT between groups. These data may suggest that obesity-altered muscle quality does not influence limb acceleration in older men, however future studies are needed to examine more functional measures of rapid movement performance.

1987 Board #4 May 28 3:45 PM - 5:45 PM
Additional Parameters In Discriminating Classifications Of Sarcopenia For An Elderly Population In Taiwan

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(No relevant relationships reported)

Sarcopenia is an age-related degenerative loss of muscle mass and muscular function. Other than classification criteria from the European Working Group on Sarcopenia in Older People (EWGSOP) and Asian Working Group for Sarcopenia (AWGS), such as skeletal muscle index (SMI), handgrips strength (HGS), and 6-m normal walking speed (NWS), many other sarcopenic-related parameters have also been studied in the literature. **PURPOSE:** To discriminate classification of sarcopenia using related sarcopenic parameters. **METHODS:** This was a cross-sectional investigation. Subjects were above the age of 65 in Taoyuan, Taiwan. Measurement data of SMI, HGS, 6-m NWS, thigh circumferences and calf circumferences, muscular strength in knee extension and flexion, 30-s and 5 times sit-to-stand, and 8-inch timed-up-and-go were collected. Discriminant analysis was employed to detect related parameters that differentiated classification of sarcopenia using EWGSOP criteria. Significant level was at $\alpha = .05$. **RESULTS:** A total 384 cases were included with averaged age of 71.2 ± 5.4 (male: *N*=135; female: *N*=249). Using the EWGSOP criteria, the prevalence of pre-sarcopenia and sarcopenia were 35.42% and 22.66% respectively. SMI and HGS contributed commonly to discriminate sarcopenia classification in male, female, and all subjects, but not 6-m NWS in male (*p*=.331). However, additionally, thigh circumference, calf circumference, and 8-inch timed-up-and-go could discriminate classification of sarcopenia for all subjects with correct prediction rate of 95.6% for male and 92.0% for female subjects. **CONCLUSIONS:** In addition to SMI and HGS, a brief thigh and calf circumference measurements in anthropometry, and the 8-inch timed-up-and-go in physical performance may seem appropriate in promotion of sarcopenia prevention for older adults in the community in Taiwan. Supported by Chang Gung Memorial Hospital Grant CORPG3G0022.

1988 Board #5 May 28 3:45 PM - 5:45 PM
Plasma Uric Acid Is Positively Associated With Muscle Strength In Older Adults - NHANES 2001-2002

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(No relevant relationships reported)

PURPOSE: To associate plasma UA with muscle strength in individuals over 50 years. **METHODS:** A cross-sectional study was performed evaluating 1,433 individuals (731 men and 702 women) from National Health and Nutrition Examination Survey (NHANES) 2001-2002. The analyses included men and women aged 50-85 years who presented complete sociodemographic, anthropometric, body composition, strength, biochemical parameters, food intake, medical conditions and lifestyle data. Plasma UA was measured by colorimetric method; kinetic communicator isokinetic dynamometer was used to evaluate voluntary peak isokinetic knee extensor strength. The outcome measurement was the peak force (Newton) of the quadriceps. Six muscle strength measurements were performed: three initial measurements were considered warm-up/learning measurements and three final measurements were considered valid, the highest peak force value was used. Lean mass was evaluated by dual-energy X-ray absorptiometry. Participants were characterized by UA tercile and sex. To assess the association between UA tercile and strength, multiple linear regression models were performed. The analysis were adjusted for age, race, education level, smoke status, alcohol intake, body mass index, physical activity, protein and energy intake, diabetes, hypertension, glomerular filtration rate and total lean mass. All analyses were performed using Stata 14.0 software. **RESULTS:** Individuals with higher UA were older, had higher weight, height, lean mass, fat mass, strength, higher proportion of smokers and alcohol users (*p*<0.05). In addition, they had lower glomerular filtration rate and consumed less protein (*p*<0.05). Linear regression showed that UA levels were positively associated with muscle strength for men (β of third tercile = 24.8 [1.75;47.9] *p*-trend=0.028) and women (β of third tercile = 22.2 [1.03;43.3] *p*-trend = 0.028). **CONCLUSIONS:** Uric acid was positively associated with muscle strength in older adults.

1989 Board #6 May 28 3:45 PM - 5:45 PM
Six-year Effects Of Power Training On Physical Activity In Older Adults With Type 2 Diabetes

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 (No relevant relationships reported)

PURPOSE: We examined the effect of power training on long-term changes in physical activity (PA) in older adults with type 2 diabetes (T2D) during a 5-year follow-up of the GREAT2DO randomized control trial. **METHODS:** 103 participants with T2D and metabolic syndrome (51% male, 67.9 ± 5.5 yrs) were randomized to receive power or sham exercise training, 3 times/week for 12 months and followed for another 5 years. During follow-up, the power group was supported to continue, and controls were crossed over to training, but neither group exercised under direct supervision. Total PA was assessed using the Physical Activity Scale for the Elderly and the Homeostasis model assessment: insulin resistance (HOMA2-IR) and glycosylated hemoglobin (HbA1c) were used as indices of IR and glucose homeostasis, respectively. **RESULTS:** Total PA decreased significantly during the follow-up period ($p=0.0001$), driven by reductions between 12 and 24 months when full supervision of exercise was withdrawn, followed by relative stability over the next 4 years. Engagement in resistance training (PRT) declined from 76% at 12 months in the original power training group to 43% of those assessed at the 6-year follow-up. Notably, 43% of the original sham group also reported engaging in PRT at 6 years. HbA1c, adjusted for total PA level over the 5 years, and diabetes medication usage were significantly lower at 72 vs. 12 months ($p=0.04$), without any effect of original group assignment. However, there was no significant change over the follow-up period for HOMA2-IR, adjusted for PA and medication usage ($p=0.23$). **CONCLUSION:** 5 years after withdrawal of fully supervised power training or sham exercise in initially inactive older adults with T2D, 43% of both groups were engaged in minimally-supervised resistance training in community sites. Although both groups reduced participation in structured exercise after withdrawal of direct supervision at 12 months, stability in Total PA level from 24-72 months along with persistence of PRT in 43% of older adults with diabetes and many progressive co-morbidities is notable and unexpected. We are unaware of any other study of unsupervised PRT in an older clinical cohort in which adherence rates of 43% have been achieved 6 years after initial randomization, accompanied by significant improvements in glucose control.

1990 Board #7 May 28 3:45 PM - 5:45 PM
Operationalisation Of Older Adults' Lifetime Physical Activity Data

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 (No relevant relationships reported)

Despite the broad knowledge about general positive health effects of regular exercise, physical activity recommendations are mostly not fulfilled. Accompanying our ageing society, research often focuses on health status and activity habits at older age. Here, knowledge about triggers on and effects of very long-term physical activity (PA) is needed. **PURPOSE:** To investigate the relationship of PA during the lifespan and at old age.

METHODS: Overall 47 nursing home residents ($n=47$) aged 81.7 ± 3.6 years participated. The Lifetime Leisure Physical Activity Questionnaire (LLPAQ) and accelerometers (4 out of 7 days; MyWellnessKey ©) were used. LLPAQ captured lifetime leisure, housekeeping and occupational activity levels across 7 lifetime episodes. The LLPAQ retest data was gained from a subcohort ($n=14$) six weeks after the first elicitation. Individual questionnaire and accelerometer data was converted to METs (Metabolic equivalent of task) and used for further data analysis. Individual estimation inaccuracies were computed as the ratio of self-reported to objectively measured current PA.

RESULTS: A linear association between accelerometer and LLPAQ data ($r=.31$, $p=.033$) for last year's PA was found. Test-retest reliability (ICC) was .7 ($CV=118\%$, $SEM=6.8$, / 63.7%). Internal consistency was (Cronbachs α) 0.8. The average inaccuracy (overestimation) in self-reported data was 176% (CI-95% 120-232%).

Adjusted for individual inaccuracy, PA at old age significantly correlated with three age episodes ($r=.354$; $r=.336$; $r=.323$; $p<.05$). Likewise, inaccuracy-adjusted self-report data was sufficient to distinguish between individuals grouped as inactive or active (PA guidelines) in lifetime and current PA (Hotelling's $t^2=45-164$; $p \leq .002$).

CONCLUSIONS:

The observed inaccuracy (overestimation) in self-reported data aligns with findings in the literature (Sallis & Saelens, 2000; Tucker et al., 2011). The findings in individually processed data indicate a relationship of lifetime and old age PA. Future studies might enhance the applicability of methods for self-report PA data handling. Valid lifetime PA data might enhance further research on the relationship of old age PA and disease occurrence.

1991 Board #8 May 28 3:45 PM - 5:45 PM
Factors Influencing Sedentary Behavior And Physical Activity In Assisted Living Residents

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 (No relevant relationships reported)

Older adults in assisted living who engage in prolonged bouts of sedentary behavior and spend little time in physical activity are at risk for frailty, physical disablement and other health problems.

PURPOSE: To describe sedentary behavior and physical activity behaviors in assisted living residents and examine factors related to those behaviors.

METHODS: Sedentary behavior and physical activity were objectively measured for seven consecutive days, 24-hours a day, with a continuous-wear accelerometer taped to the participant's thigh. Survey questionnaires were administered via one-on-one interviews and included measures of depression, social isolation, sleep disturbance, pain interference and fatigue. Data were analyzed with descriptive statistics and bivariate correlations.

RESULTS: Forty-six older adults (M/F=20/26) from 7 assisted living facilities participated (M=82.0 years, SD=10.95; BMI, M=29.4, SD= 5.6). Approximately 20 hours/day (awake and sleeping) were spent in accumulated sedentary behavior (M=19.8 hours, SD=2.1, range 13.8-22.9). Mean sitting bouts/day of >30 minutes were 10.3 (SD=2.1). Mean sitting bouts/day of >60 minutes were 4.8 (SD=2.7). Less than one hour/day was spent in stepping activity (M= 50.6 minutes, SD=29.0, range 13.1-179.7). Most stepping activity occurred during stepping bouts of one minute or less (M=38.2 minutes, SD=22.6). Three participants (6%) engaged in stepping bouts >10 minutes duration. Significant negative correlations were noted between number of sitting bouts >60 minutes and stepping duration >5 minutes <10 minutes ($r=-.375$, $p=.010$). Age negatively correlated with time spent stepping per day ($r=-.411$, $p=.005$). Positive correlations were observed between fatigue and number of hours in sitting bouts of 60 minutes or less ($r=.356$, $p=0.015$) and between BMI and number of hours spent in sitting bouts of 60 minutes or less ($r=.349$, $p=0.034$). There were no other significant correlations.

CONCLUSION: Assisted living residents spend most of their time in prolonged bouts of sedentary behavior. Interventions aimed at breaking up bouts of sedentary behavior with light intensity stepping bouts may be useful in improving the overall sedentary profile and impart health benefits.

Supported by Research Creative Activity Award University of Michigan-Flint

D-40 Thematic Poster - Physiological Responses to Heat Acclimation

Thursday, May 28, 2020, 3:45 PM - 5:45 PM
Room: CC-2010

1992 Chair: Matthew Cramer. *Defence Research and Development Canada, Toronto, ON, Canada.*
(No relevant relationships reported)

**1993 Board #1 May 28 3:45 PM - 5:45 PM
Inter-individual Variability In Rate Of Heat Acclimation Using A Standard, Fixed Intensity Protocol**

Michelle M. Saillant, Nisha Charkoudian, FACSM, Katherine M. Mitchell, Karleigh E. Bradbury, Adam J. Luippold, Beau R. Yurkevicius, Billie K. Alba, Adam C. Nixon, Robert Kenefick, FACSM, Roy M. Salgado. *USARIEM, Natick, MA.*
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In combination with increases in core temperature (T_{re}) during acute exercise in the heat, progressive increases in heart rate (HR) contribute to increased cardiovascular strain as compared to the same exercise performed in cooler conditions. It is well-established that heat acclimation (HA), defined by both thermal and cardiovascular adaptations (lower T_{re} and HR), is achieved within ~7 to 10 days of repeated exercise for 60-120 min or more in the heat. More recent research indicates that HA can be achieved in <7 days, also referred to as short-term heat acclimation (STHA). **PURPOSE:** To quantify the occurrence and magnitude of STHA in a group of young healthy males participating in a standard, 8-day military HA protocol. We hypothesized that some but not all volunteers would achieve STHA. **METHODS:** Thirteen healthy male volunteers (age 21 ± 3 yrs, ht: 173 ± 8 cm, wt: 75.1 ± 12.2 kg) participated in an 8 day exercise-heat acclimation protocol (120 minutes of treadmill walking: 3.1 mi·hr⁻¹, 2% grade, in 40°C, 40% RH). T_{re} and HR were recorded every 5 minutes. Pre- and post-exercise nude body-weight (corrected for urine output) were used to calculate total body sweat rate (SR). Individual and group mean (ANOVA) changes in final T_{re} , HR, and SR were compared across Days 1, 5, and 8 of HA. The criteria for achievement of HA were ΔT_{re} during exercise ≤ 0.9 °C and $\Delta HR \leq 33$ bpm, which were based on average values attained at Day 8. **RESULTS:** Group mean T_{re} (Day 1: 38.1 ± 0.34 vs. Day 5: 37.9 ± 0.3 vs. Day 8: 37.8 ± 0.3 °C) and HR (Day 1: 134 ± 17 vs. Day 5: 122 ± 13 vs. Day 8: 121 ± 13 bpm) were significantly decreased by Day 5 ($p < 0.05$) and did not decrease further by Day 8 ($p > 0.05$). Using our criteria for achieving HA, 31% (4/13) of the volunteers achieved HA on Day 5. SR was not different across time points (Day 1: 860 ± 148 vs. Day 5: 908 ± 210 vs. Day 8: 873 ± 203 ml·hr⁻¹; $p > 0.05$). **CONCLUSIONS:** These data suggest that during a standard fixed-intensity heat acclimation protocol, about one third of the volunteers will achieve STHA with no further change in T_{re} or HR responses beyond Day 5. Future research should evaluate the mechanisms contributing to the variability of achieving STHA. Supported by USAMRDC; author views not official US Army or DoD policy.

**1994 Board #2 May 28 3:45 PM - 5:45 PM
Physiological Changes During Five Days Of Heat Acclimation**

Candi D. Ashley, Priscilla Lamadrid, Rebecca M. Lopez. *University of South Florida, Tampa, FL.* (Sponsor: Douglas J. Casa, FACSM)
(No relevant relationships reported)

The process of acclimation is imperative to ensure worker safety in hot environments. Most industry acclimation protocols prescribe 5 days of increasing heat exposure before working in the heat while research suggests 10-14 days for full acclimation. **PURPOSE:** To determine if 5 days of acclimation can induce meaningful physiological changes for worker safety. **METHODS:** Data collected from previous heat stress studies were used. A convenience sample of 15 female and 20 male participants (age = 28 ± 6 yr, ht = 171 ± 7.6 cm, wt = 76.7 ± 16.4 kg) walked on a treadmill at a moderate metabolic rate (160 W/m²) in a hot environment (50°C and 20% RH; WBGT = 35.71 °C) while wearing shorts, t-shirt and athletic shoes. Rectal temperature (T_{re}) and heart rate (HR) were monitored continuously throughout all trials. Trials lasted approximately 120 minutes or upon attainment of sustained HR greater than 90% of age-predicted HR_{max}, $T_{re} \geq 39$ °C, or participant wished to stop. Paired samples t-tests were used to assess changes in ending HR and T_{re} over the last 2 days of acclimation. Repeated measures ANOVA were used to determine differences in T_{re} and HR over the acclimation period. Significance was set at $p \leq 0.05$. **RESULTS:** There was no significant difference in ending HR or ending T_{re} over the last 2 days of acclimation ($p \geq 0.05$), suggesting participants were acclimated. Trial duration

increased significantly from day 1 to day 5 (Time = 97 ± 23 and 115 ± 11 min, $p = 0.004$). During the first trial, 18 participants (51.4%) were able to complete 120 min, and 25 participants (71.4%) were able to complete 120 min by the end of acclimation. Beginning T_{re} was not significantly different from Day 1 to Day 5 ($p = 0.106$), however Day 1 ending T_{re} (38.35 ± 0.51 °C) was significantly higher than Day 5 (38.10 ± 0.66 °C; $P = 0.039$). Beginning HR was significantly greater for Day 1 than Day 5 (HR = 103 ± 16 and 93 ± 13 bpm; $p = 0.024$), but there was no significant difference in ending HR from day 1 to day 5 ($p = 0.056$). **CONCLUSION:** Five days of acclimation can induce physiological changes in HR and T_{re} ; specifically in resting HR and ending T_{re} . As such, industry acclimation protocols are adequate to induce physiological changes to help reduce heat illness.

**1995 Board #3 May 28 3:45 PM - 5:45 PM
No Effect Of 8 Days Of Heat Acclimation On VO_{2peak} Peak Power Output, Or Ventilatory Threshold**

Karleigh E. Bradbury, Katherine M. Mitchell, Beau R. Yurkevicius, Adam J. Luippold, Kirsten E. Coffman, Roy M. Salgado. *United States Army Research Institute of Environmental Medicine, Natick, MA.*
(No relevant relationships reported)

Adaptations from heat acclimation (HA) have been suggested to alter physiological responses during a maximal exercise test in trained individuals. These responses include a decreased oxygen cost for a given workload (improved exercise economy), or an increase in the power output at which the ventilatory threshold (VT) occurs; both factors that predict endurance performance. However, these findings are inconsistent in the literature, particularly in untrained individuals, therefore the effects of HA on maximal exercise responses remain unclear. **PURPOSE:** To examine any differences in VO_{2peak}, peak power output (PPO), and VT pre- and post-HA in untrained individuals. **METHODS:** Thirteen healthy men (mean \pm SD; age: 21 ± 3 yr; ht: 172 ± 8 cm; wt: 76 ± 13 kg) participated in the study. Subjects completed two peak oxygen consumption tests (VO_{2peak}; on a cycle ergometer) that were separated by an 8-day exercise-HA protocol (treadmill walking: 5 km·hr⁻¹, 2% grade; 40°C, and 40% RH). The VO_{2peak} test workload started at 50-75 watts (W), and increased by 25 W every min until volitional exhaustion. Metabolic data were collected continuously over the course of the test. VT was determined using the ventilatory equivalence method (an increase in VE/VO₂ with no change in VE/VCO₂). The percent change in plasma volume (% Δ VPV) was calculated from blood draws pre- and post-HA. A paired t-test was used to assess differences in physiological responses during the VO_{2peak} test and from the HA protocol. Significance was set at an alpha level of $P < 0.05$. **RESULTS:** HA was achieved as indicated by a lower core temperature (Day 1: 38.1 ± 0.3 vs Day 8: 37.8 ± 0.3 °C; $P < 0.01$) and HR (Day 1: 134 ± 17 vs Day 8: 121 ± 13 bpm; $P < 0.01$) on Day 8 compared to Day 1. The % Δ VPV from pre- to post HA was 22.8 ± 7.6 % over the course of the HA period. VO_{2peak} (3.2 ± 0.4 vs 3.1 ± 0.5 L/min) and PPO (253 ± 37 vs 257 ± 38 W, $P > 0.05$ for both) were not different after 8 days of HA. There were no differences pre- to post-HA in VO₂ (2.2 ± 0.4 vs 2.1 ± 0.4 L/min), power output (169 ± 27 vs 167 ± 31 W), VE (53.4 ± 9.6 vs 53.6 ± 10.8 L/min), or the RER (0.94 ± 0.05 vs 0.95 ± 0.06 , $P > 0.05$ for all) at which VT occurred. **CONCLUSION:** An 8-day HA protocol did not lead to changes in VO_{2peak}, PPO, or in the VO₂ and PO at which the VT occurred during a peak oxygen consumption test. Supported by USAMRDC; authors views not official US Army or DoD policy.

**1996 Board #4 May 28 3:45 PM - 5:45 PM
The Impact Of Short-Term Hot Water Immersion On Heat Acclimation And Thermotolerance**

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(No relevant relationships reported)

BACKGROUND: Environmental heat stress increases physiological strain during exercise in non-acclimated individuals. Heat acclimation (HA) protocols are often used as countermeasures to preserve physiological function during exercise in the heat. Passive heat strategies could be a potential method of HA that reduces excess physical exertion prior to activity or relocation. **PURPOSE:** To determine the effect of hot water immersion (HWI) on heat acclimation and thermotolerance. **METHODS:** 6 males (Age: 23.8 ± 1.5 ; VO_{2max}: 45.0 ± 7.5 mL/kg/min.) participated in a crossover, counterbalanced study with a four-week washout between conditions. Heat stress tests (HST) were performed PRE and POST acclimation sessions and consisted of 45 min of cycling at 50% of VO_{2max} in 40 °C, 40% RH. Acclimation sessions were either three consecutive bouts of HWI or traditional heat-exercise training (TRAD). HWI sessions consisted of 40 min of submersion at 40 °C. TRAD sessions consisted of 40 min of cycling at 50% VO_{2max} in 40 °C, 40% RH. Core body temperature (T_{core}), heart rate (HR), rate of perceived exertion (RPE), and thermal sensation (TSS) were recorded during HSTs. Blood was drawn PRE and POST HST to determine change

in plasma volume. Nude body mass was recorded before and after HSTs to calculate whole body sweat loss (WBSL). T_{core} and HR were used to calculate physiological strain index (PSI).

RESULTS: HWI decreased average HR (PRE: 158 ± 7 ; POST: 149 ± 7 ; $p < 0.05$), peak HR (176 ± 7 ; 164 ± 5 ; $p < 0.05$), and end exercise RPE (15.3 ± 1.8 ; 13.2 ± 1.9 ; $p < 0.05$). HWI had no significant effect on resting T_{core} (37.2 ± 0.4 ; 36.8 ± 0.3 ; $p = 0.66$), end exercise T_{core} (38.7 ± 0.4 ; 38.4 ± 0.3 ; $p = 0.20$), PSI (7.8 ± 1.1 ; 7.0 ± 0.8 ; $p = 0.56$), or TSS (10.8 ± 1.0 ; 9.5 ± 1.2 ; $p = 0.09$). TRAD resulted in no significant changes in average HR (PRE: 153 ± 11 ; POST: 149 ± 11 ; $p = 0.82$), peak HR (170 ± 9 ; 165 ± 10 ; $p = 0.51$), end exercise RPE (15.1 ± 1.2 ; 13.3 ± 2.0 ; $p = 0.87$), PSI (9.3 ± 2.1 ; 8.6 ± 1.4 ; $p = 0.73$), or TSS (10.5 ± 0.8 ; 10.7 ± 1.5 ; $p = 0.77$). Plasma volume expansion (%) was observed in both groups (HWI: 6.6 ± 6.4 ; TRAD: 4.3 ± 2.0 ; $p = 0.41$).

CONCLUSION: Three consecutive HWI sessions are effective in lowering HR during submaximal exercise in the heat. Compared to heat-exercise exposures, HWI is a method in which to more rapidly elicit a HA phenotype.

1997 Board #5 May 28 3:45 PM - 5:45 PM
Acute Kidney Injury Biomarker Responses To Short Term Heat Acclimation

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 (No relevant relationships reported)

The combination of hyperthermia, dehydration, and strenuous exercise can result in severe reductions in kidney function leading to an increased risk of developing acute kidney injury (AKI). **PURPOSE:** We sought to determine if short term heat acclimation (SHTA) mitigates the rise in AKI biomarkers during strenuous exercise in heat. **METHODS:** Twenty men completed two 2-hour bouts of high-intensity interval exercise before (Pre-SHTA) and after (Post-SHTA) 4 days of 90-120 minutes of exercise in either hot ($n=12$, 40°C , 40% relative humidity; HEAT) or temperate ($n=8$, 24°C , 40% relative humidity; CON) conditions. Men drank water ad libitum throughout exercise. Blood was drawn before and after exercise Pre-SHTA and Post-SHTA. AKI was defined as a serum creatinine increase ≥ 0.3 mg/dL or estimated glomerular filtration rate (eGFR) reduction $>25\%$. **RESULTS:** HEAT had a similar creatinine increase during exercise Pre-SHTA (0.35 ± 0.23 mg/dL) and Post-SHTA (0.39 ± 0.20 mg/dL), with creatinine in HEAT increasing more than CON at both time points (0.11 ± 0.07 mg/dL, 0.08 ± 0.06 mg/dL, $p \leq 0.001$), respectively. HEAT had a greater reduction in percent change eGFR than CON ($p \leq 0.001$) independent of heat acclimation status (Pre-SHTA, HEAT: $-30.2 \pm 9.7\%$, CON: $-10.5 \pm 8.5\%$; Post-SHTA, HEAT: $-26.4 \pm 12.4\%$, CON: $-8.4 \pm 5.9\%$). Biomarkers reached the threshold for AKI in HEAT Pre-SHTA ($n=9$, 75%), with fewer participants reaching the AKI threshold Post-SHTA ($n=7$, 58%, $p=0.007$). Biomarkers indicated AKI did not occur in CON at either time point. Hydration and body temperatures were similar between HEAT participants with and without biomarkers reaching the threshold of AKI both Pre-SHTA and Post-SHTA. Change in serum creatinine was related to percent of fluid replaced Pre-SHTA ($r=0.60$, $p=0.039$), while Post-SHTA was related to percent change in plasma volume ($r=0.732$, $p=0.007$). **CONCLUSION:** SHTA did not mitigate reductions in eGFR nor increases in serum creatinine during high-intensity exercise in the heat, although the number of participants reaching the threshold for AKI was reduced Post-SHTA. This suggests that SHTA may reduce the risk of developing AKI during exercise in the heat.

Supported by the National Athletic Trainers' Association Research and Education Foundation Doctoral Grant 14DGP012.

1998 Board #6 May 28 3:45 PM - 5:45 PM
Does Heat Acclimation Upregulate Skeletal Muscle Markers Of Oxidative Metabolism And Mitochondrial Biogenesis?

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 (No relevant relationships reported)

Heat acclimation (HA) increases tolerance to exercise performed in the heat and may improve aerobic fitness and performance in highly trained individuals. However, it is unknown if HA effects the expression of proteins related to mitochondrial biogenesis and oxidative capacity in skeletal muscle in active young individuals. **PURPOSE:** To investigate the effect of HA on the expression of oxidative and mitochondrial proteins in the skeletal muscle of healthy, active young-adult males and females. **METHODS:**

In a quasi-experimental design, thirteen (7 males, 6 females) aerobically fit ($VO_{2max} > 75$ th percentile) individuals underwent 10-days of HA over 14-days. Participants performed two 45-minute bouts of exercise (walking at 30-40% maximal velocity) with 10 minutes rest per session in a hot environment (dry temperature $\sim 42^\circ\text{C}$, relative humidity 30-50%). Pre- and post-HA VO_{2max} (room temperature), second ventilatory threshold (VT), protein expression of PGC-1 α , TFAM, CaMK, Cytochromes I-IV, and HSP72 were measured pre-HA and post-HA. Heat acclimation was determined comparing heart rate (HR), core temperature (CT), sweat rate, and ratings of perceived exertion (RPE) on days 1 and 10. **RESULTS:** Participants were acclimated as indicated by pre- and post-HA resting-CT (37.3 ± 0.38 vs. $37.1 \pm 0.28^\circ\text{C}$; $p = 0.04$), maximal-CT (38.8 ± 0.35 vs. $38.2 \pm 0.38^\circ\text{C}$; $p < 0.0001$), mean-HR (138.5 ± 17.7 vs. 125.9 ± 14.0 bpm; $p=0.03$), maximal-HR (170.2 ± 26.4 vs. 149.4 ± 24.5 bpm; $p=0.003$), mean-RPE (12.4 ± 1.2 vs. 9.8 ± 1.1 ; $p < 0.0001$), and maximal-RPE (15.0 ± 1.6 vs. 12.2 ± 1.9 ; $p=0.002$). Pre- to Post-HA VO_{2max} (50.2 ± 8.6 vs. 51.7 ± 11.2 mL/kg/min; $p=0.08$) and VT (31.2 ± 7.0 vs. 33.9 ± 8.7 ; $p=0.19$) were unchanged. Protein expression was unchanged pre- to post-HA; (PGC-1 α $p=0.21$, TFAM $p=0.34$, CaMK $0-0.19$, Cytochromes I $p=0.73$; II $p=0.85$, III $p=0.62$, IV $p=0.70$, Hsp72 $p=0.27$). **CONCLUSIONS:** 10-days of low intensity exercise in the heat resulted in HA, but did not increase aerobic fitness or markers of mitochondrial biogenesis and oxidative metabolism in physically active individuals. Supported by a research grant from the College of Education, University of New Mexico.

1999 Board #7 May 28 3:45 PM - 5:45 PM
Exercise Heat Exposure Induced Changes In Genetic Expression Before And After Heat Acclimation In Humans

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 (No relevant relationships reported)

PURPOSE: To evaluate changes in genetic expression of proteins that are implicated in physiological adaptation to exercise heat exposure (Hypoxia Inducible Factor -1 α [HIF-1 α], Erythropoietin [EPO], and Vascular Endothelial Growth Factor [VEGF]) during systemic adaptation related to Heat Acclimation (HA) in humans. **METHODS:** Participants ($n=18$, 13 males, 5 females: 30 ± 7.34 y; 173.1 ± 7.673 cm; 76.25 ± 14.17 kg) underwent two Heat Tolerance Tests (HTT 1 & 2; 120 min walking, 5 km/h, 2.0% grade, 40°C , 40% rh) with 12-14 days between tests. Participants in experimental group (HA) underwent six heat acclimation days between tests, while the control group (CON) avoided exercise heat exposure between HTT's. Blood was drawn pre- and post- each HTT and isolated into Peripheral Blood Mononuclear Cells, then further isolated into RNA. Then, cDNA was synthesized for Quantitative Real-Time Polymerase Chain Reaction to quantify gene expression. The data was then analyzed using the $\Delta\Delta C_T$ to acquire fold change. **RESULTS:** No statistical difference in resting rectal temperature was observed before HTT2 in HA ($-0.13 \pm 0.36^\circ\text{C}$) vs. CON ($-0.08 \pm 0.47^\circ\text{C}$; $P=0.80$). No significant changes were observed between HTT1 and HTT2 in the control group for HIF-1 α , EPO, or VEGF. However, it was observed that acute EPO fold change increased 10.6x; ($P=0.14$) from pre- to post- in HTT1 for each group. An increased fold change was also observed in both HIF-1 α and EPO between HTT1 and HTT2 (3.24x; $P=0.04$) & (7.19x; $P=0.03$) respectively in the HA group. No significant changes in VEGF were found in either group. **CONCLUSION:** Although the HA protocol utilized in this investigations was not stressful enough to induce observable rectal temperature changes, genetic expression of HIF-1 α and EPO was significantly upregulated in response to chronic exercise heat stress.

Grant Info: This publication was supported by the Mountain and Plains - Educational Research Center (MAP-ERC) Pilot Grant & the High Plains Intermountain Center for Agricultural Health & Safety (HICAHS) Pilot Grant.

D-41 Thematic Poster - Step Right Up! New Insights into Stepping and Health

Thursday, May 28, 2020, 3:45 PM - 5:45 PM
Room: CC-2011

2000 Chair: Janet Fulton, FACSM. CDC, Atlanta, GA.
(No relevant relationships reported)

**2001 Board #1 May 28 3:45 PM - 5:45 PM
Step By Step: Association Of Device-measured Daily Steps With All-cause Mortality - A Prospective Cohort Study**

Bjørge H. Hansen, Knut E. Dalene, Ulf Ekelund, FACSM, Morten W. Fagerland, Elin Kolle, Jostein Steene-Johannessen, Jakob Tarp, Sigmund A. Anderssen. *Norwegian School of Sport Sciences, Oslo, Norway.* (Sponsor: Ulf Ekelund, FACSM)
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Walking - a basic unit of locomotion - is free, does not require special training, and can be done almost everywhere. Therefore, walking might be a feasible behavior on which to tailor public health messages. There is however insufficient evidence available to determine the magnitude and shape of the relationship between steps taken per day and all-cause mortality, giving current step-based guidelines limited scientific basis. **PURPOSE:** To assess the prospective association and dose-response relationship between device-measured daily walking steps and all-cause mortality in a large population-based cohort of women and men aged 40-85 years. **METHODS:** Daily steps were measured by a waist-mounted accelerometer in 2,180 individuals (53% women) for seven consecutive days at baseline (2008-09). Participants were grouped into quarters (Q) based on their average number of steps per day and followed over a median period of 9.1 years for all-cause mortality determined by linkage with death certificates from the Norwegian Cause of Death Registry. **RESULTS:** Mean (SD) baseline age was 56 (11) years. Median (IQR) steps per day were 4651 (3495, 5325), 6862 (6388, 7350), 8670 (8215, 9186), and 11467 (10556, 13110) in Q1 to Q4, respectively. During follow-up, 119 individuals died (68% men). Higher number of steps per day was associated with lower risk of all-cause mortality with hazard ratios (95% CI) of 0.52 (0.29 to 0.93), 0.50 (0.27 to 0.94), and 0.43 (0.21 to 0.88) across ascending quarters of steps per day compared with Q1 (referent) in the multivariable model ($p < 0.001$). The dose-response association modelled using restricted cubic splines demonstrated a non-linear, inverse association between daily steps taken and all-cause mortality, with no apparent plateauing of risk-reduction within the observed variation in the exposure. **CONCLUSIONS:** We observed a 48% risk reduction for all-cause mortality between the least active and the second quartile, with an absolute difference between Q1 and Q2 of 2200 steps per day. To exemplify, given an average stride length of 0.67 cm for women and 0.76 cm for men, 2200 steps translates to a 1.4 to 1.6 km walk for women and men, respectively. If confirmed, this large gain with modest effort may serve as encouragement to many sedentary individuals.

**2002 Board #2 May 28 3:45 PM - 5:45 PM
Cadence (steps/min) Associated With Moderate Intensity Walking In Older Adults: The CADENCE-Adults Study**

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(No relevant relationships reported)

Cadence (steps/min) is an accessible and understandable metric for communicating physical activity intensity. Studies in younger and middle-aged adults consistently report ≥ 100 steps/min associated with walking at an absolutely-defined moderate intensity (i.e., 3 metabolic equivalents [METs]) or higher. However, few studies have quantified the cadence-intensity relationship in older adults.

PURPOSE: To identify a reasonable heuristic (i.e., evidence-based, practical, rounded) cadence threshold associated with absolutely-defined moderate intensity in ambulatory older adults.

METHODS: Ninety-eight older adults 61-85 years of age (49% women; age=72.6 \pm 6.9 years; BMI=25.9 \pm 3.5 kg/m²) completed a series of 5-min treadmill walking bouts. Bouts began at 0.5 mph and increased in 0.5 mph increments until participants: 1) naturally selected to run, 2) reached >75% of their age-predicted maximum heart rate (220 - age), or 3) reported a Borg scale rating of perceived exertion (RPE) >13. Oxygen uptake (VO₂; ml·kg⁻¹·min⁻¹) was measured using indirect calorimetry and cadence was derived by dividing directly-observed steps by bout duration. VO₂ was averaged over the last two minutes of each bout and divided by 3.5 ml·kg⁻¹·min⁻¹ to determine METs. Moderate intensity (3 METs) cadence thresholds were identified with two analytic approaches: 1) using Youden's index in a Receiver Operator Characteristic (ROC) curve and 2) by estimating a segmented (i.e., 'hockey-stick') regression model that accounted for repeated measures for the cadence-intensity relationship.

RESULTS: Eighty participants (82%) reached 3 METs. The ROC curve displayed an area under the curve (AUC) of 0.93. The segmented regression model indicated that cadence explained 70% of the variance in METs. The cadence thresholds associated with absolutely-defined moderate intensity were 100.3 steps/min in the ROC analysis (accuracy = 85.5%, sensitivity=86.8%, specificity=84.5%) and 103.1 steps/min in the regression analysis (95% prediction interval=70-114 steps/min).

CONCLUSION: Consistent with previous evidence collected from younger and middle-aged adults, 100 steps/min serves as a reasonable heuristic threshold to communicate absolutely-defined moderate intensity walking in ambulatory older adults. Funding: NIH NIA 5R01AG049024

**2003 Board #3 May 28 3:45 PM - 5:45 PM
Device-specific Cadence Thresholds For Moderate And Vigorous Intensity Walking: The CADENCE-Adults Study**

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(No relevant relationships reported)

PURPOSE: To identify device-specific cadence (steps/min) thresholds associated with absolutely-defined moderate and vigorous intensity (3 and 6 metabolic equivalents [METs]) for the Actical (AC), ActiGraph GT9X (AG), activPAL 3 (AP), and StepWatch 3 (SW) accelerometers.

METHODS: A sample of 75 young (21-40 years), 80 middle-aged (41-60 years), and 97 older (61-85 years) adults (N = 252, 49.6% women; mean [SD] BMI = 25.6 [3.6] kg/m² and height = 169 [9] cm) completed 5-min treadmill walking bouts separated by 2-min rests. Bouts began at 0.5 mph and increased by 0.5 mph until participants: 1) naturally chose to run, 2) reached >75% of age-predicted maximum heart rate, or 3) reported a Borg rating of perceived exertion >13. Participants wore an AC and AG (waist), AP (thigh), and SW (ankle) to assess steps. Oxygen uptake (VO₂) was measured with indirect calorimetry and converted to METs (VO₂ / 3.5 mL/kg/min). Cadence and METs were averaged over the last 2 min of each bout. Device-specific cadence thresholds were identified for the total sample and each age group by selecting those minimizing Youden index summaries of Receiver Operator Characteristic (ROC) curves.

RESULTS: Device-specific cadence thresholds associated with 3 METs were ~100 (range 95-102) steps/min, except those for the AG in young and older adults, and thresholds associated with 6 METs were ~120 (range 118-124) steps/min (Table 1). All area under the ROC curve (AUC) values were ≥ 0.90 . Sensitivity and specificity values were $\geq 80\%$ (Table 1).

CONCLUSION: Device-specific cadence thresholds accurately classified moderate and vigorous intensity in adults across the lifespan. However, 3 MET thresholds for the AG were up to 14 steps/min lower (in older adults) than those of the other devices and those reported in studies using the criterion of directly-observed steps (~100 steps/min). Future studies are needed to evaluate the performance of these thresholds in free-living settings.

Funded by NIH NIA Grant 5R01AG049024

Table 1: Device-specific cadence (steps/min) thresholds for absolutely-defined moderate and vigorous intensity treadmill walking and their classification accuracies for all participants and by age group

Device	Age Group (years)	Moderate Intensity (3 METs)					Vigorous Intensity (6 METs)*				
		Cadence Threshold (steps/min) [†]	Se (%)	Sp (%)	Ac (%)	AUC [‡]	Cadence Threshold (steps/min) [†]	Se (%)	Sp (%)	Ac (%)	AUC [‡]
Actical	All	96 [94-101]	87.5	89.2	88.3	0.94 [0.93-0.95]	121 [121-126]	98.1	86.9	87.6	0.97 [0.96-0.98]
	21-40	98 [85-103]	87.5	90.7	88.9	0.95 [0.93-0.97]	124 [122-126]	95.4	89.6	90.2	0.97 [0.96-0.98]
	41-60	100 [94-103]	88.0	93.8	90.8	0.96 [0.95-0.98]	121 [115-128]	97.2	86.3	86.9	0.96 [0.94-0.98]
	61-85	95 [76-104]	80.7	88.4	85.3	0.90 [0.87-0.93]	--	--	--	--	--
Acti-Graph GT9X	All	95 [93-98]	84.2	90.7	87.5	0.94 [0.93-0.95]	121 [115-124]	84.3	88.2	88.0	0.92 [0.89-0.95]
	21-40	94 [90-101]	85.1	89.4	86.9	0.94 [0.92-0.95]	122 [116-125]	84.6	89.0	88.6	0.91 [0.87-0.95]
	41-60	96 [94-101]	88.5	91.1	89.8	0.96 [0.94-0.97]	121 [115-128]	86.5	87.1	87.1	0.93 [0.89-0.97]
	61-85	86 [85-97]	84.8	86.5	85.8	0.92 [0.89-0.94]	--	--	--	--	--
activ-PAL 3	All	100 [97-102]	88.3	87.9	88.1	0.95 [0.94-0.96]	119 [119-124]	98.1	85.2	86	0.97 [0.96-0.98]
	21-40	97 [94-102]	89.9	88.9	89.5	0.96 [0.94-0.97]	122 [120-124]	95.2	89.5	90.1	0.97 [0.95-0.98]
	41-60	99 [96-105]	92.0	89.0	90.5	0.97 [0.96-0.98]	119 [119-126]	97.3	84.1	84.9	0.96 [0.93-0.98]
	61-85	102 [96-103]	85.1	86.9	86.1	0.93 [0.91-0.95]	--	--	--	--	--
Step-Watch 3	All	98 [97-104]	90.7	84.6	87.6	0.95 [0.94-0.96]	120 [114-123]	82.4	86.6	86.3	0.92 [0.90-0.94]
	21-40	98 [94-104]	89.1	88.3	88.7	0.95 [0.94-0.97]	120 [115-124]	87.7	86.3	86.4	0.93 [0.91-0.96]
	41-60	99 [95-106]	91.1	88.7	89.9	0.97 [0.96-0.98]	118 [106-126]	83.8	82.0	82.1	0.90 [0.86-0.94]
	61-85	102 [95-104]	84.2	86.2	85.3	0.93 [0.91-0.95]	--	--	--	--	--

METs = metabolic equivalents; Se = Sensitivity; Sp = Specificity; Ac = Accuracy; AUC = area under the ROC curve

Accuracy defined as: (true positives + true negatives) / total bouts

* Thresholds not provided for 61-85-year-old adults as only 6% of the sample attained 6 METs

† Values presented as point estimate [95% confidence interval]; ‡ 95% confidence intervals determined by bootstrap with 20,000 replicates

defined as $\text{cfPWV} \geq 10$ m/s, an established risk factor of cardiovascular diseases. Average SCo and SCA over 7 days were measured with Omron accelerometer-based pedometers (HJ-321). Odds ratios (ORs) and 95% confidence intervals (CIs) for high AS were calculated among quintiles of daily SCo and SCA. Participants were dichotomized as fast/slow walkers (obtaining any steps at ≥ 60 steps/minute or not) or active/inactive ($\geq 5,000$ steps/day or not) for a joint analysis. Covariates were sex, age, body mass index, smoking, heavy alcohol intake, diabetes, hypertension, hyperlipidemia, medications, systolic blood pressure, and SCo or SCA in respective analyses. **RESULTS:** Participants walked 5,798 (SD=2,956) steps/day on average. There were 85 (22%) cases of high AS. Compared with the least active SCo quintile, the ORs (95% CIs) were 0.45 (0.19-1.07), 0.42 (0.17-1.03), 0.32 (0.12-0.87), and 0.51 (0.20-1.33) in quintiles 2, 3, 4, and 5 after adjusting for all covariates except SCA. There were no significant associations between SCo quintiles and AS after adjusting for SCA. Compared to the slowest SCA quintile, the ORs (95% CIs) for high AS were 0.29 (0.10-0.88), 0.31 (0.12-0.77), 0.58 (0.23-1.49), and 0.67 (0.21-2.09) after adjustment for covariates including SCo. In a joint analysis, compared to inactive and slow walkers, there were reduced odds of AS among fast walkers, regardless of whether they were inactive (0.35 [0.16-0.80]) or active (0.39 [0.18-0.81]), suggesting benefits of fast walking on AS regardless of daily SCo.

CONCLUSIONS: SCA (i.e., intensity of walking) rather than total daily SCo may be associated with reduced odds of high AS among older adults.

2004 Board #4 May 28 3:45 PM - 5:45 PM Types Of Social Support And Change In Daily Steps Among Adults

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(No relevant relationships reported)

Evidence has shown a favorable link between social support and leading a physically active lifestyle. Yet, little is known about the types of social support that may be the most influential.

PURPOSE: This study examined the association between physical activity (PA) change and the types of social support adults participating in a PA intervention identified as the most helpful for their PA efforts. **METHODS:** Insufficiently active adults were randomized as self-selected teams of 3-8 participants (n=24 teams) to a 12-week technology-mediated, theory-based PA treatment (n=59 participants) or the same intervention plus a real-time PA gamified challenge (n=57 participants). There were no significant differences between conditions in changes in mean daily steps, so analyses collapsed groups and examined participants at 12 weeks (N=116) and 1 year (n=98). Participants completed an online survey at both time points, which asked them to select the most helpful type of social support they received (informational; tangible; emotional; esteem). Configurational Frequency Analysis was used to analyze participants grouped according to their characteristic configurations in terms of meaningful changes in mean daily steps from baseline ($\geq 1,000$ steps/d) as measured by an accelerometer and reported type of perceived social support. **RESULTS:** Participants averaged 4853 ± 1333 steps/d at baseline and 39% and 36% achieved a $\geq 1,000$ steps/d increase from baseline at 12 weeks and 1 year, respectively. Esteem support emerged as the most frequently reported most helpful type of support at 12 weeks and 1 year, followed by emotional and tangible support. At 12 weeks, those who achieved a $\geq 1,000$ steps/d increase and reported emotional support as the most helpful type represented the most notable statistically significant configuration (n=14; $p < .001$). At 1 year, those who achieved a $\geq 1,000$ steps/d increase and reported tangible support as the most helpful type represented the most notable statistically significant configuration (n=9; $p = .004$). **CONCLUSION:** These findings suggest that different types of support may be especially influential at varying phases of the behavior change process. Future studies should employ designs that allow for the direct comparison of the effectiveness of different types of support on physical activity in adults.

2005 Board #5 May 28 3:45 PM - 5:45 PM Associations Between Daily Steps, Stepping Cadence, And Arterial Stiffness In Older Adults

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PURPOSE: Higher daily steps counts are associated with lower arterial stiffness (AS). Less is known about the effects of stepping cadence (steps/minutes) on this relationship. We examined the associations between objectively measured steps counts (SCo), stepping cadence (SCa), and AS among older adults. **METHODS:** This cross-sectional analysis included 394 older adults (mean age 72, 59% female) enrolled in the Physical Activity and Aging Study (PAAS). AS was derived from carotid-femoral pulse wave velocity (cfPWV) using the SphygmoCor device (AtCor). High AS was

2006 Board #6 May 28 3:45 PM - 5:45 PM Computational Opportunities In The Estimation Of Free-living Temporal Gait Parameters From Wearable Accelerometry Data

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Wearable accelerometers are widely used to monitor free-living physical activity (PA) in the variety of epidemiological and clinical studies. Due to a small size, long battery life and low costs their popularity grew exponentially in recent years. This motivates researchers to seek additional utility of free-living accelerometry outside traditional PA measurements. Arguably, the assessment of mobility and gait parameters is one of the most popular and exciting applications of wearable accelerometers. However, because of the sheer size of free-living, sub-second level accelerometry data, the choice of existing analytical methods and the development of new ones is highly limited by the computational capabilities of modern computers and workstations. In this work, we explore possible solutions to this challenge. Namely, multi-core and graphics processing unit (GPU) computing. As a motivating example, we use the Adaptive Empirical Pattern Transformation (ADEPT), an open-source, dictionary-based pattern recognition method dedicated to the segmentation of walking strides in high-density accelerometry data. **PURPOSE:** We propose to minimize the computational time of the ADEPT algorithm by application of the GPU computing using inexpensive, desktop workstation equipped with the consumer-grade GPU. **METHODS:** We use data collected on 5 healthy participants equipped with the wrist-worn tri-axial Actigraph GT3X monitor over 48-hour period at sampling frequency of 100Hz. Next, we deploy the ADEPT algorithm on single-core Intel I9-900K CPU, 8-core CPU and Nvidia RTX 2080 GPU and measure total computation time. **RESULTS:** Average single-core CPU computation time was equal to 607.70 (sd = 0.3), multicore CPU was 344.40 (sd = 0.8) and GPU was 25.52 (sd = 0.07) seconds. GPU enabled computing allowed for nearly 23 times faster computation with respect to single-core and 14 times with respect to multicore processing. **CONCLUSIONS:** GPU accelerated computing allows for the application of more complex and time-consuming methods in the statistical analysis of high-density accelerometry data collected in free-living settings over multiple days. Additionally, it creates possibilities for scaling-up computationally intensive methods to much larger samples enabling their application in large epidemiological studies.

2007 Board #7 May 28 3:45 PM - 5:45 PM

Association Of Steps Per Day With Premature Mortality: Results From The Cardia Study

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PURPOSE: The 2018 Physical Activity Guidelines Advisory Committee Report calls for research to examine associations of step volume with long-term clinical endpoints, including mortality. To date, there are few prospective studies examining accelerometer-measured steps/day with mortality.
METHODS: Data are from 2027 participants from the Coronary Artery Risk Development in Young Adults (CARDIA) study with valid (≥4 days, ≥10 hours/day) accelerometer wear (ActiGraph 7164) at the year 20 exam (2005-2006). Multivariable Cox models calculated hazard ratios (HR) and 95% confidence intervals (CI) for mortality for the total sample and by race and sex.
RESULTS: The sample (45.3±3.6 years; 58% women, 41% black) had mean follow-up time of 10.8±0.9 years, and 67 total deaths occurred. The participants had a median [IQR] of 10004 [8061-12097] steps/day according to the raw output and 6670 [4987-8617] steps/day when applying a censoring equation omitting steps accumulated at low accelerations of <500 counts/minute. Black women accumulated significantly lower step volume vs. all other race-sex groups (p<0.05). Adjusting for demographics, lifestyle characteristics, and comorbidities, every 1000 higher steps/day was associated with a 10% lower risk of mortality (HR:0.90, 95% CI:0.83, 0.99). When stratifying by race or sex, HRs remained statistically significant for women (HR:0.77, 95%CI:0.66, 0.90) and blacks (HR:0.85, 95%CI:0.76, 0.96). Black women had 28% lower risk of mortality for every 1000 higher steps/day (HR:0.72, 95%CI:0.58, 0.88).
CONCLUSIONS: Among this sample of middle-age adults, accumulating a higher volume of steps/day was associated with a lower risk of mortality.

Hazard Ratios of the Association of Steps per Day with Risk of Mortality Overall and by Race and Sex Groups

	Steps/day - Raw* Median [IQR]	Steps/day - Censored ^b Median [IQR]	Deaths/Total (%)	HR (95% CI)
Categorical - Quartiles of Steps/Day among Total Sample				
Q1 (lowest)	6762 [5508-7452]	4244 [3556-4967]	27/506 (5.3%)	1.00
Q2	8959 [8553-9489]	6171 [5523-6743]	10/507 (2.0%)	0.43 (0.20, 0.90)
Q3	10981 [10501-11472]	7942 [7215-8521]	18/507 (3.6%)	0.83 (0.45, 1.56)
Q4 (highest)	14952 [12904-15660]	10950 [8836-13302]	12/507 (2.4%)	0.48 (0.23, 0.99)
<i>p for trend = 0.02</i>				
Continuous - Per 1000 Steps/Day Greater				
Total	10004 [8061-12097]	6670 [4987-8617]	67/2027 (3.3%)	0.90 (0.83, 0.99)
Women	9767 [7944-11734]	6440 [4770-8259]	32/1168 (2.7%)	0.77 (0.66, 0.90)
Men	10434 [8305-12537]	7170 [5287-9061]	35/859 (4.1%)	0.97 (0.87, 1.08)
Black	9483 [7503-11583]	6155 [4591-8110]	36/835 (4.3%)	0.85 (0.76, 0.96)
White	10280 [8440-12309]	7171 [5424-8920]	31/1192 (2.6%)	0.99 (0.87, 1.13)
Black Women	8960 [7224-11015]	5740 [4404-7553]	20/512 (3.9%)	0.72 (0.58, 0.88)
White Women	10342 [8491-12292]	7031 [5126-8752]	12/636 (1.9%)	0.82 (0.64, 1.06)
Black Men	10649 [8662-12864]	6879 [4987-8958]	16/303 (5.3%)	0.88 (0.73, 1.05)
White Men	10208 [8397-12323]	7278 [5542-9128]	19/556 (3.4%)	1.05 (0.91, 1.21)

*Raw: raw values estimated by the ActiGraph 7164 accelerometer
^bCensored: omits steps in minutes at very low intensity accelerations of <500 counts per minute (cpm)
 Models adjusted for wear time, age, sex, race, max education, center, healthy eating index, smoking status, alcohol intake, history of cardiovascular disease, type 2 diabetes, hypertension, obesity, hypercholesterolemia. All measured at Year 20.
 Type 2 Diabetes: fasting glucose ≥ 126 mg/dL or 2h GTT ≥ 200 mg/dL or reported diabetes used use
 Hypertension: SBP≥130 mmHg or DBP ≥80 mmHg or reported antihypertensive med use
 Hypercholesterolemia: ≥240mg total cholesterol or reported lipid lowering med use
 Obesity: BMI ≥ 30 kg/m²

D-42 Free Communication/Slide - Clinical Aspects of Thermal Physiology

Thursday, May 28, 2020, 3:45 PM - 5:15 PM
 Room: CC-3014

2008 Chair: Caroline Smith, FACSM. *Appalachian State University, Boone, NC.*
 (No relevant relationships reported)

2009 May 28 3:45 PM - 4:00 PM Voluntary Cooling During Exercise Is Augmented In Heat Sensitive People With Multiple Sclerosis

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Purpose: Body cooling improves exercise tolerance in heat sensitive people with Multiple Sclerosis (MS). The effectiveness of cooling modalities in real-world settings requires appropriately engaging in cooling behavior. We tested the hypothesis that people with MS voluntarily engage in cooling behavior during exercise to a greater extent than healthy controls.
Methods: In a 27.0±0.2°C, 41±2% RH environment, 7 subjects with relapsing-remitting MS who exhibited heat sensitivity (34±7y, 167±5cm, 72±15kg, EDSS: 1.9±0.8, 1 male) and 7 healthy subjects (CON, 37±7y, 168±7cm, 71±11kg, 1 male) completed two randomized trials cycling for 40 min (EX) at a fixed rate of metabolic heat production (3.5 W/kg) followed by 30 min recovery (REC). In one trial, subjects were restricted from engaging in cooling (NONE). In the other, subjects pressed a button to receive 2 min of ~2°C water perfusing a suit top as often as desired (COOL). Mean skin (T_{sk}, 8 site) and core (T_{core}, telemetry pill) temperatures and mean skin wettedness (W_{sk}, 8 site) were recorded continuously. Total voluntary time in cooling provided an index of cooling behavior. Ratings of perceived exertion (RPE), composite heat sensitivity symptom scores (HSSS, MS only) and subjective fatigue (MS only) were recorded every 10 min.
Results: T_{core} (+0.5±0.1°C, P<0.01) and W_{sk} (+0.52±0.02 a.u., P<0.01) increased in EX and remained elevated in REC (P<0.01) but were not different between trials (P≥0.35) or groups (P≥0.60). T_{sk} decreased in MS COOL compared to MS NONE from min 20 EX to 5 REC (P≤0.02). There were no other differences in T_{sk} (P≥0.25). MS spent more total time in cooling in EX (MS: 13.4±3.0 min; CON: 7.4±3.6 min, P<0.01) but not REC (MS: 1.7±1.4 min; CON: 0.3±0.7 min, P=0.40). In both trials, RPE was higher in MS vs. CON (P<0.01). HSSS increased in EX (P<0.01) but was not different between trials (P=0.25). Subjective fatigue was not different between trials in EX (P≥0.97) but was lower at 10 and 20 min of REC in COOL (P<0.02).
Conclusions: MS engaged in body cooling during EX to a greater extent than CON. While cooling did not affect HSSS or fatigue during EX, MS reported greater reductions in fatigue following exercise when cooling was permitted. Cooling during exercise could improve exercise participation and adherence.
 Supported by: ACSM Foundation Research Endowment Grant

2010 May 28 4:00 PM - 4:15 PM Blood Pressure Responses During A Cold Pressor Test Following Ketamine Or Fentanyl Analgesic Administration

Joseph C. Watso¹, Mu Huang¹, Gilbert Morales¹, Matthew N. Cramer¹, Joseph M. Hendrix¹, Frank A. Cimino, III¹, Luke N. Belval¹, Carmen Hinojosa-Laborde², Qi Fu¹, Craig G. Crandall, FACSM¹. ¹University of Texas Southwestern Medical Center & Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Hospital, Dallas, TX. ²US Army Institute of Surgical Research, San Antonio, TX. (Sponsor: Craig Crandall, FACSM)
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 (No relevant relationships reported)

Pain increases arterial blood pressure (BP) in an intensity-dependent manner. US Army Tactical Combat Casualty Care guidelines recommend ketamine (a N-methyl-D-aspartate receptor antagonist) or fentanyl (a μ-opioid receptor agonist) for pain

THURSDAY, MAY 28, 2020

management in the prehospital setting. It is unclear if pain perception and related BP responses are different between these analgesics. **PURPOSE:** We sought to determine if reductions in pain perception and BP responses during a cold pressor test were different between ketamine or fentanyl administration. **METHODS:** Thirty-four healthy participants (16M/18F; 28±6 y; 26±3 kg·m⁻², systolic BP 122±12 mmHg, diastolic BP 73±8 mmHg) completed two experimental visits in random crossover fashion, receiving either intravenous drug administration (n=22 with 20 mg ketamine, n=5 with 75 µg fentanyl, n=7 both crossover trials) or placebo (saline). Four minutes post-drug infusion, a cold pressor test was performed by placing the participant's hand in an ice water bath (~0.4°C) for two minutes. Pain perception was assessed using a 10-cm visual analogue scale immediately after the cold pressor test. Peak BP responses were calculated as the increase in BP during the second minute of the cold pressor test relative to BP just before the onset of the cold pressor test (post-infusion). Pain perception and peak mean BP changes were compared between drugs and placebo using one-way ANOVAs and Tukey's post hoc tests. **RESULTS:** Post-infusion, resting mean BP was higher (p<0.01) following ketamine compared to both fentanyl and placebo administrations (Ketamine: 106±13 mmHg; Fentanyl: 91±13 mmHg; Placebo: 93±8 mmHg; main effect: p<0.01). Ketamine and fentanyl similarly (p=0.66) attenuated pain perception to the cold pressor test compared to the placebo conditions (Ketamine: 2±3 cm; Fentanyl: 3±1 cm; Placebo: 7±1 cm; main effect: p<0.01). Consistent with reductions in pain perception, ketamine and fentanyl similarly (p=0.86) attenuated the peak mean BP response during the cold pressor test compared to placebo conditions (Ketamine: Δ 6±7 mmHg; Fentanyl: Δ 6±5; Placebo: 12±8 mmHg; main effect: p<0.01). **CONCLUSIONS:** These preliminary data suggest that ketamine and fentanyl similarly blunt pain perception and the associated BP response to a cold pressor test, despite ketamine raising resting BP.

2011 May 28 4:15 PM - 4:30 PM

Analgesics In The Pre-hospital Setting: Fentanyl Does Not Alter Tolerance To Simulated Hemorrhage In Humans

Mu Huang¹, Joseph C. Watso², Gilbert Moralez¹, Matthew N. Cramer², Joseph M. Hendrix¹, Mads Fischer¹, Luke N. Belval², Frank A. Cimino², Carmen Hinojosa-Laborde³, Craig G. Crandall, FACSM². ¹UT Southwestern Medical Center, Dallas, TX. ²Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Hospital Dallas and The University of Texas Southwestern Medical Center, Dallas, TX. ³US Army Institute of Surgical Research, San Antonio, TX. (Sponsor: Craig Crandall, FACSM)
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Hemorrhage is the leading cause of battlefield and civilian trauma deaths. Given that a hemorrhagic injury on the battlefield is usually associated with pain, it is paramount that the administered analgesic does not disrupt the physiological mechanisms that are beneficial towards the maintenance of blood pressure and vital organ blood perfusion during that hemorrhagic insult. Current guidelines from the US Army's Committee on Tactical Combat Casualty Care (CoTCCC) for the selection of pain medications administered to a hemorrhaging soldier are based upon limited scientific evidence, with the majority of supporting studies being conducted on anesthetized animals. Specifically, the influence of fentanyl, one of three analgesics employed in the pre-hospital setting by the US Army, on hemorrhagic tolerance in humans is entirely unknown. **PURPOSE:** The aim of this study is to test the hypothesis that fentanyl impairs the capacity for a conscious human to tolerate a simulated hemorrhagic insult. **METHODS:** Fourteen subjects (8 females, 27±7 years old, 173±9 cm, 77±12 kg) participated in this double-blinded, randomized, placebo-controlled crossover investigation. Following intravenous administration of fentanyl (75 µg—consistent with the US Army's CoTCCC guidelines) or placebo (saline), tolerance to a simulated hemorrhage was performed using a progressive lower-body negative pressure (LBNP) protocol to pre-syncope. Tolerance was quantified as a cumulative stress index (CSI), which is the sum of products of the LBNP stage and the duration at that stage [e.g., (40 mmHg·3 min) + (50 mmHg·3 min) ...]. **RESULTS:** Mean tolerance to the simulated hemorrhagic challenge was not different between the fentanyl and placebo trials (CSI: 585±406 mmHg·min and 626±267 mmHg·min respectively, P=0.67). **CONCLUSIONS:** These data, the first to be obtained in conscious humans, demonstrate that administration of the US Army's CoTCCC recommended dose of fentanyl does not compromise tolerance to a simulated hemorrhagic insult. These findings may be insightful in choosing the most suitable analgesic medication in the pre-hospital setting during a hemorrhagic injury.

2012 May 28 4:30 PM - 4:45 PM

Impact Of Statin Use On Thermoregulatory Outcomes During Submaximal And Maximal Exercise

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Statins are among the most widely prescribed drugs in the US and world. However, many of their side effects and drug mechanisms may impact the users safety during exercise, specifically in the heat.

PURPOSE: Perform a preliminary analysis on the thermoregulatory impact of statins during submaximal and maximal exercise in the heat.

METHODS: Participants in the 11.26km Falmouth Road Race (Falmouth, MA) were recruited. Statin (S) users were matched by age, sex, VO₂max, and body surface area (BSA) with an appropriate control (CON). All participants completed a modified heat tolerance test (HTT) (11.26km, 60% VO₂max, 2% incline; WBGT 23.42±0.77°C) about two-weeks prior to the race. Participants then reported for data collection on race day before and immediately post race. Measures of heart rate (HR), rectal temperature (Trec) and race finish time (min) were collected. Paired samples t-tests were conducted to evaluate delta values for variables collected at pre to post HTT and pre to post race day. Significance was set *a priori* at p<0.05.

RESULTS: Five S users (3 males, 2 females) were identified. Demographic data for S and 5 same sex CON were: age, 53±8y, 51±10y; height 168±8cm, 178±11cm; VO₂max 44.46±14.00ml·kg⁻¹·min⁻¹, 45.66±10.77ml·kg⁻¹·min⁻¹; and BSA 1.75±0.18m², 1.86±0.18m², respectively. Pre to Post HTT Trec delta for S (0.97±0.25°C) and CON (1.24±0.53°C) were similar (p>0.05). Pre to Post race day Trec delta for S (2.64±1.30°C) and CON (2.67±1.43°C) were similar (p>0.05). Pre to Post HTT HR delta for S (17±5bpm) and CON (19±15bpm) were similar (p>0.05). Pre to Post race day HR delta for S (38±28bpm) and CON (65±23bpm) were significantly different (p=0.012). Finish time on race day was similar between S (60.9± 11.8) and CON (60.5±10.7min).

CONCLUSION: While HR and Trec delta values appeared to be similar during submaximal exercise, HR delta was significantly lower in the S group compared to CON during a race scenario, despite similar Trec delta values. This may be a result of the known influence statins have on skin blood flow and reflect a potential for changes in cardiovascular regulation during exercise in the heat when individuals regularly use statins. Future research is warranted to determine the source of these potential thermoregulatory responses and impact on risk for heat related illnesses.

2013 May 28 4:45 PM - 5:00 PM

Interaction Between Exercise Intensity And Burn Size Affects Body Temperature During Exercise In The Heat

Luke N. Belval, Matthew N. Cramer, Mu Huang, Gilberto Moralez, Frank A. Cimino, III, Joseph C. Watso, Craig G. Crandall, FACSM. *Institute for Exercise and Environmental Medicine, Dallas, TX.* (Sponsor: Craig Crandall, FACSM)
(No relevant relationships reported)

US Army Standards of Medical Fitness exclude personnel who have sustained burn injuries covering 40% or more of their body surface area (BSA). However, this requirement is not specific to different exercise intensities that an individual is expected to perform and therefore does not take metabolic heat generation into account. **PURPOSE:** To test the hypothesis that the magnitude of the elevation in internal body temperature during exercise in a warm environment is influenced by the combination of exercise intensity and percentage BSA burned. **METHODS:** Nine healthy participants (8 males, 1 female; 33±9 y; 176±7 cm, 75.2±12.0 kg) completed eight exercise trials on a cycle ergometer, each with differing combinations of exercise intensities (Low: 4 W/kg and Moderate: 6 W/kg) and simulated BSA burn percentages in a warm environmental chamber (39.8±0.3°C, 20.5±1.5 %rh). Burns were simulated by covering 0%, 20%, 40% or 60% of participants' BSA with a highly absorbent, vapor-impermeable material. Gastrointestinal temperature (TGI) was recorded throughout exercise, with the primary analysis (mixed-model with contrasts and Bonferroni corrections comparing simulated burn trials to 0%, with p<0.017 for significance) being the magnitude of the elevation in TGI after 60 min of exercise. **RESULTS:** The statistical model identified an interaction effect (p=0.005), suggesting that the magnitude of the elevation in TGI was influenced by both exercise intensity and simulated BSA. Regardless of the percentage BSA burn simulated, the increase in TGI was similar across low intensity trials (mean increase: 0.69±0.27°C, p>0.05). However, during moderate intensity exercise the magnitude of the increase in TGI was greater for the 60% (1.76±0.39°C; p<0.001) and 40% (1.23±0.51°C; p=0.0014) BSA coverage trials, relative to the 0% (0.80±0.42°C) BSA coverage trial. There were no differences between 0% and 20% (1.06±0.42°C; p=0.049) BSA coverage trials. **CONCLUSIONS:** These data suggest that exercise intensity influences the relationship between burn injury size and thermoregulatory responses during exercise

in a warm environment. Clinical guidance and US Army Standards for burn survivors should, therefore, consider the intensity of the exercise bout alongside BSA burned when determining limitations to physical activity.

2014 May 28 5:00 PM - 5:15 PM

The Effect Of Burn Location On Internal Body Temperature Responses During Exercise In The Heat

Frank A. Cimino, III, Matthew N. Cramer, Gilberto Morales, Mu Huang, Luke N. Belval, Joseph C. Watso, Craig G. Crandall, FACSM. *The Institute for Exercise and Environmental Medicine, Dallas, TX.* (Sponsor: Craig Crandall, FACSM)
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(No relevant relationships reported)

According to the US Army's Standard of Medical Fitness (AR 40-501), extensive burn injuries will disqualify individuals from US Army service, depending in part on the anatomic location of the injury. Specifically, these guidelines state that "extensive burns on the torso will most significantly impair heat dissipation." and that burn injuries could be a disqualifying criteria for continued service. However, the effects of the location of the burn injury on thermoregulation during exercise is currently unknown. **Purpose:** This study tested the hypothesis that a torso burn injury is not any more detrimental to whole-body heat dissipation relative to a similar sized non-torso burn injury. **Methods:** Nine healthy subjects (29±6 years; 72.44±11.29 kg; 1.86±0.17 m²) walked on a treadmill (~3.3mph) in the heat (40 °C and 20% relative humidity) for 60 minutes at a fixed rate of metabolic heat generation (5.7±0.5 W/kg). Identical ~25% body surface area (BSA) burn injuries to the torso or non-torso extremities (randomized) were simulated by applying a highly absorbent vapor-impermeable material over those regions. The elevation in internal body temperature assessed via an ingestible telemetry pill, was the primary variable of interest. Additional analyses were performed to assess differences in heart rate and thermal sensation. **Results:** The statistical model (2 way repeated measures ANOVA) identified a main effect of time (p<0.001; 0.94±0.33 °C for torso and 0.91±0.34°C for extremity at end of exercise) on the increase in internal body temperature, with no effect of simulated burn location (p=0.76) or interaction (p=0.10). Heart rate and thermal sensation showed similar responses, with a significant main effect of time (p<0.001) with no effect of burn location (p=0.09) or interaction (p=0.13). **Conclusion:** Contrary to the Army's guidelines, these results suggest that torso burns do not limit heat dissipation and exacerbate thermal strain compared to non-torso burn injuries. Therefore, the Army should not consider torso burns as being more detrimental when determining whether a soldier meets the Standard of Medical Fitness.

Funding: Department of Defense - US Army W81XWH-15-1-0647

D-43 Free Communication/Slide - Concussion and Movement Performance

Thursday, May 28, 2020, 3:45 PM - 5:45 PM
Room: CC-3020

2015 **Chair:** James Onate. *Ohio State University, Columbus, OH.*
(No relevant relationships reported)

2016 May 28 3:45 PM - 4:00 PM

Effect Of Training Session On Postural Control, Self-reported Concussion Symptoms In Adolescent Female Soccer Athletes

Emily D. Geyer, Maria K. Talarico, Nathan A. Edwards, Matthew P. Brancaleone, Adam M. Culiver, James A. Onate. *Ohio State University, Columbus, OH.*
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Reported Relationships: E.D. Geyer: Other (please describe); The equipment utilized in this experiment was provided by ProtXX Inc. free of cost.

PURPOSE: Given the rising emphasis on reducing concussions in sport, it is important to understand the effects of repetitive head impacts on youth athletes and to use this information to optimize the clinical management of concussions. The purpose of this study was to determine the effect of a soccer training session with headers on postural control performance and concussion-like symptoms of healthy adolescent female soccer athletes. **METHODS:** Eighteen female soccer athletes (15±0.725 yrs) from an elite soccer club engaged in a 90-minute soccer training session with headers. Prior to and following the training session, participants completed double-limb postural control assessments with eyes open and closed, as well as a symptom questionnaire (SCAT5). An inertial measurement unit was worn behind the ear which

collected tri-axial accelerations during assessments. Mean sway velocity and sway velocity root-mean-square (RMS) were calculated for each condition. Two-way repeated measures ANOVAs were performed to determine if visual condition (eyes open, eyes closed) and time of testing (pre-, post-training) influenced postural control performance. Wilcoxon Signed Rank tests were performed to determine differences between pre- and post-training symptomology scores. Alpha level was set a priori at P≤0.05. **RESULTS:** A time main effect on sway velocity was observed where participants exhibited faster sway post-training compared to pre-training (mean difference=0.069 cm/s; p=0.004). A vision main effect on RMS was observed where participants exhibited larger RMS with eyes open compared to eyes closed (mean difference=0.038 cm/s; p=0.015). No difference in total symptom scores were observed (Z = -1.729, p=0.084). **CONCLUSIONS:** Soccer training with heading influenced postural control performance of elite adolescent female club soccer athletes, but did not influence overall symptom scores. These findings underscore the importance of incorporating postural control outcomes into clinical assessments to comprehensively evaluate performance. With heightened public concern regarding concussion and the safety of contact sports, it is imperative to assess for potential postural control deficits following training with heading in neurodevelopmentally vulnerable populations such as female adolescents.

2017 May 28 4:00 PM - 4:15 PM

Influences Of Sleep Disturbances And Mild Traumatic Brain Injury On Gait Performance Among College Students

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(No relevant relationships reported)

Sleep disturbances from stress are common among college students. In addition, student athletes in contact sports (e.g., football and soccer) are at a higher risk of receiving a mild traumatic brain injury (mTBI). Stress-related sleep disturbances and mTBI may provoke cognitive and brain changes associated with gait abnormalities. **PURPOSE:** to examine the association between stress, sleep disturbances, mTBI and gait performance among college students. **METHODS:** The control group included 28 college students (11 males, 17 females, age: 22.6±3.2 yrs) and the mTBI group consisted of 12 NCAA Division II men's and women's soccer players who indicated a history of concussion (3 males, 9 females, age: 19.6±1.3 yrs). Participants were asked to perform gait analysis with an in-shoe pressure measurement system during and after the midterm exam. Cadence, step time, stride time, stance time and swing time were measured. Meanwhile, 14-days consecutive wrist actigraphy data and three sets of questionnaires were collected to assess their stress, sleep and fatigue. A mixed-design ANOVA was used to compare gait and sleep parameters of mTBI and control groups. **RESULTS:** The mTBI group had significantly shorter step time (0.54±0.01 vs. 0.58±0.01 s, p=.011) and stance time (0.66±0.01 vs. 0.70±0.01 s, p=.013) compared to the control group. The control group had significantly longer step time and stance time during the midterm exam than after the midterm exam. However, no significant differences of gait parameters were observed for the mTBI group during and after midterm exam. During the exam week, participants in both control and mTBI groups perceived moderate stress and reported 2-3 nights of sleep disturbances. Meanwhile, stress level was positively associated with sleep disturbances, poor daytime functioning, and poor activity correlation. **CONCLUSION:** Midterm exam as a stressor resulted in sleep disturbances in both mTBI and control groups. This stressor may also cause gait abnormalities of the control group, but not the mTBI group. Another interesting finding is that shorter step time and stance time were observed in the mTBI group. Nevertheless, further studies need to examine whether this is indeed due to mTBI, or the difference between student athletes and non-athletes. Supported by Office of Research and Scholarship at UT Tyler.

2018 May 28 4:15 PM - 4:30 PM

Upping The Ante: Can Agility Performance Differentiate Previously Concussed From Healthy Controls?

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(No relevant relationships reported)

Returning to sport or active duty has the potential to put athletes or service members at risk. Yet, post-concussion assessments primarily rely on subjective reporting or simple clinical tests - tasks that lack ecologic validity in comparison with sport or combat environments. Both environments may require fast-paced movements such as turning, which involves the integration of oculomotor and vestibular information, as well as cognitive control for execution. Testing anticipated and unanticipated turns during agility tasks performed at high speeds may provide a more valid test setting,

and help to quantify differences between previously concussed and healthy persons performing more complex movement tasks. **PURPOSE:** To compare performance on unanticipated and anticipated agility tasks between previously concussed and healthy controls. **METHODS:** We tested agility performance, defined by peak turning velocity (yaw, °/s), in previously concussed and healthy controls in two participant samples: athletes (concussed $n=5$, control $n=5$) and a general population (concussed $n=8$, controls $n=10$). Athletes completed unanticipated turns cued by a light stimulus, and the general population completed anticipated turns using a modified Illinois Agility task (IAT). Peak turning velocity was extracted from a waist worn inertial sensor. Athlete and general population data were compared separately. Cohen's d effect size was used to evaluate between-group differences due to small sample sizes. **RESULTS:** The concussed athletes (mean(SD); 239(46) °/s) turned slower than the control athletes (300(37) °/s; $d = -1.45$, large effect) completing unanticipated turns. In the general population performing anticipated turns, the concussed group (220(23) °/s) turned slower than the healthy controls (237(33) °/s; $d = -0.57$, medium effect). **CONCLUSION:** Findings suggest differences between groups in both samples, despite using different agility tasks. Moving forward, we plan to evaluate anticipated turns performance in an active military duty population. However, unanticipated turn tasks, which require a movement coupled in response to stimulus are an interesting area for future exploration. Supported by the Assistant Secretary of Defense for Health Affairs (#W81XWH-18-2-0049) and the Medical Research Foundation of Oregon.

2019 May 28 4:30 PM - 4:45 PM

Analyzing Chronic Balance Deficits In A Concussed Population

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(No relevant relationships reported)

PURPOSE: Balance impairments have been extensively examined in acutely concussed individuals; however, persistent balance alterations have yet to be conclusively established. The purpose of this study was to examine persistent balance deficits using inertial measurement units (IMU's) in previously concussed participants (CON) compared to non-concussed participants (NC). **METHODS:** Forty participants ($n=20$ CON: 22.39 ± 3.40 years old, 1.90 ± 1.21 concussions, 5.64 ± 2.72 years from last concussion, sex= 50% female; $n=20$ NC: 24.81 ± 5.53 years, sex= 50% female) completed the Modified Clinical Test of Sensory Interaction on Balance (mCTSIB) while equipped with six IMU's. All participants completed the trials successfully, thus kinematic balance measures were analyzed. Between-group differences for total and planar (sagittal and coronal) mean velocity and the root mean squared (RMS) of total and planar sway acceleration were evaluated with independent t-tests. Correlations and linear regression models were used to examine the effect of time in years since last diagnosed concussion (TCON) and self-reported strenuous levels of weekly physical activity (PA) on balance variables among the CON participants. **RESULTS:** Independent t-tests produced several significant group differences during the eyes closed on foam surface (ECF) trials for total mean velocity, sagittal mean velocity, total RMS sway, and sagittal RMS sway ($p < 0.05$). Correlations indicated TCON ($p < 0.05$) and PA ($p < 0.05$) were significantly inversely related to all ECF balance variables, except coronal mean velocity and coronal RMS sway. Linear regression of TCON and PA onto balance variables during ECF testing were significant for mean velocity ($R^2=0.402$, $p=0.013$), sagittal mean velocity ($R^2=0.426$, $p=0.009$), and sagittal RMS sway ($R^2=0.301$, $p=0.047$), with total RMS sway trending towards significance ($R^2=0.297$, $p=0.05$). **CONCLUSIONS:** Our study suggests those with a concussion history may present with lingering balance alterations that diminish as time since incidence (TCON) increases and in those who maintain an active lifestyle (PA). Future research should consider using dynamic balance exercises to best evaluate balance in previously concussed participants.

2020 May 28 4:45 PM - 5:00 PM

Sport-related Concussions Have A More Conservative Stepping Pattern During Instrumented Tandem Gait Performance

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(No relevant relationships reported)

Tandem gait has emerged as a dynamic and clinically viable test of dynamic motor control following sport-related concussion (SRC). A myriad of tools are available to objectively assess gait kinematics. One piece of equipment, the Tekscan Strideway,

uses individual load cells on a series of connected force platform tiles to quantify gait. No data exists that examines the performance of SRC using this device. **PURPOSE:** The purpose of this study was to evaluate the differences in center of pressure (CoP) performance during single-task (ST) and dual-task (DT) tandem gait within 24-48 hours post-SRC. **METHODS:** 18 Division I [SRC (age: 19 ± 1.00 yr. Male=7, Female=11)] and 18 nearly matched controls [CON (age: 19.88 ± 1.05 yr. Male=7, Female=11)] completed the vestibular ocular motor screening test (VOMS) and 3 trials of ST and 1 trial of DT (serial 7s) using the Tekscan Strideway (30Hz, Boston, MA). The raw CoP trajectory for the best tandem gait trial of each condition (fastest overall) was exported and further analyzed using a custom MATLAB code. All turns during the tandem gait trials were removed and each straight path walking was composed together. The raw CoP data in the AP and ML directions were smoothed using empirical mode decomposition and then excursion and velocity data were calculated. T-tests compared the time to complete ST and DT while two multivariate ANOVAs compared CoP in the AP and ML directions. **RESULTS:** SRC took significantly longer to complete the ST trial ($p=0.006$; SRC=14.2±4.4s, CON=10.8±2.1s) but not the DT trial ($p=0.279$). The SRC group had a larger VOMS near-point convergence (NPC) ($p=0.007$; SRC=9.5±5.5cm, CON=5.2±2.9cm) and a higher VOMS change score ($p<0.001$; SRC=19.7±6.4, CON=0±0). A significant omnibus effect was noted in AP direction ($p=0.015$) but not in the ML direction ($p=0.996$) for the tandem gait CoP data. Follow-up comparisons noted that in the AP direction during ST, SRC had slower CoP excursion ($p=0.003$; SRC=1.6±0.2cm, CON=1.9±0.4cm) and lower CoP velocity ($p=0.004$; SRC=54.2±7.7cm/s, CON=66.1±14.2cm/s) but no differences during DT. **CONCLUSIONS:** These results suggest that during instrumented ST tandem gait, SRC have a more conservative and slower heel-to-toe stepping pattern.

2021 May 28 5:00 PM - 5:15 PM

The Head Shake Sensory Organization Test And Screening Individuals With Self-reported History Of Concussion

Adrian Aron, Daniel Miner, Brent Harper, Ashley Dudding, Ashley Humphries, Sam Lawrence, Brooke McDermott, Radford University, Roanoke, VA. (Sponsor: A. Lynn Millar, FACSM)
(No relevant relationships reported)

PURPOSE: The Sensory Organization Test (SOT) assesses impairments in postural control following acute concussion. Head Shake Sensory Organization Test (HS-SOT) is a superior test that challenges the vestibular system to help detect more subtle deficits missed by SOT. The purpose of this study was to assess the accuracy of the HS-SOT in identifying residual impairments of postural control in individuals with self-reported history of concussion.

METHODS: The Ohio State University-Traumatic Brain Injury Identification Method (OSU TBI-ID) determined self-reported history of concussion while NeuroCom was used to perform HS-SOT. Twenty-nine subjects were included (11 males and 18 females, mean age 25.2 ± 3.7; history of concussion: $n=14$, 5 males and 9 females, mean age 25.7±3.5; no concussion: $n=15$, 6 males and 9 females, mean age 24.8±4.0). Independent T-Tests were completed to determine performance differences based on history of concussion.

RESULTS: HS-SOT fixed surface equilibrium ratio was similar ($p = 0.988$) between those without a history of concussion (0.998 ± 0.024) and those with a history of concussion (0.998 ± 0.026). Furthermore, HS-SOT sway reference surface equilibrium ratio was also similar ($p = 0.431$) between those without a history of concussion (0.871 ± 0.128) and those with a history of concussion (0.9136 ± 0.160). Within subjects with a history of concussion, younger subjects (23.4 ± 0.8) had a lower sway index compared to older (30.3 ± 3.6) individuals (0.85 ± 0.11 vs 1.09 ± 0.16, $p=0.021$). In addition, the younger group trended toward a more recent history of a concussive event (4.7 ± 4.8 vs. 8.0 ± 3.4, $p=0.25$).

CONCLUSIONS: There was no difference in HS-SOT in subjects with or without a history of concussion demonstrating an inability to detect performance impairments. Of those with a concussion, the HS-SOT significantly identified subtle performance deficiencies in younger individuals, suggesting that time from concussion tends to normalize sub-clinical deficits. This indicates that postural control impairments initially persist but resolve over time, which may place individuals at risk for injury during this window of recovery.

2022 May 28 5:15 PM - 5:30 PM

Comparing Functional Movement Under Single And Dual Task Conditions: Implications For Post-concussion Management

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(No relevant relationships reported)

Movement assessments are commonly performed while strictly completing the assessment (single task). Sport movement is highly dynamic and requires concurrent

cognitive processing and movement (dual task). Simultaneous cognitive processing and movement may alter human movement, but to date has not been examined. **PURPOSE:** To compare kinematic and kinetic outcomes between single and dual task functional movement among healthy individuals. **METHODS:** Physically active participants (n=41, 49% female; 22.5 ± 2.1yrs; 172.5 ± 11.9cm; 71.0 ± 13.7kg) completed a functional movement assessment (cut) under single and dual task (subtracting by 6's or 7's) conditions in random order. The cut involved jumping forward from a 30cm tall box set at 50% of the participant's height and performing a single, dominant-leg, 45 degree cutting motion after landing (four trials). The cut was completed in an eight camera (Qualisys; 120Hz) 3D motion capture space with two piezoelectric force plates (Bertec; 1200Hz). Multiple repeated measures ANOVAs ($\alpha=0.05$) compared hip, knee, and ankle joint angles (deg) and normalized joint moments (Nm/kg) at initial contact in sagittal and frontal planes, and normalized peak vertical ground reaction force (vGRF; N/kg) between single and dual task conditions. **RESULTS:** Results are presented in the Table. Dual task resulted in significantly greater ($p=0.03$) varus knee moments compared to single task. Dual task vGRF force was significantly less ($p=0.01$) compared to single task. No other outcomes were significant ($p\geq 0.06$). **CONCLUSION:** Slight kinematic and kinetic differences were observed between single and dual task during the cut. Reduced vGRF and greater varus knee joint moments during dual task may indicate altered movement during concurrent cognitive loading. Our findings provide initial metrics for future post-concussion biomechanical comparisons. Supported by the University of Georgia College of Education Early Career Faculty Research Grant.

Table. Dominant Leg Kinematic and Kinetic Outcomes During a 45-Degree cut at Initial Ground Contact.

Outcome	Value Direction	Single Task	Dual Task	P-Value
		Mean (95% CI)	Mean (95% CI)	
Hip Angle (deg)	Flexion	27.4(23.4 – 31.4)	25.9(22.0 – 29.9)	0.50
	Adduction	13.1(11.2 – 15.0)	12.6(10.7 – 14.5)	0.40
Knee Angle (deg)	Flexion	4.9(2.1 – 7.8)	4.9(2.0 – 7.7)	0.93
	Varus	1.9(0.8 – 3.1)	1.9(0.7 – 3.0)	0.65
Ankle Angle (deg)	Plantarflexion	43.2(38.9 – 47.6)	40.3(36.0 – 44.7)	0.06
	Inversion	12.3(10.4 – 14.3)	12.0(10.0 – 13.9)	0.45
Hip Moment (Nm/kg)	Extension	1.07(0.95 – 1.19)	0.99(0.87 – 1.11)	0.15
	Abduction	-0.18(-0.23 – -0.12)	-0.18(-0.24 – -0.13)	0.74
Knee Moment (Nm/kg)	Extension	-0.63(-0.68 – -0.58)	-0.63(-0.68 – -0.58)	0.96
	(+): Varus(-): Valgus	-0.0015(-0.05 – -0.02)	0.0025(-0.03 – 0.04)	0.03 ^a
Ankle Moment (Nm/kg)	Dorsiflexion	0.09(0.07 – 0.12)	0.09(0.07 – 0.11)	0.78
	Eversion	0.03(0.02 – 0.03)	0.02(0.02 – 0.03)	0.22
Peak Vertical Ground Reaction Force (N/kg)		2.90(2.79 – 3.01)	2.82(2.71 – 2.93)	0.01 ^a

^a Significant at $p \leq 0.05$.

2023 May 28 5:30 PM - 5:45 PM
Dual-task Balance Control in Adolescent Athletes Following Concussion
 Tracy Zaslow, Camille Burton, Nicole Mueske, Adriana Conrad-Forrest, Bianca Edison, Tishya Wren. *Children's Hospital Los Angeles, Los Angeles, CA.* (Sponsor: Tracy Zaslow, FACSM)
(No relevant relationships reported)

Purpose: Previous research has identified deficient dual-task balance control at the time of return to play (RTP) and possible worsening after RTP in older adolescents/young adults with concussion. We investigated these issues in younger concussion patients, hypothesizing they would have slower walking speed and increased medial-lateral (ML) center of mass (COM) movement, which would normalize by RTP but worsen after resuming activity.

Methods: 13 concussed adolescents (7 male; age 10-17 years) were prospectively evaluated at their initial visit (mean 18, range 4-43 days post-concussion), at RTP clearance (46, range 12-173 days post-concussion), and one month later (26, range 20-41 days post-RTP). Standing balance was assessed using range and root mean squared (RMS) COM motion during 2-leg, eyes open standing while performing audio Stroop, side-to-side head turn (HT), and side-to-side thumb tracking tasks. Dynamic balance was assessed using walking speed and COM ML range and velocity during walking alone and with head turn and verbal fluency (reciting words starting with "F") dual tasks. Patients were compared to 11 controls (3 male) using t-tests, and changes over time were evaluated using linear mixed-effects regression. **Results:** During standing, patients had higher COM ML RMS than controls at baseline during HT and higher COM anterior-posterior (AP) range during thumb tracking. COM ML motion decreased from baseline to RTP (HT range -6.5mm, $p=0.058$; HT RMS -16.8mm, $p=0.002$; thumb range 9.2mm, $p=0.012$) and increased from RTP to 1 month follow-up (HT RMS +10.0mm, $p=0.040$; Stroop RMS +8.4mm, $p=0.086$). Patients walked slower than controls at baseline during all tasks, and COM ML range was higher in patients during verbal fluency at baseline and RTP. Walking speed increased from baseline to RTP during verbal fluency (+7.8cm/s, $p=0.044$), from RTP to post-RTP in single task walking (+6.1cm/s, $p=0.041$), and at each successive visit during HT (+6.0cm/s and +6.5cm/s, $p<0.07$). COM ML range decreased in patients from baseline to RTP with verbal fluency (-14.7mm, $p=0.011$) and from RTP to post-RTP in single task walking (-4.0mm, $p=0.061$). **Conclusion:** Balance control deficits improved by RTP and only worsened post-RTP during dual-task standing, suggesting that current conservative treatment protocols are appropriate.

D-44 Clinical Case Slide - Oncology II
 Thursday, May 28, 2020, 3:45 PM - 5:45 PM
 Room: CC-2005

2024 **Chair:** Rahul Kapur. *University of Minnesota, St Paul, MN.*
(No relevant relationships reported)

2025 **Discussant:** Suzanne S. Hecht, FACSM. *University of Minnesota, Minneapolis, MN.*
(No relevant relationships reported)

2026 May 28 3:45 PM - 4:05 PM
Concerning The Utility Of Ultrasound Imaging In Soft Tissue Lesions
 Chad Curtis¹, Christopher Jordan². ¹*St. Joseph Medical Center, Osceola, IN.* ²*St. Joseph Medical Center, Mishawaka, IN.*
(No relevant relationships reported)

HISTORY: A 13-year-old female initially presented to her primary care physician with a complaint of right forearm swelling. Her symptoms were present for approximately two weeks and she experienced constant pain in the area. Her pain and swelling were located over the dorsal aspect of the forearm. The patient's symptoms were initially presumed to be muscle strain and initial treatment included ibuprofen and ice. Of note the patient is right hand dominant. She had a follow up appointment two weeks later, and her symptoms were unchanged. Due to persistent symptoms x-rays were obtained, which were unremarkable. She was subsequently sent to the sports medicine office for possible ultrasound examination. Upon initial encounter with sports medicine clinic, the patient reported persistent pain and started to have intermittent numbness sensation in her 3rd - 5th digits. **PHYSICAL EXAMINATION:** Musculoskeletal exam of right upper extremity was completed. Inspection was without deformity or bruising. Palpation was with normal anatomy at elbow. No tenderness to palpation of the elbow was elicited. A firm mass over the right forearm extensor muscle bodies was identified in the region of the mid to proximal radius. There was also tenderness over this point. Her range of motion was within normal limits and was without pain. Her exam was significant for sensation deficit to soft touch at 3rd-5th digits. **DIFFERENTIAL DIAGNOSES:** 1. Hemangioma 2. Hematoma 3. Cystic structure 4. Malignancy **TEST AND RESULTS:** X-Rays Elbow - Normal x-rays of right elbow. Ultrasound - Hyperemic soft tissue muscle mass MRI - 2x1x4 cm gadolinium enhanced mass of anterolateral side of the mid-radius without obvious origin. Image-guided core needle biopsy Differential of PNET and monophasic synovial sarcoma. **FINAL DIAGNOSES:** Ewing Sarcoma **TREATMENT and OUTCOMES:** 1. Chemotherapy 2. Proximal radial diaphyseal resection and fusion of the distal radius with the proximal ulna. 3. NM PET was without FDG uptake to suggest recurrent or metastatic disease. 4. Follow up work up was significant for imaging with expected surgical changes and with apparent remission and without metastasis.

THURSDAY, MAY 28, 2020

2027 May 28 4:05 PM - 4:25 PM

"Painless Fracture Hides Rare Bony Malignancy"Alexander Chasin¹, Amie Kim². ¹Brookdale University Hospital and Medical Center, Brooklyn, NY. ²Mount Sinai, New York, NY. Email: azc5154@gmail.com

(No relevant relationships reported)

HISTORY: 48 year old male with history of unprovoked DVT presents to the ED with left knee pain for 3 months. Symptoms began at rest, and described as sharp constant pain localized to the knee. Three weeks prior, he was evaluated by his primary care doctor and was clinically diagnosed with a knee sprain with conservative management. Two weeks ago, he felt an atraumatic "pop" in his lower extremity. Since that time he has since been unable to weight bear. No constitutional or B-type symptoms.

PHYSICAL EXAM: Thin, well appearing male, seated in a wheelchair. Seated exam was performed secondary to the patient's pain. He was unable to bear weight on his left lower extremity and it was held in passive internal rotation. His left hip had no tenderness over the greater tuberosity and he had limited range of motion. His left knee was without erythema, effusion or warmth and there was no tenderness over the medial or lateral joint lines. Range of motion of his knee was limited. No specialized tests were able to be performed given patients positioning and discomfort. His left ankle was nontender with no gross deformities. His dorsalis pedis pulse was 2+ and flexion/extension of the toes were intact.

DIFFERENTIAL DIAGNOSIS:

- 1) Hip dislocation/fracture, pelvic fracture / fragility fracture
- 2) Internal derangement of the knee
- 3) Femoral DVT
- 4) Pathological fracture

TEST AND RESULTS:

X-ray of Left Knee AP and Lateral

Displaced and angulated fracture of distal left femoral diaphysis.

MRI Left Lower Extremity (T1)

Abnormal soft tissue invades the mid to distal femoral shaft extending into anterior compartment of quadriceps and a portion of the short head of biceps femoris.

NM Bone Scan

Focal, mild to moderate increased tracer uptake noted in the left femur from the mid shaft to distal region.

Operative Biopsy Malignant fibrous histiocytoma / undifferentiated pleomorphic sarcoma

WORKING DIAGNOSIS: Occult femur fracture secondary to rare primary bone neoplasm**TREATMENT AND OUTCOMES:**

- 1) Patient transferred to outside facility for orthopaedic oncology service and operative plate fixation
- 2) Radiotherapy - post-operative of primary lesion site
- 3) Transfer to inpatient rehab facility with post-operative protocol
- 4) Remaining work-up and management follow-up pending - including oncologic imaging and therapy, surgical outcomes, rehabilitation course.

2028 May 28 4:25 PM - 4:45 PM

Finger Pain In A Professional Dog GroomerKevin Matthew Mullins, Eugene Yousik Roh. *Stanford University, Redwood City, CA.*

(No relevant relationships reported)

HISTORY: A 36-year-old right-handed female professional dog groomer with past medical history of PCOS, presents with a chief complaint of left hand digit 3 and 4 fingertip pain. She reports progressive discomfort for the past 10 months, worsened with tactile touch especially during work, and mildly improves with rest. Describes the pain as sharp electrical sensations rated 10/10 on pain scale, sensitive to cold weather. Outside facility workup included normal hand x-rays, cervical x-rays and a hand MRI. Electrodiagnostic/nerve conduction studies demonstrated mild carpal tunnel syndrome on the left without radiculopathy, for which she has tried a neutral wrist splint without improvement. She has been seen by her PCP, rheumatology, neurology, endocrinology, and orthopedic surgery, all without a confirmatory diagnosis. Her pain is now debilitating and thus she presents to Stanford for a 6th opinion.

EXAM: On inspection no swelling or discoloration. Severe tenderness with light touch of digit 3 at the eponychial fold, ulnar side. Limited active and passive digit 3 DIP flexion due to pain. Sensation decreased in dorsal digital median nerve branch digits 3 and 4. Remaining strength and sensation in the hand intact. Phalen's test at the wrist positive while tinel's was negative. Spurling's negative.

DIFFERENTIAL: 1. Median or Palmar Digital Branch Mononeuropathy. 2. C7 Radiculopathy 3. Digital Collateral Ligament Injury 4. Tumor 5. Complex Regional Pain Syndrome 6. Mallet Finger 7. Raynaud's Phenomenon

RESULTS: Point-of-care ultrasound significant for digit 3 solitary hypochoic lesion with clear boundaries and regular shape, and internal abundant hyperemia. Finger MRI showed 4 x 3 x 3 mm circumscribed T1 hypointense T2 hyperintense, enhancing lesion at dorsal aspect of the third distal phalanx.

DIAGNOSIS: Glomus Tumor

OUTCOME: Initiation of gabapentin, lidocaine cream for symptomatic relief and referral to orthopedics for definitive treatment with plans for left middle finger glomus tumor excision. The patient is currently pending surgery at the time of this submission, additional follow-up to be presented.

2029 May 28 4:45 PM - 5:05 PM

Posterior Shoulder Pain - Baseball PitcherMary Lynch, Jacob Sellon, Marc Gruner. *Mayo Clinic, Rochester, MN.*

Email: breen.mary@mayo.edu

(No relevant relationships reported)

HISTORY: Patient is a 20 year old right handed college baseball pitcher with a past medical history of ulnar neuritis. He presented with a 4 month history of right-sided inferior periscapular pain after increasing his pitching speed and frequency. This pain initially occurred only with high velocity pitches but progressed to occur with all pitching and some overhead reaching activities. It was associated with a catching sensation but otherwise no mechanical shoulder symptoms or neurologic arm symptoms. He denied constitutional symptoms.

PHYSICAL EXAM:**General:** Healthy appearing, athletic build.**Inspection:** No obvious asymmetry.

Palpation: Non-mobile, minimally prominent mass approximately golf ball size in diameter, just inferior and medial to the inferior angle of the scapula. This was mildly tender without fluctuance.

Musculoskeletal: Normal right shoulder ROM. No scapular dyskinesia.**Neurologic:** Normal right arm strength, sensation, and reflexes.**Special Tests:** Negative shoulder impingement signs.**DIFFERENTIAL DIAGNOSIS:**

Elastofibroma dorsi

Scapulothoracic bursitis

Snapping scapula

Lipoma

Sarcoma or other tumor

TESTS AND RESULTS:**X-rays:** Unremarkable.

Ultrasound: Well-circumscribed solid soft tissue mass overlying the posterior 7th/8th ribs.

MRI: 5.4 x 1 x 3.5 cm mass in the infrascapular region underlying the serratus anterior and latissimus dorsi. No rib erosion or extension into the intercostal musculature.

FINAL DIAGNOSIS: Images favored a benign process. After waiting to complete the current season, the mass was excised. The mass was deep to the serratus anterior muscle and adhered to the 7th rib. Pathology demonstrated fibroblastic proliferation, likely reactive due to repetitive microtrauma.

TREATMENT AND OUTCOME: No follow up imaging or additionally treatments were necessary. Six weeks after excision, patient was able to throw a baseball with no pain and return to off-season baseball training.

2030 May 28 5:05 PM - 5:25 PM

Acute Hip Pain In An Immunocompromised Soccer PlayerKathryn Stockbower. *The Children's Hospital of Colorado, Aurora, CO.* (Sponsor: Morteza Khodae, FACS)

Email: kathryn.stockbower@cuaenschutz.edu

(No relevant relationships reported)

HISTORY: A 15 year-old female with a history of Crohn's disease, celiac disease and primary sclerosing cholangitis on immune-modulating therapy (ustekinumab) presents with acute left hip pain. She had mild groin pain five days prior to presentation, with an acute worsening after soccer practice two days ago. There was no acute injury. She has been limping and reports fever to 38.3°C yesterday. Her PCP referred her to sports medicine clinic, and ordered Xrays and labs.

PHYSICAL EXAM: The patient is afebrile and appears well, but sits with her left hemi-pelvis elevated. There is no warmth or erythema of the skin overlying the left hip. There is tenderness to palpation over the anterior groin, anterior inferior iliac spine and anterior superior iliac spine. Range of motion of the left hip is limited and painful in all directions. Log roll, FADIR and FABER tests are all positive for anterior groin pain.

DIFFERENTIAL DIAGNOSIS: 1) Septic hip arthritis 2) Extra-articular myositis or abscess of hip flexors 3) Synovial chondromatosis 4) Tenosynovial giant cell tumor 5) Intra-articular chondroma 6) Sarcoma

TEST AND RESULTS:

MRI enterography small bowel (staging for inflammatory bowel disease, one year ago): incidentally noted synovitis of the left hip joint

Xray hip/pelvis, one year ago: subtle flattening of the left femoral head, possible erosion within the inferior femoral neck, slightly increased left hip joint space

XRay hip/pelvis, two days ago: left hip joint space widening and possible synovial calcification of the inferior hip joint capsule, progressive flattening and widening of the femoral head

Labs: CBC normal, ESR and CRP elevated from baseline

MRI hip with and without contrast: left hip joint effusion with multinodular/lobular intra-articular mass, mild erosions along the inferior femoral neck with reactive/inflammatory changes within the adjacent musculature

Percutaneous biopsy: Inflammatory synovial fluid without tumor cells or crystals.

Tissue pathology showed giant cell tumor

FINAL DIAGNOSIS: Tenosynovial Giant Cell Tumor (TGCT), formerly known as Pigmented Villonodular Synovitis (PVNS)

TREATMENT AND OUTCOMES: Arthroscopic debridement. The patient is doing well in physical therapy.

2031 May 28 5:25 PM - 5:45 PM

A Tibial Mass In A Zipline Instructor

Jennifer Oberstar. *University of Minnesota, Minneapolis, MN.*
(Sponsor: Suzanne Hecht, FACSM)

(No relevant relationships reported)

HISTORY: A 26 yo college female active as a summer Zipline instructor presented with a right mid-shaft tibial mass present for four months. The patient had regular periods, no weight loss, no food avoidance, no hx of stress fractures, but reported fatigue. She denied past injury involving her tibia and the tibia was completely asymptomatic with running. After returning to college and less activity 3 weeks ago, the mid-tibia became swollen and painful. Over the past month her symptoms were worse at night and somewhat relieved by ibuprofen. She presented to her student health clinic and x-rays reported focal cortical thickening at the anterior aspect of the midshaft tibial diaphysis. An initial MRI Radiology read reported no bony edema suggesting an old stress fracture. The patient was treated with a CAM boot for a possible stress reaction. The patient presented to the Sports walk-in clinic for a second opinion after experiencing even more tibial pain when wearing a CAM boot.
PHYSICAL EXAMINATION: Examination revealed Ht 5'7", Wt 160 lbs, BMI 25 kg/m², Pain 5/10. **CONSTITUTIONAL**: Healthy, no fever, alert & oriented. **SKIN**: 2 cm hard palpable mass on the subcutaneous border of the right mid-tibia. No erythema or edema. **MSK**: full ROM of her lower extremity, knee and ankle. Pain in tibia with squatting.

DIFFERENTIAL DIAGNOSIS:

1. Anterior tibial bone stress injury, chronic vs new
2. Reactive sclerosis surrounding an osteolytic lesion
3. Bone tumor, Osteoid osteoma

TEST AND RESULTS:

Radiographs of Tibia and Fibula:

1. Focal cortical thickening at the anterior cortex of the midshaft tibial diaphysis.

MRI Tibia and Fibula W & WO Contrast:

1. Cortical thickening within the middle third of the anterior tibial shaft.
2. No bony edema, periostitis, or other acute pathology to suggest acute stress reaction or acute osteoid osteoma.
3. Images reviewed with MSK Radiologist and Orthopedic Oncologist. Cross-sectional CT was recommended.

CT Tibia and Fibula Lower Leg WO Contrast:

1. Thickened area of the anterior cortex of the tibia which shows a circular nidus with a central calcified area.

FINAL WORKING DIAGNOSIS:

1. Osteoid Osteoma

TREATMENT AND OUTCOMES:

1. NSAIDs trialed with minimal relief
2. Discontinue CAM boot
3. Referral to Orthopedic Oncologist
4. Scheduled for radiofrequency ablation
5. Avoid weight lifting/impact activities for 2 months

2032 May 28 3:45 PM - 5:45 PM

Discussant

William W. Dexter, FACSM. *Maine Medical Center, Portland, ME.*

(No relevant relationships reported)

D-45 Clinical Case Slide - Running III

Thursday, May 28, 2020, 3:45 PM - 5:25 PM

Room: CC-2016

2033 **Chair**: Joseph Ihm, FACSM. *Rehabilitation Institute of Chicago, Chicago, IL.*

(No relevant relationships reported)

2034 **Discussant**: Peter Sedgwick, FACSM. *Central Maine Sports Medicine, Yarmouth, ME.*

(No relevant relationships reported)

2035 **Discussant**: Mark Riederer. *C.S. Mott Children's Hospital, Ann Arbor, MI.*

(No relevant relationships reported)

2036 May 28 3:45 PM - 4:05 PM

Chest Wall Pain In A Marathon Runner

Joseph G. Dadabo, Monica Rho. *Shirley Ryan AbilityLab/ Northwestern University, Chicago, IL.* (Sponsor: Joseph Ihm, FACSM)

Email: jdadabo@sralab.org

(No relevant relationships reported)

History: A 39-year old male marathon runner presented with 1 year of left-sided anterolateral chest wall pain at ribs 10 and 11. Pain started insidiously, without trauma or other inciting incident. Pain primarily occurred with running, and typically worsened as his pace increased. Lifting weights, deep breathing, and prolonged sitting did not exacerbate pain. He denied cough, dyspnea, or wheezing.

Physical Examination: Normal chest wall expansion. No visual deformity along the ribs or costal cartilage. Tenderness to palpation was noted along the left 10th and 11th ribs and intercostal muscle anterior to the mid-axillary line. No tenderness at adjacent segments or at the same segment on the contralateral chest wall. Mild left-sided chest wall pain with leftward thoracic rotation.

Differential Diagnosis:

1. Costochondritis
2. Tietze syndrome
3. Slipping rib syndrome
4. Thoracic radiculitis
5. Pleurisy

Tests and Results:

MRI Chest Wall: Focal thickening and edema along left lower ribs at region of pain, with surrounding soft tissue swelling. No pleural or pericardial effusion. No bone marrow edema within visualized osseous structures.

Ultrasound Chest Wall: Significant signal impedance and focal thickening noted along the intercostal muscle of the left 10th and 11th ribs at the area of maximal tenderness along the anterolateral chest wall. No comparable signal changes are observed at adjacent segment levels or the same segment on the contralateral chest wall.

Final/Working Diagnosis:

1. Tietze syndrome

Treatment and Outcomes:

1. Performed corticosteroid/lidocaine injection to left 10th-11th rib intercostal muscle under ultrasound guidance
2. Pain diary for 6 hours immediately following injection
3. Routine marathon training as tolerated
4. Ice as needed after running
5. Pain resolved following injection. Inflammation and intercostal muscle hypertrophy resolved on repeat ultrasound 2 months later.
6. Patient completed Berlin and Chicago Marathons in 2019

2037 May 28 4:05 PM - 4:25 PM

An Unusual Cause Of Lower Leg Pain - Long Distance Running

Wayne Elton Derman, FACSM¹, Melissa Van Vuuren¹, James Tunnickliffe². ¹Stellenbosch University, Cape Town, South Africa. ²Matley and Partners, Cape Town, South Africa.
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(No relevant relationships reported)

HISTORY: A 42 yr runner presented to the sports medicine clinic two weeks after having successfully completed an ultra-marathon complaining of left calf pain. The onset of the pain occurred the day after the race but within a short period the pain was present after walking short distances. The pain was claudicant, with accompanying foot paraesthesia and leg weakness. Rest pain was absent. Besides hypercholesterolaemia and previous kidney stones, the patient was well, a non-smoker with some symptoms of atopy but no other relevant medical or family history.

PHYSICAL EXAMINATION: The patient appeared to be generally well, with normal vital signs. On inspection of his limbs, there was no obvious swelling, discoloration or evidence of tissue loss. On palpation the left limb was slightly cooler to touch with a prolonged capillary refill time. On examination of his pulses, his upper limb pulses were symmetrical and equal but on examination of his lower limbs his left femoral pulse was slightly diminished, with a soft bruit. The left popliteal and dorsalis pedis pulses were absent. He was unable to run, and was only able to walk approximately 100 m. No left foot pulses felt post exercise or heard on office Doppler examination.

DIFFERENTIAL DIAGNOSIS:

1. Musculoskeletal injury eg gastroc tear
2. Vascular occlusion: popliteal artery entrapment, atherosclerotic occlusion, other occlusive disease
3. Posterior chronic compartment syndrome
4. Referred pain

TEST AND RESULTS:

1. Duplex Doppler was performed but was obscured by bowel gas, yet aorta and proximal common iliac was patent. The distal common iliac and proximal external iliac could not be visualized. Distal external iliac and common femoral vessels were patent.
2. Angiogram performed of the external iliac artery, demonstrated a string-like appearance pathognomonic of fibromuscular dysplasia. A full visceral angiogram was normal.

FINAL WORKING DIAGNOSIS: Fibromuscular dysplasia of the external iliac artery

TREATMENT AND OUTCOMES:

1. A transverse arteriotomy was initially made in the CFA which revealed a 50% stenosis caused by a medial soft plaque. Fogarty thrombectomy was performed on the SFA resulting in good backflow
2. A long saphenous venous patch used.
3. Anticoagulation
4. Initial rest with gentle mobilization
5. Return to sport programme

2038 May 28 4:25 PM - 4:45 PM

Hip And Thigh Pain In A Runner

Matthew LaCourse, Brian Liem. *University of Washington, Seattle, WA.*

Email: mattlac@uw.edu

(No relevant relationships reported)

HISTORY: A 46-year-old male runner with a history of right-sided L3 radiculopathy presented with one month of recurrent right hip and thigh pain. He denied any trauma, inciting event, or recent alteration in his running regimen. Pain was described as stabbing, and localized to his right lateral hip with radiation down his anterior thigh to his knee. He also reported numbness and tingling down his anterior thigh to the knee. Recently, he experienced an incident of sudden bowel urgency with near bowel incontinence. No bladder incontinence or perineal numbness. He has a history of chronic gastroesophageal reflux disease and has taken omeprazole daily for 10 years.

PHYSICAL EXAMINATION: Full and symmetric lower extremity strength except for 4/5 with right hip abduction. Sensation intact to light touch at his hips, thighs, groin, buttocks, and scrotal region. No tenderness at the lumbar paraspinals, buttock musculature, greater trochanters, or anterior hip. Negative straight leg raise and reverse straight leg raise. Full, non-painful range of motion with lumbar flexion and extension. No pain with resisted hip flexion, or passive end range hip flexion. Negative FABER, FADIR, femoral nerve stretch.

DIFFERENTIAL DIAGNOSIS: 1. Recurrent Upper Lumbar Radiculopathy 2. Hip Flexor Tendinopathy 3. Iliotibial Band Syndrome 4. Hip Osteoarthritis 5. Femoral Stress Fracture

TEST AND RESULTS: 1. Right Hip X-Ray:- Mild osteoarthritis of bilateral hips.- Wedge sclerosis and mild periostitis of the medial aspect of the right femoral neck. 2. Lumbar Spine X-Ray:- Mild intervertebral disc height loss at T12-L1, L2-L3, and L5-S1.

3. Right Hip MRI:- Linear T1 focus with surrounding STIR hyperintensity along the medial aspect of the right femoral neck, compatible with a stress fracture.
 4. Lumbar Spine MRI:- Right foraminal/extraforaminal disc protrusion at L3-L4.
 5. DEXA Scan:- No signs of significant osteopenia or osteoporosis at the spine or hips.
 6. Calcium, 25-OH Vitamin D, Parathyroid Hormone levels: Normal
- FINAL WORKING DIAGNOSIS:** Right femoral neck stress fracture, potentially due to chronic proton pump inhibitor use
- TREATMENT AND OUTCOMES:**
1. Referral to orthopedic surgery 2. Toe-touch weight bearing for 6 weeks. 3. Discontinuation of omeprazole. 4. Consideration of future referral to endocrinology.

2039 May 28 4:45 PM - 5:05 PM

Cardiovascular-Running

Kevin Kuo¹, Amie Kim², Thomas Nguyen². ¹Icahn School of Medicine at Mount Sinai, St. Luke's-West, New York, NY. ²Icahn School of Medicine at Mount Sinai, Beth Israel, New York, NY.

(No relevant relationships reported)

History: A healthy, 26-year-old marathon runner was brought to the emergency department (ED) for altered mental status during an eighteen-mile run. At his fifteenth mile, he reported feeling increasingly warm with burning sensations. He sustained a witnessed collapse with loss of consciousness. He was alert in the ED, asymptomatic, but with anterograde amnesia. He denied prodrome including headache, dizziness, weakness, chest pain, dyspnea, or palpitations. During his ED course, he sustained a second witnessed episode of vomiting and syncope.

Physical Examination: Comfortable appearing male. Skin was warm to touch, mildly flushed. Lungs were clear to auscultation. Cardiac exam regular rate and rhythm with normal S1 and S2. He exhibited mild tenderness to palpation in lower distal extremities without peripheral edema. Compartments were soft. He was neurologically intact.

Differential Diagnosis:

- Heat syncope
- Metabolic disorder
- Cardiogenic - Acute coronary syndrome, cardiomyopathy, exercise related dysrhythmia, channelopathy
- Seizure
- Rhabdomyolysis

Test and Results:

- CPK 7,639, peaked at 15,551
- Troponin 0.553, peaked at 2.19
- EKG with t-wave inversions and ST depressions in precordial leads
- pH 7.27, pCO₂ 41.3, Lactate 5.9
- Na 143, K 5.2, Cl 107, Bicarb 18.9 Glucose 97 Calcium 10.6
- Bun 24 Cr 2.2
- Urine tox negative

Final Working Diagnosis: Rhabdomyolysis

Treatments and Outcomes:

- Admitted to the cardiac ICU for NSTEMI secondary to rhabdomyolysis, recurrent syncope, acute kidney injury, and metabolic acidosis.
- Cardiac echo showed normal ejection fraction without wall motion abnormalities.
- EKG abnormalities normalized on 5 days continuous telemetry
- Maintained on intravenous fluids and bicarbonate drip. Secondary organ function improved, with discharge on hospital day 5
- NSTEMI and recurrent syncope are unusual presentations of rhabdomyolysis in young, healthy athletes
- Pending - outpatient electrophysiology, genetic screening, cardiac rehabilitation, precautions in return to distance running

2040 May 28 5:05 PM - 5:25 PM

A Unique Overuse Stress Injury In A Professional Triathlete

Nancy Phu¹, Jonathan Minor². ¹Burrell College of Osteopathic Medicine, Las Cruces, NM. ²SPARRC - Sports Medicine, Rehabilitation and Concussion Care, Tucson, AZ.

(No relevant relationships reported)

HISTORY:

A 28-year-old male professional triathlete presented with acute on chronic low back pain for five days after completing an Olympic distance triathlon. He developed low back and hip pain the evening of the race. Pain was worsened by laying supine, sitting and walking. He reported back stiffness, which improved through the day. PT and dry needling offered little improvement. Nine months earlier he was seen for low back pain, diagnosed with sacroiliitis. This was managed by a licensed physical therapist with resolution. MRI performed years earlier identified disc bulge at L3-L4.

PHYSICAL EXAMINATION:

Inspection was unremarkable, without swelling, deformity, or ecchymosis. Mild tenderness over the piriformis and gluteus medius. No point tenderness over the PSIS, SI joints, or spinous processes. Range of motion of the trunk was full but painful with

extension, rotation to the right, and Kemp test to the right. No pain with trunk flexion, rotation to the left, side bending, or Kemp test to the left. Familiar right posterior hip pain with axial load of the flexed hip. Pain with resisted hip flexion on the right. Mild familiar right posterior hip pain with resisted hip flexion on the left. FABER, piriformis stretch, SI torque tests, and straight leg raises negative bilaterally.

DIFFERENTIAL DIAGNOSIS:

1. Strain of pelvic muscle
2. Sacroiliitis
3. Pelvic stress injury
4. Lumbo-sacral radiculopathy

TEST AND RESULTS:

MRI pelvis without contrast revealed bone marrow edema of the right inferior iliac bone adjacent to the SI joint with subtle incomplete fracture line, suggesting grade 4 stress fracture. Calcium, alkaline phosphatase, phosphorus, and magnesium levels within normal range. 25-OH-Vitamin D within normal range, perhaps lower end for high-level athlete (46.6 ng/mL). CBC and celiac screening within normal limits.

FINAL WORKING DIAGNOSIS:

Stress fracture right iliac bone

TREATMENT AND OUTCOMES:

1. 8-weeks rest from impact activities (running and cycling).
 2. Swimming with pull buoy for 4 weeks with gradual kicking introduction.
 3. Elliptical and aerobic cycling at 6 weeks, with guided power advancement.
 4. Calcium/vitamin D supplementation.
 5. Targeted PT strengthening.
- Outcome - pain free with progression and returned to uninhibited training at 12 weeks.

D-46 Clinical Case Slide - Shoulder II

Thursday, May 28, 2020, 3:45 PM - 5:25 PM
Room: CC-2022

2041 Chair: Andrew Gregory, FACSM. *Vanderbilt University School of Medicine, Nashville, TN.*
(No relevant relationships reported)

2042 Discussant: William F. Micheo, FACSM. *University of Puerto Rico, San Juan, PR.*
(No relevant relationships reported)

2043 Discussant: Yao-wen Eliot Hu. *Naval Hospital Camp Pendleton, Camp Pendleton, CA.*
(No relevant relationships reported)

2044 May 28 3:45 PM - 4:05 PM
Atypical Nontraumatic Shoulder Pain In A Baseball Player

Stacie Hirota¹, Emily Dixon², Richard Okragly¹. ¹*Trihealth Primary Care Sports Medicine, Cincinnati, OH.* ²*Trihealth Orthopedic and Sports Institute, Cincinnati, OH.* (Sponsor: Henry Stiene, FACSM)
(No relevant relationships reported)

HISTORY: 15 year old male high school baseball player with past medical history of asthma, who presented with right shoulder pain. Pain started after swinging in a baseball tournament, with no specific trauma. Pain was located posterior. He was able to continue playing baseball, however pain persisted. Initially he tried heat, ice and ibuprofen with no improvement. Pain progressively worsened over the week with walking, deep breathing and coughing. Additional symptoms included radiation into his neck and shallow breathing. He pursued evaluation at the Emergency Department. His vitals were stable with mild tachypnea, saturating 100% on room air and pulse of 72. Right first rib fracture was noted on CXR. He was discharged with ibuprofen and referral to Sports Medicine. **PHYSICAL EXAMINATION:** Vital signs stable. Respiratory exam clear to auscultation with good air movement throughout and no distress. Cervical exam with full range of motion and strength in flexion, extension, side bending and rotation with mild pain with resistant right-side bending. Right shoulder exam showed no obvious deformities, swelling or bruising. Tenderness over right supra and infraclavicular areas. Hypertonic scalene and trapezius muscles on the right. Range of motion demonstrated glenohumeral internal rotation deficiency with internal rotation of 20 degrees and external rotation of 110. **DIFFERENTIAL DIAGNOSIS:** Clavicle fracture. Pneumothorax. Scalene muscle strain. Scapula

fracture. SC or AC separation. **TEST AND RESULTS:** CXR 2 views demonstrated a transverse fracture of the first rib on the right with minimal displacement **DIAGNOSIS:** Right first rib fracture **TREATMENT AND OUTCOMES:** 1. Repeat imaging at 3 weeks post injury showed minimal callous formation. 2. Advised strict rest with non-weight bearing of the right upper extremity until repeat imaging. 3. Physical therapy for glenohumeral internal rotation deficiency found on evaluation. Including aggressive stretching and strengthening exercises for 4-6 weeks. 4. Re-evaluation at 7 weeks post injury showed no tenderness with palpation. 5. Repeat imaging at 7 weeks post injury finally showed callous formation. 6. Return to play with no restrictions at 7 weeks post injury after repeat x-rays showed callus formation, no tenderness with palpation, and full strength and range of motion.

2045 May 28 4:05 PM - 4:25 PM
Chest Wall Injury-CrossFit

Christian Douthit, MD, Hunter Miers, Mimi Zumwalt, MD.
Texas Tech University Health Science Center, Lubbock, TX.
 (Sponsor: Jacalyn McComb, FACSM)
(No relevant relationships reported)

HISTORY: 21 y/o M RHD CrossFit Coach sustained an injury to his R upper extremity while performing the “muscle up” exercise on a high bar about six weeks prior to presentation. He felt a painful pop in his shoulder/arm area after which he experienced bruising near his axilla/chest wall then unable to complete his workout. He continued to have pain/weakness along with difficulty working out with his usual gym routine, especially exercises involving pushing maneuvers. He was initially seen by another Orthopaedist, an MRI obtained, then referred to our Sports clinic. Other than a history of rapid weight loss of over 100 pounds a couple of years prior to the traumatic episode, he denies any supplement usage.

PHYSICAL EXAMINATION: Ventral Trunk/R upper extremity: loss of R chest wall contour in the “hands on hips” position/asymmetric axillary fold; TTP at bicipital groove; shoulder-painful ROM arc upon extreme abduction/elevation; weakness/pain with resisted IR/horizontal adduction.

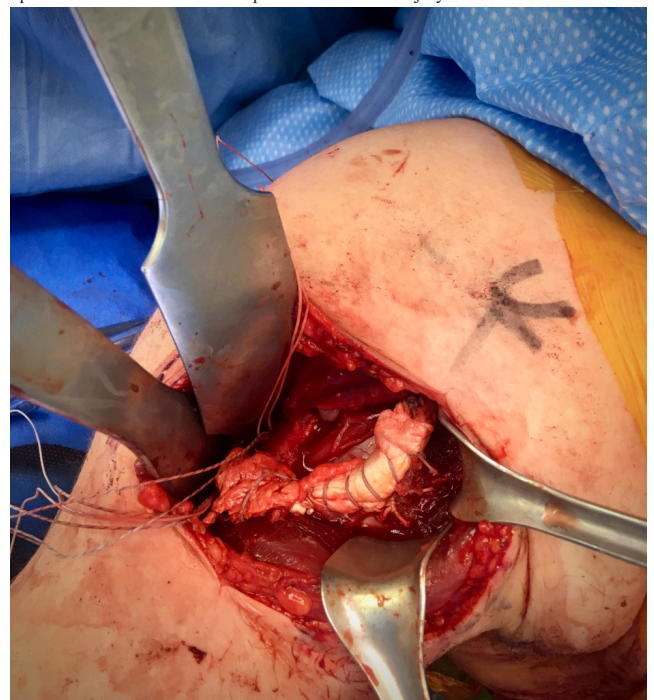
- DIFFERENTIAL DIAGNOSIS:** 1. R LH biceps tendon rupture
 2. R pectoralis muscle tear
 3. R pectoralis tendon rupture

TEST AND RESULTS: R shoulder XR plain films without abnormality MRI show signal changes in pectoralis major tendon consistent with rupture of humeral detachment/retraction into chest wall; posterior glenoid labral tear

FINAL WORKING DIAGNOSIS: R pectoralis major tendon rupture

TREATMENT AND OUTCOMES: 1. Patient underwent subacute repair with Achilles allograft augmentation 2 months post-injury.

2. He was placed in a shoulder immobilizer for 6 weeks and formal PT started at 2 weeks.
3. At his last visit 5 months post-op he was doing very well, progressing with self PT rehab exercises in the gym, no pain with daily activities and pleased with cosmesis/symmetrical chest muscle contour. He started working out again and back to approximately 80% muscle strength/endurance with push-ups/pull-ups but avoiding explosive movements that would put him at risk of reinjury.



2046 May 28 4:25 PM - 4:45 PM

Shoulder Injury - Soccer, Water Polo

Dana L. Sheng, Kevin Burnham, Robert D. Boutin, Jeremiah W. Ray, Brian A. Davis, FACSM. *UC Davis, Sacramento, CA.* (Sponsor: Dr. Brian A. Davis, MD, FACSM)
Email: DLSHENG@UCDAVIS.EDU
(No relevant relationships reported)

HX: 3 Division I athletes at 1 university.

Case 1- 21F soccer center midfielder presented with 1 month of insidious L shoulder pain that started posteriorly at the rhomboids and slowly migrated anteriorly. She denied any trauma. All activity worsened the pain, particularly shoulder ROM. She completed 6 weeks of rest and PT without improvement.

Case 2- 19M water polo player presented with 2 months of R posterior shoulder pain without preceding trauma. He improved with 2 weeks of light activity and PT, but the pain worsened as he increased activity and acutely worsened after contact play.

Case 3- 19M water polo player presented with 2 weeks of insidious onset L posterior shoulder pain. While executing power cleans, the pain became severe and he went to the ED.

EXAM:

Case 1-Diffuse pain limited L shoulder ROM. +mild GH internal rotation deficit. +tenderness and spasm of L trapezius, neck, levator, posterior deltoid, rhomboids. Spurling's (-). RTC testing nl except for pain with supraspinatus testing. O'Brien's (-). Case 2-NI visual inspection. The R shoulder had full ROM with mild discomfort posteriorly with full abduction. R rhomboid major tender to palpation. RTC testing nl; O'Brien's (-).

Case 3-NI inspection, ROM. L rhomboid major tender to palpation. RTC testing nl, biceps testing (-).

DDX:1. Rhomboid strain 2. Myofascial pain 3. Suprascapular nerve impingement 4.

Thoracic outlet syndrome

TESTS/RESULTS: Case 1-

L shoulder XR- nondisplaced stress fracture L 1st rib

Bedside U/S- cortical irregularity of 1st rib

CT chest w/o contrast- stress fracture L 1st rib

Case 2-

R shoulder XR,R ribs XR,MR RUE w/o contrast- nl

Bedside U/S- cortical irregularity of R 1st rib

Retrospective review of original XRs revealed subtle cortical irregularity of R 1st rib

CT chest w/o contrast- nondisplaced stress fracture R 1st rib

Case 3-

CXR,L shoulder XR,CT chest w/o contrast- nondisplaced fracture L 1st rib

Bedside U/S- L 1st rib fracture with large callus formation

FINAL DX:1st rib stress fracture

TX/OUTCOME:All cases with 1st rib stress fracture healed with standard relative rest, calcium and Vitamin D supplementation.

2047 May 28 4:45 PM - 5:05 PM

Back And Shoulder Pain - Heavy Lifting

Rijo Maracheril¹, Amie Kim², Kaushal Shah³. ¹Mount Sinai Hospital, New York, NY. ²Mount Sinai Hospital Beth Israel, New York, NY. ³Weill Cornell Medicine, New York, NY.
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(No relevant relationships reported)

History

52 year-old male presents with right (R) upper back pain and R anterior chest pain. Presented to Emergency Department (ED) for R scapular pain after pulling a piano 1 week ago. Clinically appreciated painful R scapular stabilizers without swelling or bony tenderness. Discharged with analgesia and muscle relaxant. Subsequently developed erythema at site and went to second ED. Clinically evaluated and discharged with opiate. Erythema progressed, and patient returned to ED.

Physical Examination

Inspection with erythema extending into R lateral neck. Blanching and warm bilateral anterior chest wall. Tenderness on palpation greater on R than L including pectoralis origin, SC joint. No crepitus. Heart and lung sounds normal, painless chest excursion. R shoulder painful adduction with FROM. R scapula painful protraction and retraction. R AC joint painless scarf sign. Cervical spine, left shoulder, bilateral elbow without additional findings.

Differential diagnosis

1. Cellulitis/Necrotizing fasciitis
2. Thoracic outlet syndrome
3. Pectoralis myositis
4. Thrombophlebitis/DVT
5. Osteomyelitis/Septic joint

Tests and Results Remarkable Labs

- WBC 15.8
- CPK 68
- CRP 460

- ESR 108

- Alk Phos 253

Chest X-Ray

- Paratracheal lymphadenopathy

CT Chest with Contrast

- Fluid collection with inflammatory changes midline between pectoralis major

muscles without gas at the level of sternal notch and manubrium

- Asymmetric soft tissue thickening in the R clavicular head, SC joint, and retrosternal region with fluid collections

MRI Chest with/without Contrast

- Sternomanubrial effusion 2.3 cm posteriorly

- R 1st rib Osteomyelitis

- R supraclavicular clavicle fluid collection 4.6 x 1.5 x 2.6 cm

Final/Working Diagnosis

Septic Arthritis

Treatment and Outcomes

1. Source unable to be found: echocardiogram WNL, drug screen negative, HIV/Hepatitis B & C/EBV/Thyroid studies negative, esophagram WNL
2. Blood cultures positive for MSSA. IR aspiration of body fluid performed without speciation. PICC line placed with 8 weeks of IV cefazolin.
3. Hospital course complicated by non-occlusive thrombus in R subclavian/proximal SVC - started on apixiban for 6 months.
4. Serial CT with resolution of infection. One month inpatient, discharged to outpatient rehabilitation.
5. Pending outpatient ID and CT surgery, serial vascular imaging.

2048 May 28 5:05 PM - 5:25 PM

Posterior Shoulder Instability In A 17 Year Old Wrestler: A Case Report.

Kathryn Alfonso¹, Jason Lee². ¹Mayo Clinic, Rochester, MN. ²Mayo Clinic Health System, Faribault, MN.
Email: alfonso.kathryn@mayo.edu
(No relevant relationships reported)

HISTORY

A 17 year old male wrestler presented to the sports medicine clinic with superoposteriorly located right shoulder pain and apprehension with overhead movements 2 days after sustaining a posterior shoulder dislocation. He received an on-site closed reduction, and was seen following the match at a local emergency room with arm numbness. He was placed in a sling after unremarkable radiographs and symptom resolution.

PHYSICAL EXAMINATION

No erythema, ecchymosis, or edema about the right shoulder joint. Tender to palpation at AC joint, acromion, and anterior capsule. Active abduction 70°, flexion 80°. External rotation 20° (pain limited). Full strength with elbow, wrist, and finger flexion and extension. Empty can, Speed's and anterior apprehension were positive; Neer's, Hawkins's, O'Brien's, and Speed's and posterior apprehension were negative.

DIFFERENTIAL DIAGNOSIS

1. Bankart lesion
2. Hill-Sachs lesion
3. Labral tear
4. Rotator cuff tear
5. Humeral fracture

TEST AND RESULTS

Right shoulder and clavicle radiographs: unremarkable.

Right shoulder MR arthrogram:

- Tear at the humeral attachment of the posterior band inferior glenohumeral ligament.
- Partial thickness teres minor tear at inferior margin insertion.
- No reverse Hill-Sachs lesion.

FINAL WORKING DIAGNOSIS

Complete reverse humeral avulsion of the glenohumeral ligament lesion (rHAGL) and isolated teres minor avulsion.

TREATMENT AND OUTCOMES

1. A right shoulder arthroscopic rHAGL and teres minor repair was performed 3 weeks after the injury.
 2. The slow posterior Bankart protocol was initiated post-operatively for 6 weeks duration with progression to active range of motion and standard shoulder stabilization protocol therapy.
 3. Pain free with full strength and range of motion at 3 months post-op.
 4. Cleared to return to sport at 5 months post-op.
- rHAGL lesions with concurrent teres minor avulsions are a rare cause of posterior shoulder instability, and should be considered when a patient presents with posterior shoulder pain and instability following a posterior shoulder dislocation. In the absence of therapy or surgical repair, there is a risk of recurrent dislocations and the development of chronic degeneration. There are limited reported cases in the literature, with return to play reported 5-8 months post-operatively.

D-47 Rapid Fire Platform - New Findings in Physical Activity and Health

Thursday, May 28, 2020, 3:45 PM - 5:05 PM
 Room: CC-Exhibit Hall

2049 Chair: Bryna C. Chrismas. *Qatar University, Doha, Qatar.*
 (No relevant relationships reported)

**2050 May 28 3:45 PM - 3:55 PM
 Non-Exercise Estimated Cardiorespiratory Fitness And Mortality From All-Causes, Cardiovascular Disease And Cancer In The NIH-AARP Diet And Health Study**

Baruch Vainshelboim¹, Jonathan Myers, FACSM¹, Charles Matthews, FACSM². ¹*Veterans Affairs Palo Alto Health Care System/ Stanford University, Palo Alto, CA.* ²*National Cancer Institute, Bethesda, MD.* (Sponsor: Charles Matthews, FACSM)
 Email: baruch.v1981@gmail.com
 (No relevant relationships reported)

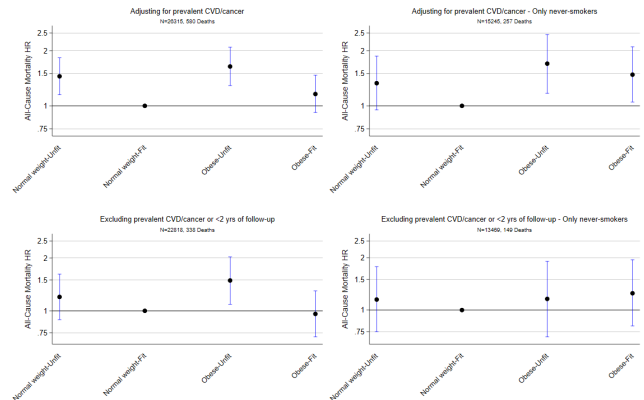
Measured cardiorespiratory fitness (CRF) with exercise testing is a powerful predictor of mortality but unfeasible in many health-care and research settings. Although non-exercise estimated CRF (NEE-CRF) has been shown to be associated with mortality outcomes, relatively small cohorts and impractical predicting variables used to estimate CRF are challenging its broad application. **PURPOSE:** To assess the association between NEE-CRF using pragmatic variables and mortality outcomes in a large prospective cohort of men and women. **METHODS:** The NIH-AARP Diet and Health Study of 330,769 participants [men (n=186,469) and women (n=144,300)] aged 50-71 years at the recruitment (1995-1996) were prospectively followed for 14.9±2.1 years until December 31, 2015. NEE-CRF was estimated using previously validated equation [34.142+1.463 (physical activity status) +0.133 (age)-0.005 (age²) +11.403 (sex)-0.254 (weight) +9.170 (height)] and analyzed for its association with mortality outcomes, utilizing multivariable Cox hazard models. **RESULTS:** During the follow up, 34,317 men and 20,295 women died from all-causes. Higher NEE-CRF was associated with lower risk of mortality due to all-causes, cardiovascular disease and cancer. For every 1-MET higher NEE-CRF there was 15%, 15%, 11% and 16%, 16%, 11% reduction in mortality risks from all-cause, cardiovascular disease and cancer, in men and women respectively. The corresponding hazards ratios and 95% confidence intervals were: 0.85 (0.84-0.86), 0.85 (0.82-0.88), 0.89 (0.87-0.91), and 0.84 (0.83-0.85), 0.84 (0.81-0.88), 0.89 (0.87-0.91) for men and women respectively (all p<0.001). **CONCLUSIONS:** Higher NEE-CRF is associated with lower risk of death due to all-causes, cardiovascular disease and cancer in a large prospective cohort. The results provide a practical implication of NEE-CRF for clinical risk stratification, referral to prevention and rehabilitation programs and utilization in large-scale epidemiological studies.

**2051 May 28 3:55 PM - 4:05 PM
 All-cause Mortality And The Fat-but-fit Hypothesis: A Reexamination Using Uk Biobank**

Jakob Tarp¹, Miguel Adriano Sanchez-Lastra², Ding Ding³, Anders Grøntved⁴, Ulf Ekkelund, FACSM¹. ¹*Norwegian School of Sports Sciences, Oslo, Norway.* ²*University of Vigo, Pontevedra, Spain.* ³*University of Sydney, Camperdown, Australia.* ⁴*University of Southern Denmark, Odense, Denmark.*
 Email: jakob.tarp@nih.no
 (No relevant relationships reported)

Obesity is associated with an increased risk of premature mortality, but observational studies implies that obese adult with high cardiorespiratory fitness (CRF; ‘fat-but-fit’) may not be at an increased risk. However, the evidence for the ‘fat-but-fit’ hypothesis is limited by insufficient control of confounding from smoking and risk of reverse-causality bias from pre-existing conditions. **PURPOSE:** To examine evidence for the ‘fat-but-fit’ hypothesis using different approaches for reducing confounding and reverse-causality bias. **METHODS:** CRF was estimated from linear extrapolation of the heart rate response during a submaximal bicycle ergometer test in women and men from the UK Biobank cohort. Watts per kg fat-free mass was split into unfit (<20%) or fit (>60%) based on the age-sex stratified sample distribution and combined with measured body-mass index (BMI) as normal weight (NW; BMI 18.5 – 25) or obese (BMI ≥ 30) yielding four CRF-BMI combinations. All-cause mortality was ascertained from death registers. Multivariable-adjusted cox-regression models were used to estimate hazard ratios (HR) and 95% confidence intervals (CI). **RESULTS:** Over a median follow-up of 7.7 years, 580 deaths in 26,315 participants were recorded. In analysis adjusting for prevalent CVD/cancer and using NW-fit as

the reference, being NW-unfit or obese-unfit were associated with increased mortality with HRs of 1.45 (CI: 1.15, 1.83) and 1.64 (1.29, 2.09), see figure. Mortality was not increased in the obese-fit against the reference (1.16 (CI: 0.92, 1.47)). Associations were attenuated when excluding individuals with prevalent CVD/cancer and early deaths. Re-analyzing with restriction to never-smokers resulted in similar HRs across the fat-fit combinations against the NW-fit reference. **CONCLUSION:** Obese-unfit, but not obese-fit, individuals have an increased risk of premature mortality as compared with NW-fit individuals. The association appears susceptible to bias.



**2052 May 28 4:05 PM - 4:15 PM
 Association Of Physical Activity Best Practices For Early Care And Education With Time-use And Children’S Physical Activity**

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 (No relevant relationships reported)

PURPOSE: Our goal was to estimate the time-use exchanges associated with physical activity (PA) best practices for early care and education (ECE) centers on the PA behaviors of children. **METHODS:** The Environment and Policy Assessment and Observation (EPAO) was collected on 150 classrooms from 80 child care centers along with corresponding accelerometer (ActiGraph GT3X+) data on 472 children. Data were aligned to evaluate how center activities matched with children’s sedentary and PA behaviors. EPAO data were used to assess compliance with select best practices from the Nutrition and PA Self-Assessment for Child Care: ≥60 min/d of outdoor play, ≥120 min/d of indoor/outdoor play, and <60 min/d of sedentary time. Linear mixed models were used to examine children’s PA outcomes based on compliance with best practices. Center-level models were adjusted for day of week, month, and wear time. Child-level models were additionally adjusted for child’s age, sex, and race/ethnicity. **RESULTS:** Meeting the outdoor play best practice was associated with a significant shift in centers’ time use: +56.7 min/d of outdoor play and -38.5 min/d of indoor play. Meeting this best practice was associated with ~9 min/d increase in children’s total PA. Meeting the indoor/outdoor play best practice was also associated with a shift in centers’ time use: +66.9 min/d of indoor/outdoor play, -29.7 min/d of screen/sitting, -11.4 min/d for circle time, -2.9 min/d for snack, -3.8 min/d for morning meal, and -19.2 min/d of non-classified activities. Meeting this best practice was also associated with a ~14 min/d increase in children’s total PA. Meeting the best practice for limiting sedentary time was associated with -55.0 min/d of screen/sitting, +24.4 min/d of indoor play, +15.1 min/d of outdoor play, +8.4 min/d for circle time, and +2.2 min/d for lunch. Meeting this best practice was associated with a ~7.0 min/d increase in children’s light activity, but there were no significant associations with their sedentary or moderate-vigorous PA. **CONCLUSIONS:** These results suggest that increasing time for play does not directly translate to increases in total PA. These findings suggest the need for more quality play opportunities (e.g. provider-led PA) rather than allocating time alone to improve daily PA.

THURSDAY, MAY 28, 2020

2053 May 28 4:15 PM - 4:25 PM

The Prevalence Of Meeting 2008 Versus 2018 Physical Activity Guidelines In Adults With Overweight/obesity

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Both the 2008 and 2018 Physical Activity Guidelines for Americans (PAG) recommend ≥ 150 min/wk of moderate physical activity (PA) for substantial health benefits and suggest many adults may need ≥ 300 min/wk of moderate PA for additional health benefits (including weight control). The 2008 PAG specified that PA be accumulated in bouts ≥ 10 minutes, however, this criteria was removed in the 2018 PAG.

PURPOSE: To determine the extent to which removing the bout criteria impacts the prevalence of meeting PAG for weight control in adults with overweight/obesity.

METHODS: Participants were 155 adults with overweight/obesity enrolled in an 18 month weight loss intervention. Baseline levels of bout and total moderate-to-vigorous PA (MVPA, SenseWear device) were used to determine proportion meeting 2008 vs 2018 PAG, and to classify subjects into 3 mutually exclusive groups: meeting 1) ≥ 300 min/wk of both bout and total MVPA (BOTH; n=28), 2) ≥ 300 min/wk of total (but not bout) MVPA (TOTAL; n=65) or 3) < 300 min/wk of bout or total MVPA (NEITHER; n=62). We also compared age, sex, BMI, body fat mass (FM, DXA), and fitness (VO_{2max}) across groups.

RESULTS: The proportion of subjects meeting 2008 (18%) vs. 2018 (60%) PAG was significantly lower ($P<0.01$). BOTH had a higher mean age vs TOTAL (mean \pm SD; 43 \pm 10 vs 37 \pm 9 y, $P<0.01$). BOTH had the lowest proportion of females, followed by TOTAL, and then NEITHER (64% vs 83% vs 94%, $P<0.01$). BOTH had a lower BMI and FM compared to TOTAL and to NEITHER (BMI: 32 \pm 3 vs 35 \pm 4 vs 36 \pm 4 kg/m², $P<0.01$; FM: 36 \pm 7% vs 41 \pm 5% vs 43 \pm 4%, $P<0.01$), with no differences between TOTAL vs NEITHER. BOTH had the highest VO_{2max} (adjusted for age and sex), followed by TOTAL, and then NEITHER (28.1 \pm 4.6 vs 25.0 \pm 4.4 vs 22.6 \pm 3.9 mL/kg/min, $P<0.01$).

CONCLUSIONS: In this cross-sectional analysis of adults with overweight/obesity, removing the bout criteria resulted in a 3 fold greater prevalence of meeting PAG for additional health benefits (including weight control). Meeting 2018 PAG (but not 2008 PAG) did not significantly differentiate between levels of BMI or FM compared to not meeting 2018 PAG. Researchers planning on using PAG for screening eligibility should be aware of the clinical health differences in adults who meet 2008 vs 2018 PAG. Prospective studies are needed to determine how removing the bout criteria impacts weight control.

2054 May 28 4:25 PM - 4:35 PM

Physical Activity Time Of Day And Risk Of Weight Change In Men And Women

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(No relevant relationships reported)

PURPOSE: Laboratory studies suggest there are potential benefits of morning vs. evening exercise on various physiologic responses in humans but results from epidemiologic and intervention studies are less consistent. The purpose of this study was to examine the association between free-living physical activity timing and change in weight over a three-year period.

METHOD: Participants (n=549, 58% women, 66% non-Latinx white) completed an accelerometer protocol for at least six days during two non-consecutive quarters in 2015 and self-reported weight in 2015 and 2018. Multinomial logistic regression was used to explore associations between the proportion of total moderate-vigorous physical activity (MVPA) achieved before noon and percent weight change (loss, gain, stable). All analyses were stratified on sex and adjusted for age, race/ethnicity, number of comorbidities, energy intake (self-reported in 2015), accelerometer wear time, sleep time, and total MVPA (to isolate time-of-day effect).

RESULTS: Participants accumulated 12-64% of their MVPA in the morning hours. Participants who accumulated more MVPA in the morning were more physically active overall (81 vs. 69 min./day MVPA Q4 vs. Q1) but were also more likely to have insufficient sleep (7.1 vs. 8.2 hr./day Q4 vs. Q1). Women accumulating most of their MVPA in the morning hours (Q4, >42%) were 1.99 times more likely to maintain their weight over three years (95% confidence interval [CI]: 0.95, 4.69). MVPA timing did not appear to be associated with weight change among men. Race/ethnicity-stratified results suggested that the associations were not different among black, Latinx, or white participants.

CONCLUSION: In addition to the impact of physical activity duration, frequency, and intensity on weight control, physical activity timing may also play a role, particularly

in women. The timing of MVPA is a fairly flexible aspect of the behavior and may confer additional benefits regarding weight control; however, more research is needed to fully understand the associations.

2055 May 28 4:35 PM - 4:45 PM

Cardiorespiratory Fitness And Muscle Strength With The Prevalence Of Diabetes: WASEDA'S Health Study

Dong Wang, Susumu S. Sawada, FACSM, Hiroki Tabata, Kumpei Tanisawa, Ryoko Kawakami, Kaori Ishii, Katsuhiko Suzuki, Mitsuru Higuchi, FACSM, Koichiro Oka, Shizuo Sakamoto. *Waseda university, Saitama, Japan.*
(No relevant relationships reported)

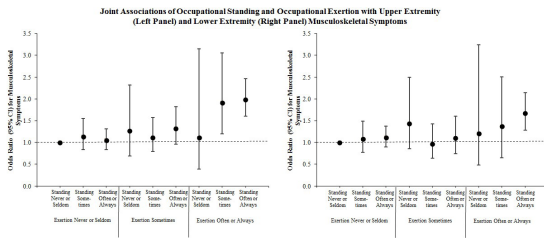
Limited data are available on the relationship of cardiorespiratory fitness (CRF) and muscle strength (MS) with the prevalence of diabetes. **PURPOSE:** This cross-sectional study was to investigate the independent and joint relationship of CRF and MS with the prevalence of diabetes among Japanese men in the WASEDA'S Health Study. **METHODS:** WASEDA'S Health Study is a cohort study which was launched in 2014. We used part of the baseline data collected for this study. Participants were 627 Japanese men [median (inter quartile range) age 56 (48-65) years] who completed a medical examination, leg extension power test, and graded exercise test using cycle ergometers at baseline. The participants were divided into two groups based on CRF and MS, respectively. The prevalence of diabetes was based on self-reports from questionnaires and/or blood tests at the medical examination. Odds ratios and 95% confidence intervals (95% CIs) for the prevalence of diabetes were obtained using logistic regression models while adjusting for age, body mass index, physical activity, family history of diabetes, cigarette smoking, and alcohol intake. **RESULTS:** 49 participants had diabetes. Using the lower CRF and MS as a reference, odds ratios and 95% CIs for the higher CRF and MS were 0.56 (0.26-1.21) and 0.51 (0.25-1.05), respectively. Also, using the lower CRF and lower MS group as a reference, odds ratios and 95% CIs were 0.52 (0.20-1.33) for the lower CRF&higher MS group, 0.55 (0.21-1.41) for the higher CRF&lower MS group, and 0.31 (0.12-0.79) for the higher CRF&higher MS group, respectively. **CONCLUSIONS:** These results suggest that there is a relationship between CRF and MS with the prevalence of diabetes. In addition, there is a joint relationship of CRF and MS with the prevalence of diabetes among Japanese men.

2056 May 28 4:45 PM - 4:55 PM

Joint Associations Of Occupational Standing And Occupational Exertion With Musculoskeletal Symptoms In A Us National Sample

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PURPOSE: As evidence has implicated sedentary behavior as a health risk factor; initiatives to reduce workplace sitting time by replacing it with standing have received considerable interest. However, concerns have been raised that standing exposes workers to other health hazards; notably observational studies have linked occupational standing to musculoskeletal pain. These prior studies, however, are potentially flawed. For many occupations, standing at work co-occurs with high physical exertion, thus the observed associations between standing and musculoskeletal pain could be confounded by the physical exertion that accompanies many standing-based occupations. The purpose of this study was to examine the joint associations of occupational standing and occupational exertion with musculoskeletal symptoms. **METHODS:** Data for this analysis come from the 2015 National Health Interview Survey, a US nationally representative survey. Occupational standing and exertion were assessed by self-report on a 5-point Likert scale. Presence of musculoskeletal symptoms (pain, aching, or stiffness) for upper extremity (neck, shoulders, elbows, wrists, fingers) and lower extremity (hips, knees, ankles, toes) joints was also assessed. **RESULTS:** There was a significant interaction between occupational standing and occupational exertion ($p<0.05$). Occupational standing was associated with upper extremity and lower extremity symptoms only among the group with high levels of occupational exertion (Figure). Among those reporting lower levels of occupational exertion; occupational standing was not associated with upper or lower extremity symptoms. **CONCLUSIONS:** Results from this US representative survey suggest the association between occupational standing and musculoskeletal symptoms is largely driven by the co-occurrence of occupational exertion and bring into question the contention that standing in itself incurs adverse musculoskeletal symptoms.



2057 May 28 4:55 PM - 5:05 PM

Late Adulthood Physical Activity Trajectories In Relation To All-cause Mortality

Alpa V. Patel, FACSM¹, Sara E. Strollo¹, Erika Rees-Punia¹, Lauren R. Teras¹, Ying Wang¹, Corinne R. Leach¹, Janet E. Fulton, FACSM², Susan M. Gapstur¹. ¹American Cancer Society, Atlanta, GA. ²Centers for Disease Control and Prevention, Atlanta, GA. Email: alpa.patel@cancer.org (No relevant relationships reported)

PURPOSE: Despite the known benefits of being physically active, about half of U.S. adults (and nearly two-thirds of adults age 65+ years) do not meet current U.S. Physical Activity Guidelines for Americans of 150-300 minutes of moderate (75-150 minutes of vigorous) physical activity (MVPA) per week. Given the aging U.S. population and rising healthcare costs, identifying factors associated with healthy aging is critical. There is limited epidemiologic evidence examining whether increasing or initiating MVPA in later adulthood can increase longevity. This study examined the association between late adulthood MVPA trajectories and all-cause mortality in a large U.S. prospective cohort.

METHODS: This analysis included 71,862 Cancer Prevention Study-II Nutrition Cohort participants (mean age 74.1 years; range 52-89 years) who were free of major chronic diseases. Participants self-reported MVPA at two time points approximately 5-years apart and were categorized based on their level of adherence to MVPA guidelines at each time point (inactive, "insufficiently active", "sufficient", and ">double minimum recommended"). 12 trajectories were defined (4 each for consistent, increasing, or decreasing MVPA); participants who were consistently "insufficiently active" served as the reference category. Multivariable Cox proportional hazards regression modeling was used to estimate hazard ratios (HR) and 95% confidence intervals (CI).

RESULTS: After an average of 9.9 years of follow-up, 22,736 deaths occurred. The most active participants (>double recommended) at both time points had a 24% lower mortality risk compared to insufficiently active participants (95% CI 0.73-0.79). Those who increased MVPA over time (insufficient to sufficient) also had a lower mortality risk (HR=0.85, 95% CI 0.80-0.91). Conversely, those who decreased activity (sufficient to inactive) had a higher mortality risk (HR=1.18, 95% CI 1.10-1.26). Associations were similar for men and women, and for cardiovascular disease and cancer-specific mortality.

CONCLUSIONS: Maintaining a physically active lifestyle at older ages is optimal for longevity. Public health messaging should encourage active individuals to maintain their physical activity level as they age and reinforce that it is never too late to start being active.

D-58 Free Communication/Poster - Older Adults

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
Room: CC-Exhibit Hall

2082 Board #1 May 28 2:00 PM - 3:30 PM

Arterial Elasticity Response To Short-term Endurance Resistance And Blood Flow Restriction Training In Older Men

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PURPOSE: To test hemodynamic and arterial elasticity response to 8-week endurance (END) and blood flow restriction resistance training (BFR) in older men.

METHODS: Fifteen older male subjects (age= 57±4.6 yr.) were randomly assigned to one of two training groups (END, n=8 & BFR, n=9) that performed the leg press, leg extension, leg curl, chest press, lat pulldown, and biceps curl exercises 3x/wk for 8 weeks. All training sessions began with subjects warming up in a gym by walking/ jogging at their self-selected speed for 5 min. The END group performed exercise for 4 sets of 15 reps at 40-65% of one repetition maximum (1RM) with 30 sec rest between each set. The BFR group performed exercises for 4 sets of 20 reps at 20-30% of 1RM with 30 sec rest between each set. The BFR cuffs were placed on both arms (pressure ranged from 140 to 160 mmHg) or legs (pressure ranged from 160 to 200 mmHg) for the related exercises with 3-5 min rest in between upper and lower body exercises for cuff placement. Fasted subjects (for at least 8 hr.) reported to the lab and hydration level was assessed by clinical urine refractometer before testing sessions. Pre and post-training pulse wave analysis (PWA) and velocity (PWV) were measured non-invasively using SphygmoCor-Xcel.

RESULTS: One-way ANOVA did not detect any significant differences between group means for any of the hemodynamic variables at baseline. There were no significant condition main effects for any of the variables measured. However, there were significant main effects for time with the pre-test demonstrating higher values than the post-test values for aortic diastolic pressure (p< 0.04), aortic and systemic mean arterial pressure (p< 0.03), end systolic pressure (p= 0.04), and mean arterial pressure during diastole (p< 0.04). In addition, trends for significant time main effects were detected for PWV (p= 0.09), aortic systolic pressure (p= 0.06), systemic systolic and diastolic pressure (p= 0.08), systemic mean arterial pressure (p= 0.06), and pressure time index for diastolic pressure (p= 0.08).

CONCLUSIONS: The findings of the study indicate that both BFR and END resistance training programs are similarly effective in decreasing the central and systemic blood pressure that could be due to training-related adaptations in vascular function and structure.

2083 Board #2 May 28 2:00 PM - 3:30 PM

No, Near And Far Transfer Upon Balance Training Interventions Through Lifespan: Findings From Rcts And Practical Implications

Lars Donath, German Sport University, Cologne, Germany. (Sponsor: Prof. Dr. Scott Drum, FACSM) Email: l.donath@dshs-koeln.de (No relevant relationships reported)

Task-specificity vs. task-transfer upon neuromuscular exercise training through lifespan: Practical implications derived from RCTs and meta-analytical reviews

Prof. Dr. Lars Donath & PD Dr. Oliver Faude
Department of Intervention Research in Exercise Training, German Sport University, Cologne
Department of Sport, Exercise and Health, University of Basel, Germany

Neuromuscular training can reduce injuries and falls in athletes and the aging population. However, the training responses and adaptability to different types of neuromuscular exercises are not fully elucidated.

PURPOSE: To provide an overview based on several randomized controlled trials and meta-analyses of our group with respect to training adaptation with a) lacking, b) near) and c) far transfer effects. **METHODS:** Data of more than 5000 healthy participants between the age of 8 and 80 years of age were considered. Neuromuscular performance was assessed employing static, unstable and dynamic balance testing, gait assessment and strength examination. All tests were conducted before and after the intervention period. The intervention included different types of balance training ranging from static tasks to agility tasks and lasted from 8 to 50 weeks of training. Repeated measures analyses of variance with baseline measures as covariate were computed in the RCTs and inverse variance models with random effect size estimation (Hedges g adjusted for small samples) have been conducted in the meta-analytical reviews.

RESULTS: All randomized controlled trials revealed significant (p<0.05) moderate to large effects (SMD>0.5) in the tests that are closely related to the trained exercise task. Transfer effects to other neuromuscular tasks (e.g., strength, balance) are negligible to small (SMD<0.3). These findings have been underpinned by two meta-analytical reviews. Transfer effects have been observed for some strength variables (e.g., rate of force development), performance indicators (e.g., sprint) and selected dynamic balance indices **CONCLUSION:** In order to ensure adequate and specific training adaptations, multimodal exercise programming should be carefully conducted based on complexity, challenge, background and progression, aligned with the intended training goals.

2084 Board #3 May 28 2:00 PM - 3:30 PM

Bouncing For Balance: Mini-Trampoline Training Reduces Fall Risk In Older AdultsQuinn Anderson, Sara Bergen, Rachel Breuer, Erik Hayes, Bradley J. Kendall. *Taylor University, Upland, IN.**(No relevant relationships reported)*

While CVD is the leading cause of death, falls are one of the most prominent causes of accidental mortality in older adults. Unfortunately, interventions in older adults often target either cardiovascular fitness or balance, with few utilizing exercise modalities that address both at once. One modality that has shown promising results on cardiovascular fitness and balance is mini-trampoline training. However, investigations on this modality have been limited in older adults. **PURPOSE:** To compare the effects of 6-weeks of mini-trampoline training to 6-weeks of walking on fall risk and functional fitness in older adults. **METHODS:** Twenty participants (mean age 72±6.9) completed six weeks (3 sessions/week) of trampoline training consisting of aerobic (e.g., jumping jacks) and balance (e.g., tandem skips) exercises, all of which took place on a mini-trampoline. Each session was led by a trained research staff member. For comparison, a control group (n=18, mean age 66±7.4) participated in an unmonitored walking program for six weeks (3 sessions/week) with a goal of increasing average step count by 100 steps every week. At the start and conclusion of the intervention, all participants were assessed on measures of balance (i.e., fall risk and single-leg stands), mobility (i.e., 4-square step test and 8-foot up-and-go), and aerobic endurance (i.e., 6-minute walk test). **RESULTS:** Due to significant differences between the groups at baseline, change scores were calculated for all measures and were compared using independent samples t-tests. Following training, the trampoline group significantly reduced fall risk $t(36) = 2.129, p < .05, d = .87$, increased single-leg stand time, $t(36) = 7.04, p < .01, d = .87$, and decreased 4-square step test time $t(36) = 2.651, p < .05, d = 1.5$ compared to the walking group. Both groups decreased their 8-foot up-and-go times and increased 6-minute walk distance after the six weeks. However, change scores were not statistically different between the groups ($p > .05$). **CONCLUSION:** As a result of this study, it appears that mini-trampoline training is a viable exercise modality for older adults to reduce fall risk and improve balance while providing similar cardiovascular benefits (i.e., improvements in walking distance) to those as a result of walking.

2085 Board #4 May 28 2:00 PM - 3:30 PM
Comparison Of The Effects Of Two Different Resistance Training Programs On Strength In Older MalesRicardo Parra, Murat Karabulut, FACSM. *University of Texas - Rio Grande Valley, Brownsville, TX.**(No relevant relationships reported)*

PURPOSE: The purpose of this study was to compare the effects of 8 weeks of blood flow restriction (BFR) training and traditional endurance resistance training on isotonic, isokinetic, isometric strength in older males. **METHODS:** A total of 17 males (57.0 yr ± 4.6 yr) completed the study. Subjects were randomly assigned to two training groups: blood flow restriction (BFR; n = 9) or endurance resistance training (END; n = 8). Prior to exercise training, baselines measurements were recorded, including height, weight, one repetition maximum (1RM), and unilateral knee extension testing to determine maximal voluntary contraction (MVC) and isokinetic torque at 60°/sec and 180°/sec. Training was held three times a week in a training room under laboratory settings and under the supervision of an experienced and certified strength and conditioning specialist, who ensured that subjects used proper exercise form and provided verbal encouragement. The following machine-based exercises were performed: Leg press, leg extension, leg curl, chest press, and shoulder press. Following a warm-up consisting of a 5-minute walk or jog, the BFR group performed 4 sets of 20 repetitions of the 5 exercises at 20-30% 1RM, while the END group performed 4 sets of 15 repetitions of the 5 exercises at 40-65% 1RM, with 30-60 seconds of rest between exercises. Cuffs were placed at the upper most portion of the limbs. Initial cuff tightness was kept between 30 and 40 mmHg for upper and lower limbs, and final pressure of the cuffs was between 140 to 160 mmHg for upper body 160 to 200 mmHg for lower body. BFR group rested 3-5 minutes between upper and lower body exercises. Following completion of the 8-week training, the measurements at baseline were re-recorded. **RESULTS:** One-way ANOVA resulted in no difference between groups at baseline. Time main effects were seen in 1RM ($p \leq .05$), isokinetic torque at 60°/sec ($p \leq .05$) and 80°/sec ($p \leq .05$), and MVC ($p \leq .05$) tests. **CONCLUSION:** The BFR and END training protocols resulted in similar results on improving strength after 8 weeks of resistance training. It could be speculated that even though half the weight was lifted during the BFR sessions compared to the END sessions, the BFR-related local and systemic changes elicited similar improvements in isotonic, isokinetic, and isometric strength in older males.

2086 Board #5 May 28 2:00 PM - 3:30 PM

The Impact Of Verification Phase Intensity For Determination Of VO₂max In Older AdultsJared M. Dickinson, FACSM¹, Ian R. Villanueva², John N. Campbell², Serena M. Medina², Theresa M. Jorgensen², Shannon L. Wilson², Nathan Serrano², Siddhartha S. Angadi, FACSM², Glenn A. Gaesser, FACSM². ¹Arizona State University and ²Central Washington University, Ellensburg, WA. ²Arizona State University, Phoenix, AZ.*(No relevant relationships reported)*

Maximal oxygen uptake (VO₂max) declines with age and is a strong predictor of morbidity and mortality risk. Thus, accurate assessment of VO₂max is important for the older population. **PURPOSE:** To evaluate the use of a verification phase performed at different intensities for determination of VO₂max on a stationary cycle ergometer in older adults. **METHODS:** Twenty-two older adults (67±6 yr; 26.3±5.1 BMI) were recruited to participate in the study. Each subject completed two experimental trials in a randomized, counterbalanced cross-over design. Both trials consisted of an identical traditional ramp test, followed by 10 min of active recovery, and a verification phase performed at either 85% (VP85) or 110% (VP110) of the peak work rate achieved during the ramp. Expired gases and heart rate (HR) were continuously monitored throughout each test. VO₂peak was determined using the highest 30-sec average. **RESULTS:** No significant differences were observed for absolute (L/min) VO₂peak between VP85 (1.86±0.72; P=0.679) or VP110 (1.79±0.73; P=0.200) and the associated ramps (1.85±0.73 and 1.82±0.72, respectively). There was also no significant difference in maximal HR (bpm) between VP85 (153±17; P=0.243) or VP110 (146±16; P=0.085) and the associated ramps (150±17 and 149±16, respectively). However, individual data indicated that 36% of subjects achieved a ≥2% greater VO₂ (L/min) during the VP85 compared to the ramp, while only 15% of subjects achieved a ≥2% greater VO₂ (L/min) during the VP110 compared to the ramp. Moreover, the trend of a decreased percentage of subjects achieving a higher value compared to the ramp during VP110 as compared to the VP85 was fairly consistent across all physiological data (using the collected coefficient of variation [CV] data). While no significant differences (P>0.05) were found for most variables between the two ramp tests, 40% of subjects achieved a VO₂ (L/min) during the second ramp test that was higher than the CV between ramp tests. **CONCLUSION:** These data suggest that if a verification phase is employed for VO₂max assessment in otherwise healthy older adults, a power slightly below peak work rate may provide a more accurate assessment compared to a power slightly above peak work rate. Supported by intramural funds from ASU

2087 Board #6 May 28 2:00 PM - 3:30 PM

Assessment Of Cardiorespiratory Fitness In Older Adults With Cognitive ImpairmentShirit Rosenberg, Hallie Nuzum, Heather Taylor, Peter Louras, J. Kaci Fairchild. *Palo Alto Veterans Health Care System, Los Altos, CA.* (Sponsor: Dr. Jonathan Myers, FACSM)
Email: shiritkamil@gmail.com*(No relevant relationships reported)*

Interest in the potential benefits of physical activity (PA) and exercise on cognition in late life has grown exponentially in the past decade. Peak oxygen uptake (VO₂) is one of the most widely used metrics of physical fitness. The most accurate measure of VO₂ is cardiopulmonary testing (CPX); however, this method may not be easily accessible in many settings nor appropriate for all populations, including older adults. Self-report measures of PA are easily administered and readily available, yet these measures rely on an accurate recall of past activity. This may be difficult for older adults with even mild forms of cognitive impairment. Identifying alternative methods that accurately estimate a patient's physical fitness are essential.

PURPOSE: To evaluate the use of multiple measures of physical fitness in a sample of older adults with amnesic Mild Cognitive Impairment (aMCI).

METHODS: The sample included 105 older adults who were diagnosed with aMCI (93.3% male, aged = 71.2 ± 9.2 years). Measures of physical fitness included CPX, 6-minute walk test (6MWT), and the Yale Physical Activity Survey (YPAS). Analysis included comparison of the sub-maximal measures of physical fitness (6MWT) and self-report measures (YPAS) with directly-measured cardiorespiratory fitness on key measures on physiologic measures of fitness (e.g., peak VO₂, resting blood pressure (BP), BMI).

RESULTS: The 6MWT demonstrated a stronger correlation with directly-measured peak VO₂ ($r = 0.62, p = 0.00$) compared to YPAS. The YPAS activity dimensions summary index (composed of questions on vigorous activity, leisurely walking, moving, sitting, and standing) correlated marginally with VO₂max ($r = 0.28; P = 0.01$). The YPAS index of vigorous activity was slightly correlated with VO₂max ($r = 0.21; P = 0.03$). CPX was inversely correlated with BMI ($r = -0.21; P = 0.03$) and non-significantly with resting BP. Resting BP and BMI was not significantly associated with 6MWT nor the YPAS indices.

CONCLUSION: The present analysis suggests that even mild forms of cognitive impairment impact the validity of self-report measures of physical fitness. Sub-maximal tests of aerobic capacity, such as the 6MWT, provide more accurate estimates of cardiorespiratory fitness and are easily administered in a variety of settings in which older adults receive health care.

2088 Board #7 May 28 2:00 PM - 3:30 PM
Physical Fitness In Older Adults: Is There A Relationship With The Modified Functional Movement Screen?

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 (No relevant relationships reported)

There is an increasing emphasis on maintaining and improving physical function and capacity in older adults. Measures obtained through physical fitness testing can help provide health/fitness practitioners with important information used to structure the exercise and rehabilitation programs prescribed for older adults. The modified Functional Movement Screen™ (mFMS) has been utilized as a tool to screen for movement proficiency, stability, motor control and balance in older adults. Yet, its relationship to other measures of physical fitness is not yet fully understood. **PURPOSE:** Determine the relationship between mFMS scores and measures of physical fitness in older adults. **METHODS:** In total, 78 older adults (36 males and 42 females; mean age \pm SD: age 69.00 \pm 7.61 years) completed this cross-sectional study. Physical tests included: handgrip strength (HG), back-leg strength dynamometer (BLS), 8 ft. Up-and-Go (8UG), vertical jump (VJ), medicine ball throw (MBT), chair stand (CST), arm curl (AC), and 6-minute walk (6MW). Participants also completed the mFMS which consists of 4 screens: Shoulder Mobility Screen (SMS), Deep Squat (DS), Active Straight Leg Raise (ASLR), and Lower Body Motor Control Screen (LB-MCS). Scoring criteria ranges from (0-3) for the SMS, DS, and ASLR screens, with higher scores indicating better performance. The LB-MCS is scored as pass/fail. Spearman's *R* correlations were conducted to determine associations between physical fitness tests and the mFMS. **RESULTS:** The DS was significantly correlated with all fitness tests ($p < 0.05$). Specifically, higher DS scores were associated with improved HG ($r = 0.29$), BLS ($r = 0.50$), VJ height ($r = 0.51$), MBT ($r = 0.41$), CST ($r = 0.56$), AC ($r = 0.29$), 6MW ($r = 0.53$), and 8UG ($r = -0.64$) performance. Lastly, better 8UG ($r = -0.35$), BLS ($r = 0.32$), and 6MW ($r = 0.29$) performance were associated with individuals who passed the LB-MCS ($p < 0.05$). No other screens were significantly associated with physical fitness tests. **CONCLUSION:** Increased DS scores and passing the LB-MCS may contribute to overall improvement of physical fitness in older adults. Health practitioners desiring to increase measures of physical fitness in older adults and who use the mFMS as a screening tool may want to focus on increasing DS and LB-MCS movement proficiency.

2089 Board #8 May 28 2:00 PM - 3:30 PM
The Relationship Between Hip Displacement In The Anteroposterior Direction And Life-space Mobility Among Older Women

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PURPOSE: The ability to recover one's balance using a hip-based strategy is important to avoid falls, but many older adults have limited hip flexibility. This study aimed to clarify the relationship between hip displacement during voluntary motion (Hip-D) in the anteroposterior direction and life-space mobility, and to examine whether Hip-D could be used to independently distinguish the quality of one's life-space mobility by comparing the results on the Life-Space Assessment (LSA) scale. **METHODS:** Hip-D and physical functions related to fall prevention were measured in 319 community-dwelling older women. Hip-D was defined as the maximum moving distance of the great trochanter in the anteroposterior direction. The participants were also classified into good and poor life-space mobility groups based on their LSA scores. The ability of the Hip-D and physical functioning tests to distinguish the above groups was determined using DeLong's test of the area under the receiver operating characteristic curve (AUC) for each test. **RESULTS:** Hip-D was significantly greater in the good life-space group (25.2 \pm 6.9 cm) than in the poor life-space group (17.3 \pm 5.1 cm). The LSA score was moderately correlated with Hip-D ($r = 0.51$, $p < 0.05$) but only weakly with the fall-related physical functioning parameters ($|r| = 0.15-0.39$). Hip-D had the highest AUC (0.824, 95%CI: 0.776-0.872) among all parameters, and the Hip-D cutoff value was 20.9 cm. The AUC for Hip-D was significantly greater than those for all fall-related physical functioning parameters (AUC = 0.591-0.754) in an examination based on DeLong's test. **CONCLUSIONS:** Hip-D measurements of older adults were easy to obtain and were moderately correlated with life-space mobility.

As such, this approach represents a useful way to predict life-space mobility. Hip-D measurements proved to be more reliable for this purpose than the other fall-related physical functioning parameters studied. It will be necessary the care prevention exercise to improve Hip-D (at least over 21 cm) for older adults.

2090 Board #9 May 28 2:00 PM - 3:30 PM
Validity And Reliability Of Walk Tests For Cardiopulmonary Fitness In The Elderly According To Distances And Time To Walk

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Abstract

Background and Purpose: Cardiopulmonary Fitness is one of health fitness factors, and it correlates chronic disease incidence and mortality in terms of cardiovascular diseases, hypertension, and diabetes. Walk test is commonly used to maintain physical function for CF of the elderly in their daily lives. The most commonly used walk tests are 6MWT (6 minute walk test) at a 30m straight line suggested by ATS (American Thoracic Society) and 20m walk test suggested by the SFT (Senior Fitness Test). However, both tests need long hallway and big space. The purpose of this study was to assess the validity and reliability of walk tests to estimate CF for elderly according to distances and time to walk.

Methods: 57 subjects without any disease were recruited from community site. Over 2 or 3 days, 57 subjects performed three CF tests. First test was sub-maximal exercise test on treadmill using modified Bruce protocol. Second test was 10min walk test at 20m straight line. Third test was 10min walk test at 30m straight line. In walk tests, distance was measured for 2, 4, 6, 8, and 10min. Mean and SD were calculated to describe the data. For validity of the test, the Pearson correlation coefficient was used to compare VO_{2max} (kg/min/kcal) to distances. Multiple regression analysis was conducted to develop several Equations for predicting VO_{2max} were developed by multiple regression analysis through gender, age, BMI and distance to walk. Win SPSS 25.0 was used for statistical analysis and significance level was $p < 0.05$.

Results and discussion: The results of walk tests were moderately correlated with VO_{2max} (0.64 $< r < 0.66$, $p < 0.05$). The model from 20m course at 6mins explained 48% of VO_{2max} . In addition, the model from 30m course at 2mins explained 47% of VO_{2max} . According to these results, both walk tests were moderately correlated with VO_{2max} . **Conclusions:** The feasibility of walk test for estimating CF of the elderly was confirmed to be highly positive correlated with VO_{2max} . In the 20 meter, straight distance model explained 47% of the variability in VO_{2max} . And in the 30 meter, straight distance model explained 48% of the variability in VO_{2max} . As the result, CF of the elderly can be estimated by walk test regardless of its distance and time.

Keywords: Walk Test, Cardiopulmonary Fitness Test, Validity, Reliability

2091 Board #10 May 28 2:00 PM - 3:30 PM
Accelerometer-determined Physical Activity And Functional Fitness In Community-dwelling Older Japanese Women

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PURPOSE: The proportion of elderly people in Japan's population now exceeds 28%, identifying the country as a "super-aging society." It is important for people to maintain health and independence as they age. Therefore, it is important for them to maintain functional fitness. The purpose of this study was to analyze the associations between accelerometer-determined physical activity and clinical measures of functional fitness. **METHODS:** One hundred ninety-nine community-dwelling Japanese women (age: 68.9 \pm 4.8 years, BMI: 22.4 \pm 2.8) wore an Active Style Pro HJA-350IT accelerometer for five weeks (Omron Healthcare Co., Ltd, Japan) on their waistline for the entire day, except when bathing, showering, swimming, or sleeping. The instrument measured the daily number of steps and accumulated time (minutes) spent in sedentary behavior (SB: < 1.5 metabolic equivalents or METs; 1 MET=3.5 ml/kg/min), light-intensity physical activity (LPA: 1.5 to 2.9 METs), and moderate- and vigorous-intensity physical activity (MVPA: ≥ 3.0 METs). Common functional fitness measures included hand grip, sit-up, sit and reach, functional reach, chair stands, 10-m walk, 10-m obstacle walk, and timed up and go. Functional fitness of participants was compared according to quartiles of steps/day and time spent in SB, LPA, and MVPA.

These quartiles are denoted as Q1 (lowest activity quartile), Q2, Q3, and Q4 (highest activity quartile). RESULTS: Participants accumulated (median, [IQR]) 6,939 [5,000-8,896] steps/day, 286.1 [228.0-349.7] SB min/day, 451.1 [398.1-509.3] LPA min/day, and 68.9 [45.7-93.0] MVPA min/day. The 10-m walk, 10-m obstacle walk, and timed up and go measures differed significantly across the steps/day quartiles (Q1<Q2, p<0.05) and MVPA quartiles (Q1<Q2, Q3, Q4, p<0.05). The 10-m walk (Q1<Q2, p<0.05), timed up and go (Q1<Q2, p<0.05), and functional reach (Q2, Q3> Q4, p<0.05) measures differed significantly across SB quartiles. There were no differences observed across LPA quartiles. CONCLUSIONS: Accelerometer-determined physical activity, especially time in MVPA, was associated with a number of different functional fitness measures.

2092 Board #11 May 28 2:00 PM - 3:30 PM
Functional Assessment Of Older Adults: Inter-rater Reliability Of Rapid Stepping And Weight-shifting Tests
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The control of both rapid stepping movements and medial-lateral (ML) motion during standing balance and locomotion becomes increasingly difficult with aging. This aspect of function can be an early indicator of fall risk in older adults, but the ability to measure this in the clinic is limited. This analysis is part of a project to develop a clinically-feasible test of rapid stepping performance that challenges medial-lateral motion in older adults. **PURPOSE:** To determine the inter-rater reliability for three tests challenging rapid stepping performance and ML control of weight-shifting motion. **METHODS:** Older adults aged 70-96 yrs performed three rapid stepping tests: 1) the Step in Place test (SIP, n = 43) where participants stepped in place as fast as safely possible until reaching 20 footfalls of the first stepping foot, 2) the Repeated Alternating Stair Touch Test (RASTT, n = 37) where participants tapped, alternating right and left, with the ball of each foot a centered piece of tape on the top front edge of a small step as fast as safely possible for 20 s, and 3) the modified-RASTT (n = 37) which differed from the RASTT with the foot taps aimed straight forward on the step. Observations (# of steps for the RASTT tests, and time (s) for SIP) were compared between two experimenters rating one trial from each participant using independent, two-tailed t-tests, Pearson (r) correlations, and intra-class correlations (ICC) for the two RASTT tests. Given its non-normal distribution, a Spearman Rank (rho) test and a two-tailed Mann-Whitney U test were used to compare the SIP test results between raters. **RESULTS:** There was no difference between raters for the RASTT (mean [SD]: 22.9 [6.8] vs. 22.8 [6.9] steps, p = 0.194), the modified-RASTT (mean [SD]: 23.3 [7.3] vs. 23.2 [7.2] steps, p = 0.168), or the SIP (median [IQR]: 10.7 [8.6] vs. 10.8 [8.6] s, U = 912, p = 0.920). The two experimenters' ratings were highly correlated for both the RASTT (r = 0.998, ICC = 0.998), the modified-RASTT (r = 0.994, ICC = 0.993), and the SIP (Spearman's rho = 0.997). **CONCLUSIONS:** Our results indicate that these tests exhibit high inter-rater reliability.

2093 Board #12 May 28 2:00 PM - 3:30 PM
Efficacy Of 6-week Suspension Training Exercises On Fitness Components In Older Adults
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 (No relevant relationships reported)

PURPOSE: To determine the efficacy of a 6-week suspension training exercises on fitness components in older adults.
METHODS: Three male and eight female volunteers (Age = 80.0 ± 4.9 yrs; Height = 166.3 ± 9.5 cm; Body Mass = 71.2 ± 4.9 kg; Body Fat = 34.2 ± 2.6 %) participated in the 6-week suspension training program. Pre- and post-fitness assessments comprised of handgrip dynamometer, functional reach, and overall balance. The 6-week suspension training intervention required individuals to perform a variety of exercises on the suspension training system for forty-five minutes, twice per week. A paired sample t-test was used to determine differences from pre to post (p ≤ 0.05).
RESULTS: Data revealed no significant difference between pre- and post-body fat (34.2 ± 2.6 % vs 34.3 ± 2.8 %) or handgrip dynamometer (22.4 ± 1.9 kg vs 22.8 ± 1.8 kg). There was, however, a statistical improvement from pre- to post in functional reach (57.2 ± 6.4 cm vs 68.6 ± 4.3 cm; p = 0.02) and overall balance score (67.5 ± 2.4 vs 72.2 ± 2.2; p = 0.02).
CONCLUSIONS: A 6-week suspension training exercise program was adequate to enhance core stability and overall balance amongst older adults.

2094 Board #13 May 28 2:00 PM - 3:30 PM
Relationship Between Ecg Abnormalities And Senior Fitness Test Performance In Older Adults
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 (No relevant relationships reported)

Background: ECG abnormalities in older adults are associated with high risk of coronary heart disease and subsequent cardiac events. Cardiorespiratory fitness (CRF) is an important predictor of mortality in older adults. CRF is impacted by loss of mobility, strength, and function leading to increased risk of mortality in the elderly. The Senior Fitness Test (SFT) is a functional measure of strength, aerobic endurance, flexibility, and agility/balance in older adults. ECG testing may be related to SFT performance, and may indicate deficits in CRF or functional capacity. Understanding the relationship between ECG abnormalities and SFT performance may aid in prescribing safe, effective exercise programs for this population. **Purpose:** The purpose of this pilot study was to measure the relationships between 12-Lead resting ECG data and SFT performance in male and female older adults. **Methods:** Anthropometrics, BP, resting HR, 12-lead resting ECG, and SFT measurements were taken in 30 older adults (Age: 71.9±7.69yrs; Height: 65.81±3.39 in; Weight: 174.55±64.61lbs; BMI: 28.4±5.59kg/m²). SFT performance and ECG abnormalities were recorded, and relative VO₂ was calculated. Relationships were analyzed using chi square statistics and Pearson's correlations. **Results:** ECG abnormalities were present in 57% of this population, but no significant relationship between abnormal ECG and age, gender, VO₂, or SFT performance was found. There was a significant positive association between 30-sec chair stand (lower body strength) and 30-sec arm curl (upper body strength) performance (r=.73, p=.000), and between the 8-ft up and go (agility) and 6-min walk (CRF) distance (r=.77, p=.000). There was a significant inverse relationship between 30-sec chair stand (lower body strength) and 8-ft up and go (agility) time (r=-.69, p=.000). **Conclusion:** The presence of ECG abnormalities in over half of this population did not correlate with poor CRF or SFT performance. Lower body strength was associated with higher CRF and agility/balance, regardless of gender, age group, or ECG. Presence of ECG abnormalities may not have a negative effect on SFT performance, and older adults should be encouraged to participate in a supervised exercise program to prevent frailty and loss of independence.

2095 Board #14 May 28 2:00 PM - 3:30 PM
Senior Fitness Test Performance Vs. Norms In Older Adults: A Pilot Study
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 (No relevant relationships reported)

Background: Functional capacity and independence in older adults is affected by mobility limitations, strength deficits, and loss of function, all of which can lead to frailty and mortality in older adults. This physical decline can be attenuated by early detection of functional limitations. The Senior Fitness Test (SFT) measures functional strength, aerobic endurance, flexibility, and agility/balance in older adults. **Purpose:** The purpose of this pilot study was to examine SFT functional performance scores in comparison to criterion-referenced population norms in male and female older adults. **Methods:** Anthropometrics, BP, resting HR, and SFT measurements were taken in 30 older adults (Age: 71.9±7.69yrs; Height: 65.81±3.39 in; Weight: 174.55±64.61lbs; BMI: 28.4±5.59kg/m²). SFT scores were recorded, and relative VO₂ was calculated. Performance scores were compared to norms and percentile ranks based on age group and gender. Relationships were analyzed using 2-way ANOVA. **Results:** In this sample, a higher BMI was significantly related to upper body strength(p=.007), but not lower body strength. There were no significant differences in SFT scores or relative VO₂ based on age group or gender. Almost all age groups and genders were classified as "average" or "above average" in comparison to SFT norms for all tests. Only males <64yrs scored below average (10th percentile) on the 6-min walk test. There were no significant differences between this population and SFT normative data. **Conclusion:** Overall, results indicated that age and gender were not significantly related to lower SFT performance, CRF, or function in tasks of daily living. However, a higher BMI was significantly related to higher upper body strength. SFT scores can be used to track functional physical ability in older adults and may be beneficial prior to beginning a supervised exercise program.

2096 Board #15 May 28 2:00 PM - 3:30 PM
Using Virtual Reality To Improve Postural Stability In Elderly Women

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PURPOSE: To observe through objective testing using an assessment module incorporated in a new virtual reality (VR) system whether elderly people's static and functional balance is improved by VR balance training program that is based on movements performed in everyday life.

METHODS: Thirteen healthy elderly women participated in 12 sessions of balance-based VR training (three times a week, 30 minutes per session). The system used combined a posturographic platform with a 3D measurement system based on time-of-flight cameras (Kinect). All objective outcomes: the quiet standing test, Functional Balance Test (FBT) and limit of stability (LOS) test were measured on 3 occasions: before the intervention, after 6 training sessions and after the completion of the 4-week program.

RESULTS: Results showed significant improvement in LOS performance after the intervention. In FBT participants exhibited significant decrease ($p < .01$; Kendall's $W = 0.5$) in the average time to target hit after 6 trainings. The average center of pressure velocity increased after 6 and 12 sessions, however, did not reach significance ($p = .053$), nevertheless, the effect size was large ($\eta^2 = 0.22$). Movement optimization in FBT and parameters of quiet standing test were not significantly affected by training.

CONCLUSIONS: These results demonstrate that even a relatively short 4-week training period can bring positive outcomes. 12 training sessions of balance VR training using the force platform and Kinect sensor resulted in significant improvement of postural stability in healthy elderly women. This trial supports the potential therapeutic use of VR training program which is based on movements performed in everyday life.

2097 Board #16 May 28 2:00 PM - 3:30 PM
Effects Of Jump Training On Postural Balance And Leg Muscle Function In Healthy Older Adults

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Age-associated loss of skeletal muscle strength and postural balance are critical determinants of independent daily living activities in later life. **PURPOSE:** This study aimed to investigate the effects of different jumping exercise tempos on static balance and leg muscle function in healthy older adults. **METHODS:** Twenty-six community-living older adults were randomly assigned to a quick 108 per minute tempo (QJ; $n = 14$; 6 men) or slow 60 per minute tempo [AS1] (SJ; $n = 12$; 5 men) jumping exercise group. Both groups performed one set of jumps until they reached a level of exertion they perceived as difficult (Borg-RPE Scale of 15). Both groups trained three times a week for 12 weeks and participated in 60-min supervised group exercise sessions at a local health center. Outcome measures included center of foot pressure (CoP) sway parameters during quiet standing with eyes open (EO) and eyes closed (EC), four-square step (FSS), two-step stride length (TSL), and rate of force development (RFD) for vertical ground reaction force in sit-to-stand movement. **RESULTS:** Repeated-measures analysis of variance showed a significant main effect for FSS ($P = 0.009$) and TSL ($P = 0.002$). After the training period, QJ demonstrated a significantly decreased FSS time (5.17 ± 1.00 vs. 4.87 ± 1.00 s, $P < 0.05$) and SJ demonstrated a significantly increased TSL (210.8 ± 21.1 vs. 227.3 ± 27.2 cm, $P < 0.05$). Both groups showed no changes in CoP sway parameters with EO or EC in quiet standing. **CONCLUSIONS:** Jumps at a quick tempo improved dynamic standing balance evaluated by the FSS, while jumps at a slow tempo improved leg muscle strength. Thus, 12 weeks of jump training at different tempos appeared to have no effects on quiet standing balance, but different effects on dynamic standing balance and leg muscle strength in healthy older adults. [AS1]The phrase 'per minute' was included for one group only, but the meaning was not clear. Please check my suggested alterations.

2098 Board #17 May 28 2:00 PM - 3:30 PM
Effects Of Water-based Detraining/re-training On Muscular Fitness And Functional Capacity In Elderly People

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The positive long-term effects of exercise training on health-related outcomes in elderly people as well as the negative effects of training interruption are well documented. Despite largely used, little is knowing about the effects of detraining/re-training in water-based exercise training.

PURPOSE: To evaluate the effects of water-based detraining/re-training on low limb peak torque and functional capacity in an elderly population.

METHODS: One hundred and eighty-nine older individuals (68±6yrs) from both genders (176 female and 13 male) engaged in water-based training (training period = 6±3yrs), had their lower limb peak torque (dynamometer), functional capacity (Time Up and Go test [TUG]; and 6-min walk test [6WT]) assessed before exercise training interruption (TI), after 12-weeks of interruption (DT) and after 12-weeks of re-training (RT) on water-based strength training (45minute per session twice a week).

RESULTS: Lower limb peak torque decreased from TI (12.83 ± 3.86 kg/f) to DT (10.78 ± 3.66) ($p < 0.01$), and was increased after RT (17.37 ± 4.35 kg/f) ($p < 0.01$), achieving higher values compared to TI ($p < 0.01$). No effects of detraining were observed for both 6WT or TUG ($P > 0.05$), however re-training increases the performance on 6WT (425.94 ± 65.30 m) and TUG (6.84 ± 1.50 sec) compared to the TI (6WT = 390.00 ± 55.47 m; TUG = 9.71 ± 1.91 sec; $p < 0.01$, for all).

CONCLUSIONS: Detraining decreases muscle strength, but does not affect functional capacity. Water-based re-training induces additional improvements on muscle low limb peak torque and functional capacity in elderly people previously engaged in water-based training.

2099 Board #18 May 28 2:00 PM - 3:30 PM
How Age Range Affect Energy Expenditure And Exercise Efficiency Among Older People During Cycling

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The reduced cardiorespiratory function and muscle performance in the elderly significantly minimize an individual's functional aerobic capacity. Any further decline may make them unable to complete daily activities and then have a negative influence on living independently.

PURPOSE: the purpose of this study was to examine the influence of age on changes in energy cost in two significantly different age elderly groups and one young counterpart group.

METHODS: The investigation was conducted on 30 healthy women in stationary cycling. Participants were stratified by age into young adults (Y; 20-25 years), older adults (OD; 60-65 years) and the more older adults (OU; 66-70years) with the same sample size.

The position on the cycle ergometer was adjusted for each participant. The protocol started with a rest metabolism test using a calibrated K4b² in which subjects were sitting on the cycle ergometer quietly. Then followed by a familiarization process. During the cycling test, each participant performed eight different 300-second trials. Eight trials were under the combination of 2 power output (60 and 100 Watts, W) and 4 cadences (self-selected, 40, 60 and 90 rotations-per-minute, rpm). Oxygen consumption (ml/min) and energy expenditure (EE, kcal/min) were calculated during the last 3 min of each testing condition.

RESULTS:

1. $\dot{V}O_2$ Outcomes
 Gross $\dot{V}O_2$ and net $\dot{V}O_2$ had a similar pattern. $\dot{V}O_2$ at 100 W output power was larger than those at 60 W of each age group ($p < 0.05$). However, for the same level of output power, only $\dot{V}O_2$ parameters in the Y group ($M_G = 1916.40$ and $M_N = 1606.96$) were significantly higher than those in the OU group ($M_G = 1577.88$ and $M_N = 1279.05$) at 100 W output power ($p < 0.05$).

2. EE outcomes

The age*power interaction effect on gross EE and net EE was significant, which were $F(2, 27) = 4.07$, $p = .029$ and $F(2, 27) = 3.73$, $p = .037$, respectively. Similarly, The interaction effect of age*cadence was significant with respect to gross EE and net EE, which were $F(6, 81) = 2.36$, $p = .038$ and $F(6, 81) = 2.66$, $p = .021$, respectively.

CONCLUSION:

Based on the above findings, the small change of age range would significantly affect the body energy cost during cycling. In view of oxygen consumption and energy cost, the choice of power output and cadence should be mainly considered in older adults, especially for the age ≥ 66 yrs individuals.

2100 Board #19 May 28 2:00 PM - 3:30 PM
Resistance Training Increases Insulin-Like Growth Factor-1, Strength, Physical Function, And Mental Flexibility In Female Older Adults

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The hormone insulin-like growth factor-1 (IGF-1) has anabolic effects in adults. The aging process negatively affects IGF-1 levels, muscle strength, physical performance, and cognitions. There is limited evidence regarding the effects of resistance training (RT) exercise on IGF-1 levels, muscle strength, physical function, and cognitions in Latin American female older adults. **PURPOSE:** To determine the effect of a RT program on IGF-1, muscle strength, physical function and cognitions in Costa Rican female older adults. **METHODS:** Twenty-six older adults were randomly assigned to a control (CTRL, n = 14, age = 68.8 \pm 3.7 yr.) or experimental (EXP, n = 12, age = 69.3 \pm 2.5 yr.) group. Both groups attended the exercise sessions two times/week, 40-min/session, for 8 weeks. The CTRL group performed slow-motion stretching exercises, and the EXP group performed RT exercises at 70% of 8-RM. Pre- to post-measurements were obtained on IGF-1, muscle strength, the 30-s chair-rise test, and short-term memory, working memory, psychomotor speed, attention and mental flexibility. Mean differences were studied by mixed 2 (groups) x 2 (measurements) ANOVA. Tukey's post-hoc tests followed significant ANOVA interactions. **RESULTS:** IGF-1 increased in EXP (Pre= 161.0 \pm 55.6 vs. Post= 205.3 \pm 49.3 ng/mL) and CTRL (Pre= 128.6 \pm 51.5 vs. Post = 174.9 \pm 70.7 ng/mL) groups (p < 0.05). Significant improvements (p < 0.05 for all) were found in leg extension (EXP= 52.3 \pm 9.4 vs. CTRL= 47.9 \pm 8.6 kg), chest press (EXP= 52.3 \pm 16.1 vs. CTRL= 42.6 \pm 9.1 kg), hip adduction (EXP= 47.1 \pm 12.8 vs. CTRL= 37.8 \pm 6.7 kg), back strength (EXP= 45.5 \pm 10.4 vs. CTRL= 39.4 \pm 4.6 kg), 30-s chair test performance (EXP= 14.8 \pm 1.3 vs. CTRL= 10.3 \pm 1.8 rep/30-s), and mental flexibility (EXP= 143.0 \pm 16.6 vs. CTRL= 142.1 \pm 16.4 s). **CONCLUSION:** A RT program improved muscle strength, physical function, and mental flexibility in female older adults compared to an active control group. The positive change in mental flexibility is a relevant finding due to the small number of studies in older adults. The increase in IGF-1 in both groups following eight weeks of physical activity and training are beneficial for older adults due to the proven importance of growth factors for brain health.

2101 Board #20 May 28 2:00 PM - 3:30 PM
Functional Characteristics Of Musculoskeletal Ambulation Disability Symptom Complex (mads) In Community-dwelling Older Women

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PURPOSE: For promoting the independence and prevention of falls of older adults, new category of motor disorders was established: musculoskeletal ambulation disability symptom complex (MADS). MADS is defined as an increased risk of falls and isolation due to an age-related decline in balance and walking ability. The purpose of this study was to understand functional characteristics of MADS by examining the association among physical performance, cognitive functions and sedentary behavior in older community-dwellers in Japan.

METHODS: Participants: 59 women aged 65 years and older (mean age 71 \pm 4 yrs.) participated in this study. After the participants completed a demographic questionnaire, motor function assessments measurements, one-leg standing time with eyes open (OLS) and timed up-and-go test (TUG), were conducted as diagnostic criteria for MADS. Then, the participants were divided into two groups according to OLS time; **G1:** longer than 15 sec. and **G2:** less than 15 sec. **Measurements:** Following variables were measured; 1) physical function -- hand-grip strength, chair-stand, functional reach, gait speed (10 m), 2) cognitive function -- Mini-Mental State

Examination (MMSE) and Trail Making Test-A (TMT-A), and 3) sedentary behavior -- self-reported questionnaire. Data are presented as means \pm SD, and analyzed using unpaired t-test and ANCOVA.

RESULTS: The average time of OLS was significantly different between G1 and G2 groups (61.3 \pm 36.9 and 8.2 \pm 3.6 sec., p<0.01). Age was significantly different between the G1 and G2 (70.3 \pm 2.5 vs. 72.7 \pm 3.2 yrs., p<0.05). The results show that maximal gait speed and TUG were significantly lower in G1 than G2 (1.82 \pm 0.24 vs. 1.66 \pm 0.25 m/sec., p<0.01) and (7.0 \pm 1.1 vs. 8.0 \pm 1.5 sec., p<0.05), respectively. In ANCOVA adjusting for the age, TMT-A and sedentary time were significantly different between G1 and G2; TMT-A : 93.9 \pm 29.8 sec. vs. 103.3 \pm 30.6 sec., p<0.01 and sedentary time: 8.8 \pm 0.9 vs. 10.2 \pm 1.5 hrs./day, p<0.05. MADS may affect the TMT-A and sedentary time in the older women.

CONCLUSIONS: These results suggest that decline in physical and cognitive functions, and sedentary behavior may be significantly associated with the risk of MADS in older women. Follow up studies are necessary to examine physical and cognitive functions of older adults with and without MADS.

2102 Board #21 May 28 2:00 PM - 3:30 PM
Distinct Types Of Physical Exercise On Functional Autonomy, Quality Of Life And Elderly Fitness

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The aging process is associated with physiological changes that cause progressive declines in biological function, imposing a potential threat to the functional capacity. This condition impairs elderly independence, primarily when it is associated with chronic diseases or locomotive disorders. On the other hand, the physical exercise can mitigate some of those effects **PURPOSE:** the study aimed to analyze the effects of three different training programs (strength, muscular endurance, and aerobic) on functional autonomy, quality of life, and elderly physical fitness index. **METHODS:** After the inclusion and exclusion criteria, the sample consisted of 133 individuals, randomly divided into four groups: muscle strength group (MSG=31) muscular endurance group (MEG=32) aerobic group (AG=35) and a control group (CG=35). Initially, the sample groups were submitted to the following procedures: functional autonomy (GDELAN protocol), quality of life (WHOQOL-OLD), and elderly physical fitness index (1600m walking test, left leg calf circumference and lean mass for body composition assessment, elbow flexion, and extension test, sit and stand-up test, range of motion evaluation through the Normalflex). **RESULTS:** After four months of training, there was a significant difference (p<0.0001) between the CG and all other experimental groups for functional autonomy. For quality of life, there was a significant difference in the post-test phase between the CG and the experimental groups in the domain 1 (AG: p=0.001; MSG: p<0.0001; MEG: p=0.001) and domain 6 (MSG: p=0.011), the results being favorable to those three groups. In the pretest phase, there was no significant difference between the groups. For the elderly physical fitness index there was a significant difference in the post-test phase between the CG and the experimental groups, in the VO2max (AG: p<0.0001 and MEG: p<0.0001), range of motion (AG: p<0.0001; MSG: p<0.0001; MEG: p<0.0001) and muscle endurance (AG: p=0.025), the results being favorable for those three groups. In the pretest, there was no significant difference between the groups. **CONCLUSIONS:** The strength group presented a higher rate of functional autonomy improvement ($\Delta\%$ -22.5876, p<0.0001), quality of life ($\Delta\%$ 11.96531, p<0.0001) and elderly physical fitness index ($\Delta\%$ 11.0992, p<0.0001).

2103 Board #22 May 28 2:00 PM - 3:30 PM
EKG CHARACTERISTICS IN SENIORS PARTICIPATING IN A STRUCTURED FITNESS PROGRAM: A PILOT STUDY

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PURPOSE: Undergraduate exercise science students can benefit from curriculum which includes authentic, hands-on opportunities for learning. A 12-lead

electrocardiograph (ECG) can serve as both as a teaching and screening tool to assess cardiac abnormalities in seniors (over age 65) prior to beginning an exercise program. The purpose of this pilot study was to evaluate the ECG characteristics of older adults prior to participation in a twice-weekly supervised strength training program. **METHODS:** Thirty seniors (Males = 10; Females = 20; Age = 72 ± 7.6yrs) completed cardiovascular screening with resting 12-lead ECG analysis prior to program participation. An exercise physiologist reviewed all ECG results and any identified abnormalities were referred to a cardiologist. Gender, ECG abnormalities, and anthropometrics were compared using a mixed model ANOVA. Chi-square analysis was used to test for differences in the frequency of ECG findings across gender. **RESULTS:** Thirty seniors (Males = 10; Females = 20; Age = 72 ± 7.6yrs) completed cardiovascular screening with resting 12-lead ECG analysis prior to program participation. An exercise physiologist reviewed all ECG results and any identified abnormalities were referred to a cardiologist. Gender, ECG abnormalities, and anthropometrics were compared using a mixed model ANOVA. Chi-square analysis was used to test for differences in the frequency of ECG findings across gender. **CONCLUSIONS:** A pre-exercise ECG can be a useful teaching and screening tool for students who are preparing to supervise older adults in a structured strength training program. ECG results can be used to adjust training variables (type, duration, and intensity) accordingly for each individual senior participant.

D-59 Free Communication/Poster - Special Populations

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
 Room: CC-Exhibit Hall

**2104 Board #23 May 28 2:00 PM - 3:30 PM
 Chatting While Cycling Can Enhance "Positive Affect" In Patients With Cardiovascular Disease**

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PURPOSE: Previous studies demonstrated that aerobic exercise activates the frontal area of the left hemisphere, which stimulates optimistic feelings. We hypothesized that having fun chatting with friends while cycling (Chatting While Cycling: CWC) would enhance the benefits of exercise, and this would particularly benefit patients with cardiovascular diseases who find exercising a strenuous activity. Therefore, the aim of present study was to analyze the differences in the positive affect of patients during two aerobics routines: CWC and cycling alone.

METHODS: The sample comprised eight patients with cardiovascular disease and nine healthy gender-matched volunteers that performed two aerobics routines. To determine the positive affect, we performed electroencephalography (EEG; NegPos, Neuro Sky) and applied the following formula (Right Alpha 10 sec Avg - Left Alpha 10 sec Avg) / (Right Alpha 10 sec Avg + Left Alpha 10 sec Avg). In addition, the subjective optimistic feelings during exercise was measured using a questionnaire. Each routine involved the same exercises and duration (15 minutes). The intensity was controlled through a 60% peak VO₂ in the cardiopulmonary exercise test. The mean values of EEG data were calculated and used for analysis in the paired t test (level of significance, *p* < .05). The relationship between positive affect and subjective optimistic feelings was analyzed using Pearson's coefficient of correlation.

RESULTS: In patients with cardiovascular disease, the positive affect during exercise was significantly higher for CWC than cycling alone (CWC 46.9 vs. cycling alone -5.9, *p* = 0.014). On the other hand, healthy volunteers exhibited no such routine-dependent differences. Furthermore, positive affect was associated with increased subjective optimistic feelings during CWC (*r* = 0.839, *p* = 0.005).

CONCLUSIONS: Aerobic exercise while chatting with friends is recommended for positive affect in cardiac rehabilitation settings. The authors have no conflicts of interest.

**2105 Board #24 May 28 2:00 PM - 3:30 PM
 Technological Advancements Fail To Elicit Improvements In CVD Detection**

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Modern and more sophisticated body composition instruments may offer superior determination of cardiovascular risk compared to older, more simple assessments such as body mass index (BMI). **PURPOSE:** To determine whether the Fit3D-calculated measurement of "Body Shape Rating" (BSR) is more accurate than BMI

as a predictor of cardiovascular risk factors. **METHODS:** 17 subjects (7 female, 10 male; aged 18-26) underwent laboratory testing beginning with a body composition assessment by the Fit3D (FIT3D Inc., San Mateo, CA). Subjects then had their heart rate and blood pressure recorded in a resting state before, during, and after a treadmill exercise bout. Descriptive statistics characterized the study sample and simple linear regressions tested the relationships between BSR and blood pressure. **RESULTS:** In the pre-exercise measurements, BSR correlative measures with systolic blood pressure, diastolic blood pressure, and mean arterial pressure were: *r* = -0.082 (*P* = 0.755), *r* = -0.052 (*P* = 0.843), and *r* = -0.102 (*P* = 0.698) respectively. In the post measures, BSR correlative values with systolic blood pressure, diastolic blood pressure, and mean arterial pressure were: *r* = -0.128 (*P* = 0.625), *r* = -0.073 (*P* = 0.782), *r* = -0.102 (*P* = 0.698) respectively. **CONCLUSION:** In our sample, BSR failed to elicit significant correlations with blood pressure. While the Fit3D offers a clear technological improvement to simple anthropometric measurements, the pre- and post-exercise measurements did not indicate utility in determining cardiovascular risk.

**2106 Board #25 May 28 2:00 PM - 3:30 PM
 Walking Characteristics In Individuals With Stroke Differ Based On Walking Speed, Endurance And Daily Steps**

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PURPOSE: Walking is an ideal means of obtaining physical activity, yet people with stroke take few daily steps. The purpose of this study was to examine how the walking characteristics of bouts per day, maximum steps per bout and time spent walking differ between individuals with various walking speeds, walking endurance and daily steps. Additionally, we aimed to identify cutoff values for differentiating active and inactive ambulators (i.e. those who do and do not achieve physical activity guidelines through walking).

METHODS: Stepping data from 252 individuals with chronic stroke (>6 months) with mean age of 63 (13) years and step count of 4,277 (3,064) steps per day were analyzed. Individuals were placed into previously established levels of ambulation (i.e. household ambulators, limited community and unlimited community ambulators), based on walking speed, walking endurance and daily steps (via two days of StepWatch activity monitoring). Differences in walking characteristics were assessed between ambulation levels (e.g. household vs. community ambulators). Linear regression determined which characteristics best predicted daily step counts. Receiver Operating Characteristic (ROC) curves and area under the curve (AUC) determined which variable was most accurate in classifying active (>5,500 steps) and inactive (<5,500 steps) individuals.

RESULTS: Regardless of categorization by walking speed, walking endurance or daily steps, household ambulators had significantly fewer bouts per day, maximum steps per bout and time spent walking compared to both limited and unlimited community ambulators (*p* < 0.001). Only 81 (32%) participants obtained >5,500 steps per day. The two highest AUC values were 0.91 (95% CI 0.88, 0.95) for maximum steps per bout and 0.83 (95% CI 0.78, 0.88) for bouts per day. Cutoff values of 648 maximum steps per bout or 53 bouts were used to differentiate active and inactive ambulators.

CONCLUSIONS: Walking characteristics differed based on an individual's walking speed, walking endurance and daily steps. Differences in daily steps between household and community ambulators are largely due to shorter and fewer walking bouts. Interventions aimed at improving walking after stroke should promote increased walking bouts of any length to increase physical activity after stroke.

**2107 Board #26 May 28 2:00 PM - 3:30 PM
 Gross Motor Functions Assessed Through The Tgmd-3 In Down Syndrome Individuals And Related Gender Differences**

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PURPOSE: Down Syndrome (DS) individuals show a markedly reduced general coordination, resulting in an overall reduced motor proficiency which limits their participation and, consequently, inclusion in sport activities. In this work we aim to characterize gross motor functions in DS, assessed by means of the Test of Gross Motor Development (TGMD 3), and assess possible gender-related differences.

METHODS: Thirty-six age- and gender-matched DS individuals (Age: 29.1±7.5 years; Stature: 1.53±0.09 m; Mass: 67±14 kg; BMI: 28.6±14.1 kg/m²; *n* = 18 females (FE), 18 males (MA)), recruited in 5 European countries, performed the TGMD

version 3 (TGMD-3). Participants were matched also for their daily physical activity ($p = 0.6$) as assessed by the international physical activity questionnaire (IPAQ). TGMD-3 includes 13 skills classified as Locomotor Skills (Running, Galloping, Hopping, Skipping, Horizontal jumping, and Sliding) or Ballistic Skills (Two-hand and One-hand striking, Dribbling, Overhand throwing, Underhand throwing, Catching, and Kicking). For each skill, two attempts were performed. A video analysis was performed to assess if the performance criteria were respected. For each criterion, the participant scored 1 if the performance criterion was respected and 0 if not. Individual scores of the two attempts for each skill classified as Locomotor or Ballistic were separately summed. The total gross motor functions score was the sum of Locomotor and Ballistic skills. All scores were computed as a percentage of the maximum achievable score. MA and FE scores were compared using RM-ANOVAs ($\alpha=0.05$). **RESULTS.** The participants had a total gross motor function score of 51% on average, similar for MA and FE ($F_{1,34} = 1.39$; $p = 0.24$; $M = 54\%$; $F = 48\%$). No significant differences between MA and FE were observed for the total scores of Locomotor or Ballistic skills ($F_{1,34} = 1.45$; $p = 0.23$). At single skill level, MA outperformed FE in the kicking skill ($F_{1,34} = 8.14$; $p = 0.007$; $M = 47\%$; $F = 22\%$). **CONCLUSION.** These results highlight gross motor functions limitations in this population, showing a similar impairment of MA and FE, especially for locomotor functions. The different score obtained between MA and FE in the kicking skill may reflect an European cultural bias. Co-funded by the Erasmus + Programme of the European Union, GA 2018-2512.

2108 Board #27 May 28 2:00 PM - 3:30 PM
Using Causal Agency Theory To Promote Functional And Independent Performance In Adults With Intellectual Disabilities

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Research suggests adults with intellectual disabilities (ID) have significantly lower levels of physical activity (PA) and fitness compared to the general population. This can affect their physical functioning and increase risk for obesity. Carefully structured exercise has improved functional performance in adults with ID. Limited exercise interventions for adults with ID emphasize self-determined behaviors, which can facilitate PA and ultimately quality of life among adults with ID. Causal Agency Theory (CAT) explains how people become self-determined; that is how they develop the actions and beliefs necessary to engage in self-caused, autonomous action in response to basic psychological needs and autonomous motivation as well as contextual and environmental challenges. **PURPOSE:** To examine the effects of a 10-week guided progressive resistance training (PRT) program on functional and independent performance in adults with ID. **METHODS:** Using a block randomization, 11 participants (25±6yrs) were allocated to a guided group (GG) and 11 (23±8yrs) to a non-guided group (NGG). GG received a PRT intervention in a community-based fitness center that included 3-week familiarization to promote correct and independent performance of exercises and technology-enhanced strategies to promote CAT skills (e.g., goal setting, choice-making). NGG only received the PRT intervention with instruction typically provided by a certified personal trainer. **RESULTS:** Paired *t* tests showed that after the 10-week PRT program, only the GG significantly improved ($p < .05$) correct and independent performance of 4 PRT exercises and scores on Six-Minute Walk Test (SMWT) and Plank Test compared to the NGG. Both groups significantly improved ($p < .05$) Chest Press 1RM and Leg Press 1RM. After controlling for preintervention differences, ANCOVA found practically and/or statistically significant differences between GG and NGG for postintervention Chest Press 1RM, $F(1, 20) = 3.00$, $p = .100$, $\eta_p^2 = .14$; Leg Press 1RM, $F(1, 20) = 7.25$, $p = .015$, $\eta_p^2 = .29$; SMWT, $F(1, 20) = 10.85$, $p = .000$, $\eta_p^2 = .38$; and Plank Test, $F(1, 20) = 3.49$, $p = .078$, $\eta_p^2 = .16$. **CONCLUSION:** The guided PRT intervention with its familiarization training and technology-enhanced CAT strategies has the potential to promote functional and independent performance in adults with ID.

2109 Board #28 May 28 2:00 PM - 3:30 PM
Which Exercises Close Diastasis Recti Abdominis In Parous Women? An Experimental Cross-sectional Study

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Diastasis recti abdominis (DRA) is defined as an impairment with midline separation of the two rectus abdominis muscles along the linea alba. The condition affects a significant number of women during the antenatal- and postnatal period and is hypothesized to cause abdominal-, pelvic-, and low back pain, decreased abdominal muscle strength, as well as cosmetic concerns. A study among US physical therapists

found that the most commonly used exercises in treatment of DRA were indrawing and pelvic floor muscles (PFM) exercises. However, experimental studies have found that both indrawing and PFM contraction increase the inter-recti distance (IRD). Randomized controlled trials (RCT) are few, and both interventions and results differ between studies. **PURPOSE:** To investigate the immediate effect of different abdominal- and PFM exercises on IRD in women with DRA. **METHODS:** Following power calculation of sample size, 38 parous women were included in this cross-sectional study. 2D ultrasound was used to measure IRD at rest and in random order of eight different exercises. A paired *t*-test was used to compare IRD at rest with IRD recorded during each of the exercises and differences between exercises. Means with 95% confidence intervals (CI) are reported. *P*-value was set to <0.05 . **RESULTS:** Head lift and twisted crunch significantly decreased the IRD, both above and below the umbilicus. Above the umbilicus, the mean difference between rest and head lift was 10 mm (95% CI: 7, 13.2, $p < .001$) and twisted crunch 9.4 mm (95% CI: 6.3, 12.5, $p < .001$). Below the umbilicus, the mean difference between rest and head lift was 6.1 mm (95% CI: 3.2, 8.9, $p < .001$) and twisted crunch 3.5 mm (95% CI: 0.5, 6.4, $p = .02$). PFM contraction, maximal in-drawing and PFM contraction+maximal in-drawing increased the IRD below the umbilicus, mean difference; -2.8 mm (95% CI: -5.2, 0.5, $p = .02$), -4.7 mm (95% CI: -7.2, -2.1, $p < .001$) and -5.0 mm (95% CI: -7.9, -2.1, $p < .001$), respectively. **CONCLUSION:** Head lift and twisted crunch decrease, while maximal in-drawing and PFM contraction increase the IRD. RCTs are needed to investigate whether head lift and twisted crunch are effective in permanently narrowing the IRD. The Norwegian Women's Public Health Association fully funded the study.

2110 Board #29 May 28 2:00 PM - 3:30 PM
Critical Ages For Changes In Isometric Force Production In Women Aged 20 To 89 Years

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Although one of the greatest changes observed with aging is the loss of muscular strength, few studies have identified the onset of these reductions in women with increasing age. **Purpose:** To examine the influence of chronological age on maximal voluntary isometric contraction (MVIC) force for the finger flexors and knee extensors (KE) in recreationally active women. **Methods:** One-hundred and forty-two women (age: 47.1 ± 17.7 years, height: 164.2 ± 7.0 cm, 67.1 ± 10.7 kg), matched for physical activity were included in the present analysis. Participants were selectively recruited to include ≥ 10 participants for each five-year age interval (e.g. 20-24, 25-29 years, etc.). Testing included three separate visits where participants completed three trials of maximal handgrip strength tests (HGS) followed by three trials of KEMVICs performed on the right side of the body. Participants completed each trial within the same hour of day as the initial testing session and all testing visits were completed 7-10 days apart. Segmental analyses were performed in combination with the Davies test to verify critical age periods for mean MVIC values. An age was deemed 'critical' when statistical significance was achieved performing the Davies test *a priori* at $p \leq 0.05$. **Results:** Mean \pm SD for KEMVIC and HGS were 209.2 ± 43.6 Nm and 31.6 ± 4.3 kg, respectively, and model fit for the KEMVIC and HGS across the participants was $r^2: 0.64$ and $r^2: 0.67$ ($p < 0.001$), respectively. The Davies test revealed critical age periods for KEMVIC and HGS of 46.1 ± 3.6 and 66.28 ± 1.29 years, respectively. Both muscle groups displayed marginal losses prior to the respective critical age periods (KEMVIC: -0.45 Nm/year and HGS: -0.03 kg/year), whereas following the critical age period, the reductions increased significantly for both muscle groups (KEMVIC: 2.32 Nm/year, $p < 0.001$; HGS: -0.67 kg/year, $p = 0.03$). Importantly, the segmented model provided a significantly improved fit when compared to linear and quadratic models for KEMVIC ($p < 0.001$ and $p < 0.001$, respectively) and HGS ($p < 0.001$ and $p = 0.027$, respectively). **Conclusion:** These data indicate that muscle groups of the upper and lower body do not display uniform changes with increased age. Although both muscle groups are routinely needed in daily life, the upper body appears to maintain strength until later in life.

2111 Board #30 May 28 2:00 PM - 3:30 PM
Increasing Exercise Is Not Associated With An Increase In Sedentary Time In Obese Adults

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BACKGROUND: It is now established that sedentary time is an independent predictor of morbidity and mortality. Whether increasing exercise is associated with an increase in objectively measured sedentary time is unclear.

PURPOSE: To determine if increasing exercise consistent with consensus recommendations is associated with corresponding increases in sedentary time in abdominally obese adults. **METHODS:** Participants were 98 sedentary adults (BMI 31.8 ± 3.7 kg/m², age 55 ± 7.1 years) randomly assigned to one of the following 4 groups: i) no-exercise control (n=19), ii) low-amount, low-intensity exercise (LALI) (180 and 300 kcal/ session for women and men, respectively, at 50% of VO₂peak, n=24), iii) high-amount, low-intensity exercise (HALI) (360 and 600 kcal/session, respectively, at 50% of VO₂peak, n=36), iv) high-amount, high-intensity exercise (HAHI) (360 and 600 kcal/session, respectively, at 75% of VO₂peak, n=24). All exercise sessions were supervised. Sedentary time was determined objectively by accelerometry measured at baseline, 8, 16 and 24 weeks using established cut-points. **RESULTS:** The mean exercise time for LALI, HALI and HAHl were 31.2 ± 6.7 , 58.3 ± 7.8 and 42.7 ± 4.5 min/day respectively. Corresponding values for sedentary time were 10.6, 10.3, and 10.4 hrs/day respectively. No statistically significant differences in sedentary time at baseline was observed between exercise groups ($p=0.81$). Similarly, no significant difference in the change in sedentary time at 24 weeks was observed between exercise groups ($p=.59$). The mean value for change in sedentary time for the 3 exercise groups combined was -15 mins/day. **CONCLUSIONS:** Increasing exercise consistent with consensus recommendations is not associated with a corresponding change in sedentary time independent of exercise amount or intensity. These observations counter the suggestion that fatigue associated with the adoption of exercise in obese adults may lead to corresponding increase in sedentary time.

2112 Board #31 May 28 2:00 PM - 3:30 PM
VO₂-PO Discordance In Paraplegia; Considerations For Using Power Output To Prescribe Exercise At Various Intensities

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Endurance exercise is often prescribed relative to peak power output (% PO_{peak}) obtained during a graded exercise test (GXT). Persons with spinal cord injury (SCI) conducting arm cycle ergometry (ACE) display a unique VO₂-PO relationship not yet quantified in the context of exercise prescription. Indirect evidence suggests that a relatively low % PO_{peak} will be required to elicit a given % VO₂ during moderate intensity continuous exercise (MICE). Applying this concept of VO₂-PO discordance to high intensity interval exercise (HIIE) prescription, one must consider the possibility for a seemingly moderate intensity % PO_{peak} to elicit a physiological response indicative of HIIE.

PURPOSE: To determine the % PO_{peak} required to elicit a target VO₂ during MICE, and to explore the use of % PO_{peak} to prescribe HIIE in persons with SCI.

METHODS: Ten adult men (39±10 yr) with chronic (13.2±8.8 yr) paraplegia (T2-T10) completed a GXT with 3 min stages where PO increased 20 W-stage⁻¹ from a starting PO (10-40 W) estimated to elicit volitional exhaustion in 8-12 min. Then, in a randomized order, % PO_{peak} was used to prescribe MICE and HIIE. The duration of each session was chosen so that the sessions were isocaloric. During MICE, ΔVO₂/ΔPO was used to estimate the power output that would elicit a steady state 50% VO₂peak. HIIE was completed with 2 min duty cycles at 70:10% PO_{peak}. For HIIE, the last minute of the work or recovery phase was used to calculate the mean VO₂ of working and recovery phases.

RESULTS: Mean cardiorespiratory fitness (19.2±5.2 ml·kg⁻¹·min⁻¹) classified participants as 'good' based on normative data. PO_{peak} was a strong predictor of VO₂peak ($r=.960$, $p<.001$) and VO₂ gain (ΔVO₂/ΔPO) was 10.3 ± 1.8 ml·min⁻¹·W⁻¹. During MICE, 24.6±6.7% PO_{peak} elicited a VO₂ of $53.1 \pm 6.5\%$ VO₂peak (10.1±2.2 ml·kg⁻¹·min⁻¹). During HIIE, the work and recovery phases averaged 88.3 ± 6.7 and $49.2 \pm 6.8\%$ VO₂peak (16.9±4.2 and 9.3±2.2 ml·kg⁻¹·min⁻¹, respectively), and 29.4±7.7% of the session was spent above 80% VO₂peak. MICE and HIIE were isocaloric (115.9±21.8 and 116.6±35.0 kcal, respectively; $p=.903$).

CONCLUSION: Both MICE and HIIE conditions demonstrated evidence of VO₂-PO discordance. These findings emphasize the unique considerations pertaining to the use of % PO_{peak} to prescribe ACE in SCI.

2113 Board #32 May 28 2:00 PM - 3:30 PM
Avoiding Diabetes After Pregnancy Trial In Moms (ADAPT- M): Evaluating Fitness In Postpartum Women Who Have Had Recent Gestational Diabetes Mellitus (GDM)

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Gestational diabetes mellitus (GDM) affects approximately 6% of women, and 20% develop type 2 diabetes (T2DM) by 10 years post delivery with higher rates in non-Caucasian ethnic groups. Early postpartum lifestyle interventions such as physical activity (PA) are recommended to improve health outcomes and reduce future T2DM. Despite benefits of PA, postpartum women report difficulty to engage and adhere to PA due to barriers such as childcare and poor support. Little is known about whether this high-risk group are achieving age-predicted fitness (APF) and meeting PA guidelines.

PURPOSE: To describe cardiorespiratory fitness and PA levels in Caucasian and non-Caucasian women with recent GDM, and the association between fitness and PA measures. **METHODS:** This cross-sectional study recorded baseline data from a multi-ethnic cohort of women with recent GDM at 12 to 20 weeks postpartum, who were part of a health-coaching intervention called Avoiding Diabetes after Pregnancy Trial in Moms (ADAPT-M) between 2014 and 2017. Women underwent a graded exercise treadmill test, anthropometric measures, diastasis rectus screening and completed the International Physical Activity Questionnaire (IPAQ). Baseline characteristics were compared between Caucasian and non-Caucasian ethnicity using T-test, Chi square and Mann-Whitney U tests. The relationship between APF and PA guidelines was assessed with a Chi-Square test. **RESULTS:** We evaluated 149 participants at mean 16.5 ± 4.3 weeks postpartum (mean age 36.7 ± 4.6 years, 70.5% non-Caucasian), had a mean fitness of 9.7 ± 1.9 metabolic equivalents ($98 \pm 19.2\%$ APF), body fat $36.2 \pm 5.6\%$, BMI 29.7 ± 6.8 kg/m², and diastasis rectus was present in 20%. Of those, 52% were below APF while 84.5% were meeting PA guidelines (IPAQ). Non-Caucasian women were significantly less likely to meet PA guidelines ($p=0.0002$) and had lower PA levels ($p<0.001$). Overall, level of PA on the IPAQ did not correlate with APF ($p<0.10$). **CONCLUSION:** Postpartum women with recent GDM had average APF and 84.5% were meeting PA guidelines, although significantly lower levels were seen in non-Caucasian women. Level of PA on the IPAQ did not correlate with APF in this population. Postpartum diabetes prevention programs for women with recent GDM should optimize PA, particularly for higher-risk non-Caucasian ethnic groups.

2114 Board #33 May 28 2:00 PM - 3:30 PM
Pregnancy In Elite Athletes And Their Return To Sport

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PURPOSE: The study aimed to enhance knowledge on pregnancy and return to sport in the postpartum period in elite female athletes.

METHODS: 34 Norwegian elite athletes (33.1 year) and 34 active controls (31.5 year) were asked about training and competitive history, pregnancy-related issues, injuries, eating disorders (ED) and practical experiences, through a questionnaire and interview. Independent Samples T-tests or Chi-square Tests for between-group differences and paired-Samples T-tests and repeated measures ANOVA for within group differences were used.

RESULTS: No group differences in fertility problems, miscarriage, pre-term birth or low birth weight were found. Both groups decreased training volume all trimesters and the first two postpartum periods compared to pre-pregnancy. More athletes (71 %) than controls (32 %) ($p=.002$) returned to sport/exercise at week 0-6 postpartum. We found no group differences in complications during pregnancy and delivery, but athletes reported fewer common complaints such as nausea ($p<.01$), musculoskeletal complaints ($p<.05$) and obstipation ($p<.05$). Twelve percentage of the athletes experienced stress fracture postpartum. Number of athletes with clinical ED (12 %) was reduced postpartum (6 %), while constant in controls (3 %). Athletes were not satisfied with advice related to strength training (18 %) and nutrition (41 %) during pregnancy.

CONCLUSION: Elite athletes and active controls get pregnant easily, deliver healthy babies and decrease training during pregnancy and the first postpartum periods compared to pre-pregnancy. Most athletes and every third control returned to sport or exercise at week 0-6 postpartum. Athletes report limited nutrition guidance, stress fractures and decreased ED postpartum.

2115 Board #34 May 28 2:00 PM - 3:30 PM
Preferred Leg Drives Seated And Bilateral Exercise In Chronic Stroke And Healthy Control
 Jordan Brown¹, Nicholas Siekirk¹, Bradley Kendall², Victoria Pardo³, Qin Lai³, Sujay Galen⁴, Trevor McCready⁵, Samantha Atty⁶, Sam Wilson¹, Jessica Mutchler¹, Tamara Hew-Butler, FACSM³. ¹Georgia Southern University, Statesboro, GA. ²Taylor University, Upland, IN. ³Wayne State University, Detroit, MI. ⁴Georgia State University, Atlanta, GA. ⁵Central Michigan University, Mount Pleasant, MA. ⁶University of Southern California, Los Angeles, CA. (Sponsor: Tamara Hew-Butler DPM, PhD, FACSM, FACSM)
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PURPOSE: The NuStep Cross Trainer (NS) approximates the bipedal and upright stepping pattern. However, it is unknown how the history of stroke may influence recurrent exercise. The purpose of this study was to examine performance outcomes on the NS in a chronic stroke condition (SC) and an age plus sex-matched control (HC). **METHODS:** In order to determine cadence, each participant performed a 10 minute (min) pretest on the NS at an RPE between 12 and 16. After returning to resting HR and BP, participants then performed a 5-min exercise bout on the NS. **Summary of RESULTS:** SC and HC did not differ in age (*Mdn*: 66 years vs. 57 years, respectively) or BMI (Stroke: $M = 27.02 \pm 4.57$ vs. Healthy: $M = 26.46 \pm 4.63$), $p > .05$. There were no differences in RPE, METS, elevation gain (ft), estimated energy cost (k/cal), average (avg.) speed (mph), avg. steps per min, or avg. bilateral power (W) between the HC ($n = 19$) and SC ($n = 15$); $p > .05$. However, HC produced higher total steps ($M = 723.18$ steps \pm 137.64) compared to the SC ($M = 597.67$ steps \pm 116.90); $t(30) = 2.683$, $p = .012$. Total step distance (miles) for the HC (mean rank = 19.74) was also greater than the SC (mean rank = 11.77), $U = 62.0$, $z = -2.363$, $p = .018$. However, Δ avg. pedal power (W) between the HC's limbs (left-right) ($M = -2.00 \pm 3.528$) was not different than SC (affected-non-affected) ($M = -3.50 \pm 4.852$); $t(29) = .997$, $p = .32$. HC Δ ROM (in) (mean rank = 17.50) did not differ from SC (mean rank = 13.62), $U = 85.5$, $z = -1.214$, $p = .252$. The SC did not demonstrate strength deficits on their affected side; $p > .05$. Bilateral comparison revealed the SC's affected side contributed less pedal power ($18.08W \pm 9.61$) than the non-affected side (21.58 ± 10.34); $p = .030$. HC produced higher levels of force on their preferred right leg ($M = 48.68$ lbs \pm 10.05 lbs vs. $M = 44.42 \pm 9.78$); $p < .001$. No ROM difference was observed between limbs in HC or SC; $p > .05$. **CONCLUSION:** Healthy participants covered more distance by producing more steps (not Δ ROM) in the 5-minute exercise bout on the NS. The mechanical coupling of the NS seems to encourage equal ROM contribution, but the preferred leg will contribute higher avg. power in both SC (i.e., via non-affected) and the HC (i.e., via right leg). This study was supported by a grant from the National Institutes of Health, P30 AG015281. And the Michigan Center for Urban African American Aging Research.

2116 Board #35 May 28 2:00 PM - 3:30 PM
Patient-provider Discussions And Postpartum Health Outcomes
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Evidence suggests women value health-related conversations with health care providers, particularly during and after pregnancy. Patient-provider discussions about postpartum mental/physical changes during postpartum care may prepare women to cope with and view postpartum changes more favorably and engage in healthier behaviors after delivery. **PURPOSE:** To examine relationships between patient-provider discussion occurrence and satisfaction and 1) moderate-to-vigorous physical activity (MVPA), 2) body satisfaction, and 3) depressive symptoms postpartum. **METHODS:** Survey data were collected from 230 postpartum women (3-12 months) who received pre/postnatal care in the United States for a singleton pregnancy. Women reported occurrence of (yes/no) and satisfaction with (5-point Likert scale; 1=very dissatisfied, 5=very satisfied) patient-provider discussions about expected postpartum mental and physical health changes, current MVPA, body satisfaction (Body Areas Satisfaction Scale) and depressive symptoms (10-item Center for Epidemiologic Studies Depression Scale). Linear and logistic regression models examined relationships between postpartum patient-provider discussions (occurrence and satisfaction) and current MVPA (any vs. none; meeting recs vs. not meeting recs), body satisfaction, and depressive symptoms. **RESULTS:** Women were 7.2 \pm 2.8 months postpartum at the time of survey completion. Postpartum patient-provider discussions were reported in 73.4% of women. Satisfaction with information provided during postpartum discussions averaged 4.0 \pm 0.8. Overall, 74.3% engaged in any MVPA and 47.4% met recommendations. Women who reported a postpartum discussion were more likely to engage in any MVPA (OR=2.00, 95% CI: 1.06, 3.81). Higher body satisfaction was observed in women reporting postpartum discussions ($p=0.04$)

and greater discussion satisfaction ($p=0.002$). Depressive symptoms were inversely related to discussion satisfaction during postpartum care ($p=0.02$). **CONCLUSION:** Postpartum discussions with healthcare providers may not only benefit physical health, but also mental health and health behavior. Understanding the content of such discussions may help provide insight into what types of discussions can most effectively promote all aspects of postpartum health.

2117 Board #36 May 28 2:00 PM - 3:30 PM
Postpartum Body Composition: A Case Study Of Two Pregnancies
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 (No relevant relationships reported)

Numerous changes to body composition occur during and post-pregnancy in apparently healthy women. Significant changes, specifically to fat mass and bone mineral density, have acute and chronic impacts on overall wellness. **PURPOSE:** The purpose of this case study is to examine the body composition changes of a woman in her 30s over two pregnancies. **METHODS:** Dual-energy x-ray absorptiometry (DEXA) scans were performed before each pregnancy and two weeks, five months, and twelve months after delivery. At each scan the participant was asked about physical activity, lactation status, and supplementation. **RESULTS:** DEXA scan results prior to pregnancy 1 (P1) and pregnancy 2 (P2) were similar for all variables, except total bone mineral density. However, the individual gained considerably more fat during P2 (P1: 15.7 lbs; P2: 28.7 lbs fat gained). Five months post-pregnancy, fat mass was still elevated (P1: 3.8 lbs; P2: 12.7 lbs over baseline) and continued to decrease until 12 months after delivery. Lean mass was increased from baseline at two weeks post-pregnancy (P1: 96.52 lbs.; P2: 97.1 lbs). However, gained lean mass was lost by five months postpartum (P1: 89.89 lbs.; P2: 91.2 lbs). During P1, lean mass remained about the same from five to 12 months but increased at 12 months after P2 (96.2 lbs). After P1, the individual had a substantial decrease in bone mineral density, losing 0.49% at two weeks postpartum, 4.68% at five months, and 9.20% twelve months. Bone mineral density remained below baseline prior to P2, but did not decrease as dramatically following P2. Using the initial baseline, bone mineral density was 3.53% lower at two weeks, 6.57% at five months, and 7.64% at 12 months. During both postpartums, the trunk (P1: 12.1%; P2: 11.54%), spine (P1: 13.5%; P2: 11.36%), and pelvis (P1: 12.4%; P2: 14.34%) decreased more than total bone mineral density. At each appointment, the participant reported breastfeeding, being physically active, but did not exercise consistently. **CONCLUSIONS:** Exclusive breastfeeding combined with an active lifestyle but no formal exercise was adequate to restore fat mass and lean mass by 12 months postpartum. Total bone mineral density decreased following both pregnancies. The baseline bone mineral density for the second pregnancy was lower than the initial baseline, but less decline post-partum.

D-60 Free Communication/Poster - Cardiac
 Thursday, May 28, 2020, 2:00 PM - 4:30 PM
 Room: CC-Exhibit Hall

2118 Board #37 May 28 3:00 PM - 4:30 PM
Sex Differences On Measures Of Pulse Wave Reflection Response To Heavy Battle Rope Exercise
 Alena J. Varner, Erica M. Marshall, Jason C. Parks, Stacie M. Humm, Sarah G. Kearney, Meredith C. Paskert, J. Derek Kingsley, FACSM. Kent State University, Kent, OH.
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PURPOSE: To determine if there are sex-specific responses to heavy battle rope exercise (HRE) on measures of pulse wave reflection. **METHODS:** Twenty-seven resistance-trained individuals (Men: $n=14$, Mean \pm SD: Age: 23 \pm 3 yrs; Women: $n=13$, Age: 22 \pm 2yrs) participated. All measurements were collected at Rest, and 15 (Rec1), 30 (Rec2), and 60 (Rec3) minutes following HRE. Augmentation index (AIx), augmentation index at 75bpm (AIx@75), wasted left ventricle energy (EW), and subendocardial viability ratio (SEVR) were recorded via applanation tonometry. HRE utilized six 15-second exercise bouts using a double wave pattern (180bpm), with 30-second seated recovery. Two-way repeated measures ANOVAs were used to determine sex differences across time. **RESULTS:** There were significant sex by time interactions for AIx ($p = 0.003$), AIx@75 ($p = 0.029$), and EW ($p \leq 0.001$). AIx for men was augmented compared to women during Rec1, Rec2, and Rec3 (Men= Rest: 9.4 \pm 9.6 %, Rec1: 31.4 \pm 13.1 %, Rec2: 18.3 \pm 12.4 %, Rec3: 18.6 \pm 8.3 %; Women= Rest: 10.5 \pm 10.8 %, Rec1: 21.1 \pm 10.6 %, Rec2: 12.6 \pm 7.3 %, Rec3: 7.1 \pm 5.7 %).

Alx@75 for men was augmented during Rec1, Rec2 and Rec3 compared to women (Men= Rest: 0.4 ± 7.6 %, Rec1: 33.6 ± 12.4 %, Rec2: 20.1 ± 13.3 %, Rec3:15.8 ± 9.9 %; Women= Rest: 16.8 ± 39.5 %, Rec1: 33.6 ± 12.4 %, Rec2: 20.1 ± 13.3 %, Rec3: 15.8 ± 9.9 %). EW for men was augmented compared to women during Rec1, Rec2, and Rec3 (Men= Rest: 305.4 ± 219.6 dynes/sec/cm-2, Rec1: 2153.5 ± 866.7 dynes/sec/cm-2, Rec2: 1235.3 ± 779.5 dynes/sec/cm-2, Rec3: 1212.0 ± 593.7 dynes/sec/cm-2; Women= Rest: 258.4 ± 248.2 dynes/sec/cm-2, Rec1: 1257.3 ± 656.7 dynes/sec/cm-2, Rec2: 706.1 ± 688.9 dynes/sec/cm-2, Rec3: 331.9 ± 287.2 dynes/sec/cm-2). Compared to Rest, Alx, Alx@75, and EW for men was significantly greater during Rec3, while Rec3 for women returned to Rest. SEVR had a significant main effect of time ($p \leq 0.001$), in that Rest was augmented compared to Rec1, Rec2, and Rec3 for both sexes (Men= Rest: 159.4 ± 26.0 %, Rec1: 92.3 ± 14.2 %, Rec2: 103.9 ± 27.6 %, Rec3: 127.6 ± 22.4 %; Women= Rest: 142.4 ± 25.3 %, Rec1: 83.2 ± 15.5 %, Rec2: 109.0 ± 21.3 %, Rec3: 129.3 ± 22.0 %). **CONCLUSION:** These data suggest sex differences in pulse wave velocity after HRE. There was a greater decrement of left ventricular function in men up to 60 minutes, and women recovered faster following HRE.

2119 Board #38 May 28 3:00 PM - 4:30 PM
Exercise Training Improves High Blood Pressure Variability-induced Cardiac Damage In Normotensive Rats

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 (No relevant relationships reported)

High blood pressure variability (BPV) at rest is harmful to organ perfusion even if blood pressure (BP) is within normal values. Exercise training (ET) is known for its effectiveness in reducing BP and BPV; however, the effects of high BPV without sustained hypertension are unclear. **PURPOSE:** To study the effects of ET in cardiac morphofunctional parameters in an experimental model of high BPV. **METHODS:** Normotensive rats (256±4 g, mean BP 110±4 mmHg) underwent sinoaortic denervation (SAD) or sham surgery. SAD consists of baroreceptors afferent arm resection, thus increasing BPV. After 1 week of SAD, rats were divided into sedentary or trained. ET was performed on a treadmill (10 weeks, 5x/week, 60-70% of VO₂ max). After this period, BP and heart rate (HR) were directly measured (Windaq, 2kHz). Cardiovascular autonomic modulation and spontaneous baroreflex sensitivity were analyzed in frequency domain (Matlab). Echocardiography and cardiac histomorphometry were also performed. Two-way ANOVA was used to compare groups; numeric results are described when $p < 0.05$; 8 rats/group were used. **RESULTS:** When compared to control, SAD increased BPV in 5x, as well as the % of cardiac collagen in 2.5x, and the diastolic parameter isovolumetric relaxation time (IVRT) (21±1 vs. 35±1 ms); whereas it reduced VO₂ max (-20%) and the cardiac capillary density (-54%). In sham rats, ET reduced resting HR (-50 bpm/14%), while cardiac vagal modulation (+8.5%), baroreflex sensitivity (+55%), cardiac capillary density (+45%), and VO₂ max (+10%) were augmented. In contrast, ET in SAD increased both HR (~+30 bpm/8%) and cardiac sympathetic modulation (~+50%), with no alterations in baroreflex and vagal modulation. Interestingly, ET in SAD rats improved BPV (-30%), VO₂ max (+9%), IVRT (-6 ms/17%), collagen content (-29%) and capillary density (+50%) in the heart. BPV was highly associated with VO₂ max ($r = -0.74$), collagen $(r = 0.87)$ and capillary density ($r = -0.72$). **CONCLUSION:** High BPV by SAD impaired cardiac function, morphology, and autonomic nervous system. ET ability to decrease BPV was associated with better aerobic capacity and cardiac morphology, even without improvements in BP, HR and autonomic modulation. Therefore, ET-induced cardiac adaptations do not depend, at least in part, on baroreceptors signaling to central commands.

2120 Board #39 May 28 3:00 PM - 4:30 PM
The Affection Of Different Weeks Hiit And Moderate Intensity Aerobic Exercise For Cardiac Muscle'S Ampk And Pgc1 α Of Rats

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 (No relevant relationships reported)

PURPOSE: Through the research about the affection of different weeks HIIT and moderate-intensity aerobic training on cardiac muscle oxidative ability and cardiorespiratory fitness to determine the effective load of HIIT and MICT to improve the cardiorespiratory fitness. **METHODS:** 120 6-week-old male Wistar rats were randomly divided into 4 groups (N=30): 2 week Group (C), 4 week Group (D), 6 week Group (E), 10 week Group (F). Each group contains a control, moderate-intensity training with HIIT three teams, 10 rats in each group. Rats in the control group didn't exercise, the training program

of exercise group rats were depended on the Results of the maximal oxygen uptake test. 50 minutes exercise per day and 5 times per week. Rats in each group after the prescribed number of weeks were collected cardiac muscle. Protein levels of AMPK and PGC-1α were detected by Western blotting. SPSS17.0 for data analysis. **RESULTS:** 1. 2 weeks and 10 weeks of HIIT group on improving of rat cardiac muscle oxidative capacity and cardiovascular fitness has a significant impact ($P < 0.05$); 2. HIIT on aerobic capacity in rats at 10 weeks improved most significantly ($P < 0.05$), MICT on aerobic capacity of rats had no significant effect in 10 weeks; 3. The change of AMPK and PGC-1α and Vo₂max in the HIIT group are more consistent than its in the MICT group. **CONCLUSION:** 1. HIIT is more effective than Moderate-intensity continuous training in the way to improve aerobic capacity; 2. Effect of Long-term HIIT can be more pronounced in respect of enhancing aerobic capacity; 3. HIIT can promote cardiac muscle aerobic capacity through AMPK/PGC-1α Signaling Pathway.

The Pgc1 α levels in different groups				
Group	2weeks	4weeks	6weeks	10weeks
CON	1.00±0.00	1.00±0.00	1.00±0.00	1.00±0.00
MICT	1.12±0.38	1.06±0.03	0.76±0.12	1.15±0.04
HIIT	0.95±0.24	0.91±0.03	1.09±0.43	1.32±0.26

The AMPK levels in different groups				
Group	2weeks	4weeks	6weeks	10weeks
CON	1.00±0.00	1.00±0.00	1.00±0.00	1.00±0.00
MICT	1.04±0.26	1.16±0.30	0.97±0.26	1.16±0.14
HIIT	0.93±0.22	0.83±0.19	1.17±0.36	1.28±0.17

2121 Board #40 May 28 3:00 PM - 4:30 PM
COMPARISON OF THE 'SEATTLE' AND 'INTERNATIONAL' CRITERIA ELECTROCARDIOGRAM INTERPRETATION IN DIVISION II COLLEGE ATHLETES

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PURPOSE: A 12-lead exercise stress test is a screening tool used to detect abnormalities that may predispose collegiate athletes to sudden cardiac death. Experts in the field have developed new standardized criteria to better interpret electrocardiogram (ECG) in athletes. The purpose of this study was to compare the Seattle criteria to the most recently created International criteria in regards to ECG abnormalities in Division II collegiate athletes. **METHODS:** Fifty-two athletes (Males = 26; Females = 26) completed cardiovascular screening with a resting 12-lead ECG analysis which was read and interpreted according to each criteria by an expert in the field of exercise science. ECGs were classified as 'normal' and 'abnormal' according to the parameters of each criteria and the abnormal condition was noted. Chi-square analysis was used to assess differences between criteria. **RESULTS:** The total number of ECGs identified as abnormal decreased from 6 (11.5%) using the Seattle Criteria to 1 (1.9%) using the International Criteria ($p < 0.05$). The most common ECG abnormality identified using the International Criteria was T wave inversion 6 (11.5%). The newer definition of pathological Q waves reduced the number of ECGs identified as abnormal from pathologic Q waves from 3 (Seattle) to 1 (International) (66% reduction; $p < 0.05$). **CONCLUSIONS:** Following the International Criteria for ECG interpretation significantly reduces the total abnormal and false-positive ECG rates in DII collegiate athletes compared to the Seattle Criteria without compromising sensitivity

2122 Board #41 May 28 3:00 PM - 4:30 PM
Effect Of Astragalus Injection Combined With Aerobic Exercise On Myocardial Renin-angiotensin System In Diabetic Mice

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Abstract: **PURPOSE:** This investigation aimed at investigating the synergistic effect of Astragalus injection combined with aerobic exercise on myocardial renin-angiotensin system in diabetic mice, and clarify whether the myocardial disease of diabetic mice is improved. **METHODS:** 32 6-week-old male db/db mice were randomly

divided into 4 groups, Diabetes mellitus group, Astragalus injection group, Swimming group and Astragalus injection + swimming group. Monitor the amount of drinking water, body weight and blood glucose changes. The myocardial tissue was executed after 6 weeks and the ventricular mass index was calculated; detect the angiotensin II (Ang-II), angiotensin-converting enzyme (ACE) and angiotensin converting enzyme 2 (ACE2) in each group of myocardium tissues. **RESULTS:** In addition to diabetic group, the ventricular mass index of each group was elevated ($P < 0.05$). In addition to the diabetic group, the Ang-II levels of myocardial tissues were decreased ($P < 0.05$). In addition to the diabetic group, the ACE and ACE2 levels averaged increased ($P < 0.05$). **CONCLUSIONS:** Myocardial ACE, ACE2 enzyme activity is generally low, Ang-II content is also higher than other groups, and the decrease of enzyme activity will promote the increase of Ang-II content, indicating that renin-angiotensin system is overactivated, resulting in strong vasoconstriction and myocardial ischemia and hypoxia, and eventually lead to all kinds of cardiomyopathy. After the intervention of astragalus membranaceus or aerobic exercise, the activity of ACE, ACE2 enzyme was increased and the level of Ang-II content was also significantly suppressed. Astragalus membranaceus or aerobic exercise had a positive effect on renin-angiotensin system in myocardial tissue of diabetic mice, and played a protective role in the myocardium of diabetic mice. It was speculated that there was a great deal of inhibition on renin-angiotensin system in myocardium of diabetic mice. It may be achieved by increasing the enzyme activity of ACE2 to inhibit the formation of Ang-II in diabetic myocardial tissue.

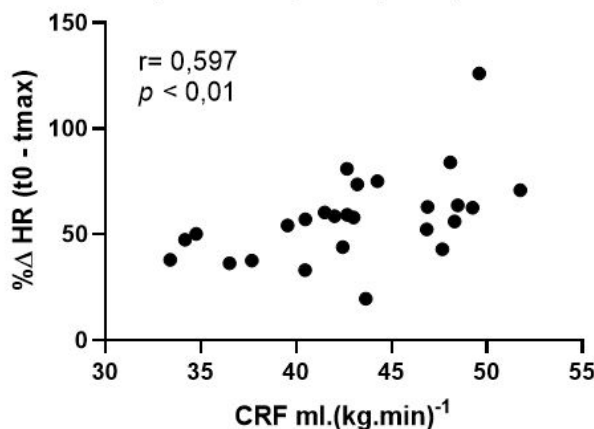
FUNDING: This study was supported by Practical Innovation training Program for College students in Jiangsu Province (201510330021Y).

2123 Board #42 May 28 3:00 PM - 4:30 PM
Cardiorespiratory Fitness And Cardiac Autonomic Function In Brazilian Firefighters

João Paulo Araujo Barbosa, Kevin Alves Barreto, Daniel RF Saint-Martin, Edgard MKVK Soares, Mayda Castro, Rosenkranz Maciel Nogueira, Guilherme E. Molina, Luiz Guilherme Grossi Porto. *Universidade de Brasilia, UnB e Grupo de Estudos em Fisiologia e Epidemiologia do Exercício e da Atividade Física - GEAFS, Brasilia, Brazil.*
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INTRODUCTION: There are many ways to indirectly determine the autonomic balance, such as by means of heart rate variability, Valsalva maneuver and active orthostatic stress (AOS). In an AOS test, heart rate (HR) shows a bimodal behavior with a fast HR increase that is explained mainly by vagal withdrawal and a subsequent HR decrease, associate to a vagal reactivation and baroreflex control. Studies have shown a controversial relationship between cardiorespiratory fitness (CRF) and the cardiac autonomic function. **PURPOSE:** To correlate CRF and the vagal withdrawal response to AOS in Brazilian firefighters. **METHODS:** We evaluated 26 male military firefighters. AOS test was performed in the morning immediately before the on-duty period. A Heart Rate monitor was used to continuously record HR during AOS. Jackson's questionnaire was used to estimate CRF. The relative difference between the basal (supine) and peak HR (orthostatic) during AOS ($\% \Delta \text{HR} [t_0 - t_{\text{max}}]$) was calculated to express the vagal withdrawal in relation to basal HR. Due to a nonparametric distribution Spearman correlation test was used ($p \leq 0.05$). **RESULTS:** We observed a positive correlation ($r = 0.597, p < 0.01$) between $\% \Delta \text{HR} (t_0 - t_{\text{max}})$ and CRF (Figure 1). **CONCLUSION:** It was shown that the higher the cardiorespiratory fitness (CRF), the greater the vagal withdrawal as evaluated by $\% \Delta \text{HR} (t_0 - t_{\text{max}})$. Besides being necessary for job-task performance, higher CRF seems to be associated with an improved cardiac autonomic function in firefighters. CRF may be a protective factor for autonomic disorders in firefighters.

Figure 1: Spearman correlation between CRF and HR response during AOS (n = 26)



2124 Board #43 May 28 3:00 PM - 4:30 PM
40 YEARS OF SECULAR TREND OF RESTING HEART RATE IN 12-14 YEARS-OLD STUDENTS

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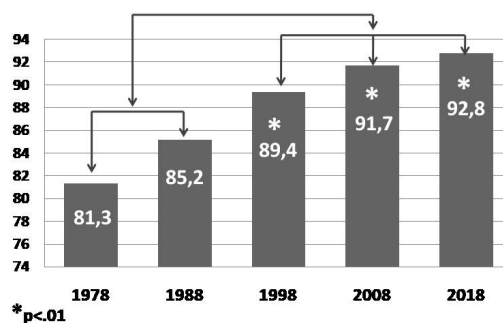
PURPOSE: To compare the behavior of rest heart rate (RHR) during four decades in schoolchildren

METHODS: Data were obtained from the Ilhabela Mixed Longitudinal Project of Growth and Development from Ilhabela, organized since 1978 with 2 appraisals a year, carried out during the months of May and October. Sample consisted of 262 boys from 12-14 years old, divided into 5 periods: 1978 (n = 41), 1988 (n = 43), 1998 (n = 61), 2008 (n = 52) and 2018 (n = 65). Measures included body weight, height, BMI, and Rest Heart Rate, that was measured by stethoscope before starting a cycle ergometer test. It was taken an ANOVA one-way to compare the RHR from each decade, followed by Scheffé post-hoc test; with a significant level of $p < .01$.

RESULTS: Figure 1 shows that RHR was significant higher in 1998, 2008, and 2018 when compared to 1978 and 1988. The percent delta of each decade RHR from 1998, 2008 and 2018 was 9.1%, 11.3%, and 12.4% higher than the 1978 values, respectively. RHR from 1998, 2008, and 2018 were 4.7%, 7.1%, and 8.2% higher than in 1988, respectively.

CONCLUSIONS: In 40 years there was a positive secular trend of resting heart rate among adolescents from Ilhabela. It was hypothesized that this increase may be related to changes in the students lifestyle and in the environment they live, which may have contributed to a hypokinetic behavior, reducing the level of physical fitness, and resulting in a cardiac overload.

Figure 1 – Secular Trend of Resting Heart Rate



THURSDAY, MAY 28, 2020

2125 Board #44 May 28 3:00 PM - 4:30 PM
Echocardiographic Characteristics Of Endurance And Non-Endurance Competitive Athletes

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 (No relevant relationships reported)

PURPOSE: To compare echocardiographic measures between endurance and non-endurance athletes.

METHODS: Echocardiographic studies were performed in 250 well-trained male and female subjects aged between 13 and 38 years (Age = 20.9 ± 5.5 years, BMI = 22.7 ± 3.3 kg/m²; mean ± SD). Twenty-five variables were analyzed. Statistical summaries stratified by gender and age group were initially produced. Afterwards, the subjects aged 15 years or over (n = 224) were classified into two categories according to the characteristics of their sport discipline: "Endurance" (cardiorespiratory endurance) and "Other" (Non-Endurance). Univariate comparisons between the two groups were conducted within each gender stratum in a subset of fifteen variables: Heart rate (HR), Left ventricular diastolic diameter (LVDD), Left ventricular diastolic diameter index (LVDDI), Interventricular septum thickness (IST), Left ventricular shortening fraction (LVSF), Left ventricular posterior wall thickness (LVPWT), Relative wall thickness (RWT), Left ventricular mass index (LVMI), Left auricular diameter (LAD), Aortic root diameter (ARD), Inferior vena cava diameter (IVCD), E/A ratio (EAR), E/e' ratio (E/e'), Right ventricular systolic velocity (RVS) and Left ventricular global longitudinal strain (GLS). The Student's *t*-test for independent samples was applied. Statistical significance was declared at the 0.05 level.

RESULTS: In men, statistically significant higher values were identified in the endurance group for IST (10.5 ± 0.2 vs. 9.7 ± 0.1 mm), LVPWT (9.4 ± 0.1 vs. 8.8 ± 0.1 mm), RWT (0.33 ± 0.005 vs. 0.32 ± 0.004), LVMI (117.2 ± 3.0 vs. 104.5 ± 2.3 mm) and LAD (39.2 ± 0.5 vs. 37.5 ± 0.4 mm); and in women, the endurance group had significantly lower HR values (60.1 ± 1.8 vs. 64.5 ± 1.2 beats/min), and significantly higher LVDDI (31.6 ± 0.5 vs. 29.2 ± 0.3 mm/m²) and LVMI (95.9 ± 2.6 vs. 82.4 ± 1.7 mm) values; (mean ± SE).

CONCLUSIONS: Most of the echocardiographic variables showed higher sample means in the endurance athletes, although not all the differences were statistically significant. The endurance group showed significantly higher values of left ventricular wall thickness and left auricular diameter in men, and significantly higher values in variables related to the left ventricular eccentric hypertrophy in women.

2126 Board #45 May 28 3:00 PM - 4:30 PM
Associations Between Sedentary Behavior And Steps With Heart Rate Variability In Desk Workers

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PURPOSE: More sedentary behavior (SB) has been associated with reduced heart rate variability (HRV) in blue-collar workers; however, this association has not yet been examined in desk workers who engage in high levels of SB. This study explored associations between SB and steps/day with HRV in desk workers. **METHODS:** This analysis of baseline data of a subsample of participants from an ongoing clinical trial included thirty-three insufficiently active adults (age: 43.7 ± 11.6 yr; BMI: 30.0 ± 6.3 kg/m²) with desk jobs and elevated blood pressure. An activPAL3 micro device was placed on the anterior midpoint of the thigh for one week to measure SB and steps. Total and prolonged (≥30 continuous minutes) SB and total steps/day were averaged across valid days for participants with ≥10 hr/day on ≥4 days. For HRV, beat-to-beat intervals were collected during a 10-min supine rest using a Polar V800 monitor, with the last 5 min analyzed using Kubios software to measure parasympathetic-related HRV parameters including: mean R-R intervals, root mean square of successive differences (RMSSD), standard deviation of normal R-R intervals (SDNN) and high frequency (HF). Natural-log (ln) transformation was applied for skewed HRV variables. Simple and partial Pearson's correlations between SB, steps/day and HRV parameters were calculated before and after controlling for age. **RESULTS:** Correlations were not statistically significant between total or prolonged SB with any of the HRV parameters (Table 1.). Steps/day were correlated with mean R-R intervals (r = .371; p = .034), with the correlation attenuated when controlling for age (r = .320; p = .075). No other significant correlations were detected between steps/day and other HRV parameters. **CONCLUSION:** While SB was not correlated to HRV, more steps/day were related to greater parasympathetic-related HRV in adults with desk jobs. These results may suggest that movement rather than SB should be the focus of approaches to enhance HRV.

Table 1. Correlation between sedentary behavior, steps per day and HRV parameters.

	Total sedentary time	Prolonged sedentary time (≥30 min bouts)	Steps/day
Mean R-R	r = -.200; p = .265	r = -.163; p = .364	r = .371; p = .034*
lnRMSSD	r = -.006; p = .974	r = -.094; p = .604	r = .131; p = .468
lnSDNN	r = -.052; p = .776	r = -.117; p = .515	r = .145; p = .420
lnHF	r = -.030; p = .869	r = -.076; p = .675	r = -.080; p = .658

* indicates significant correlation at p < .05; r = Pearson's correlation; lnRMSSD, natural logarithmic root mean square of successive differences; lnSDNN, natural logarithmic standard deviation of R-R; lnHF, natural logarithmic high frequency.

2127 Board #46 May 28 3:00 PM - 4:30 PM
Effect Of Aerobic Exercise On Cardiac Diastolic Dysfunction: Role Of Heat Shock Protein 27

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Purpose: To evaluate the role of heat shock protein 27 (HSP27) in the effect of aerobic exercise on cardiac diastolic dysfunction in type 2 diabetic rats.

Methods: Forty male Sprague-Dawley rats were randomly divided into four groups: control (C), aerobic exercise (A), diabetes (D), and diabetes plus aerobic exercise (DA). Type 2 diabetes was induced by feeding with a high-fat high-sugar diet for 7 weeks followed by a single intraperitoneal injection of streptozotocin (30mg/kg) in the rats. Aerobic exercise was performed on a rodent treadmill at 21m/min for 60 min, 5 days per week for 8 weeks. Metabolic factors, such as fasting blood glucose (FBG), triglycerides (TG), cholesterol (CHOL) and lipoproteins, were determined by a standard procedure. Cardiac structure and function, such as left ventricular diastolic upper diameter (LVIDd), left ventricular diastolic terminal volume (EDV) and ejection fraction (EF), were measured using echocardiography. Myocardial HSP27 protein expression and phosphorylation were determined using western blot, and myocardial HSP27-titin colocalization were determined using double immunofluorescence. Two-way ANOVAs with post-hoc tests were used to assess differences between groups.

Results: No pathological changes were observed in the myocardial structure in all four groups. Compared to the C group, the D group had significantly higher levels of FBG, TG, and CHOL (all p<0.01), and significantly lower LVIDd and EDV (both p<0.01). Compared to the D group, the DA group had significantly lower levels of FBG, TG, and CHOL (all p<0.01) and significantly higher LVIDd and EDV (both p<0.05). Interestingly, compared to the C group, the D group showed significantly lower myocardial HSP27 phosphorylation and HSP27-titin colocalization (both p<0.05), while the DA group showed significantly higher myocardial HSP27 protein expression and phosphorylation, and HSP27-titin colocalization than the D group (all p<0.01). **Conclusion:** Decreases in myocardial HSP27 phosphorylation and HSP27-titin colocalization are likely involved in early diastolic dysfunction in diabetic rats. Increased HSP27 phosphorylation and titin colocalization may be an important mechanism by which aerobic exercise restores diastolic function in diabetic rats.

2128 Board #47 May 28 3:00 PM - 4:30 PM
Cardiac Autonomic Function Is Associated With Blood Pressure And Cardiovascular Disease Risk In Adults

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Risk of cardiovascular disease (CVD) can begin as early as young adulthood. With the prevalence of CVD in the United States expected to increase as the population ages, strategies for the early identification of CVD risk are needed to improve interventions and reduce the future burden of CVD. Cardiac autonomic dysfunction, measured non-invasively through heart rate variability (HRV), has been suggested as an early marker of CVD. Reduced HRV is associated with increased CVD risk among older adults or those with existing metabolic disease, but data are limited in young adults.

PURPOSE: This study examined the association between HRV and a commonly used CVD risk prediction variable, systolic blood pressure (SBP), and 30-year Framingham risk score as a measure of long-term CVD risk, in a cohort of young adults. **METHODS:** A total of 23 females (24.8 ± 1.9 yr) and 17 males (26.0 ± 2.3 yr) performed study measurements in one visit. Assessments included 10-minute seated HRV collection using a wearable sensor, blood pressure, waist circumference and body mass index. HRV data were filtered and visually inspected for artifacts. The root mean square of successive differences in the time domain (RMSSD) was used as the variable

of interest. The 30-year Framingham risk score was calculated from sex, age, SBP, body mass index and antihypertensive treatment, smoking, or diabetes mellitus status. Multiple linear regression was used to investigate the association between RMSSD and SBP or 30-year risk score, adjusted for sex. **RESULTS:** Hypertension was observed in 43% of females and 76% of males. RMSSD was inversely associated with SBP ($p = 0.01$, $\beta = -0.11$) and 30-year risk score ($p=0.217$, $\beta = -1.9$). Sex significantly influenced the association between RMSSD and SBP ($p<0.05$). **CONCLUSIONS:** In this limited sample, our data suggest that lower HRV is associated with higher SBP and higher CVD risk. Because 30-year risk score is designed to better discriminate long-term CVD risk from multiple factors, this supports the predictive capacity of reduced HRV as an early marker of CVD. Further research is needed to determine whether additional factors, such as race disparities, physical activity level or metabolic variables, can influence this association. Supported by NIGMS/NIH UL1GM118979, TL4GM118980 and RL5GM118978.

2129 Board #48 May 28 3:00 PM - 4:30 PM
Utility Of Serial Short-time Indices Of HRV And Cardiac Dynamics Throughout The Day

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Short-time indices of heart rate variability (HRV) and cardiac regulatory dynamics (CRD) throughout a 24-hr recording may provide an alternative to the collection of a full 24-hr recording, however, methodological approaches need to be further evaluated. **PURPOSE:** The purpose of this study was to examine the robustness of various methodological approaches of short-time indices of HRV and CRD throughout a 24-hr period.

METHODS: Eight healthy males completed two 24-hr visits. R-R intervals were recorded continuously using a heart rate monitor. Measures of HRV include the root mean square of successive R-R intervals (RMSSD) and the standard deviation of R-R intervals (SDNN), while CRD was assessed using sample entropy (SampEn). Each 24-hr recording was separated into 145 epochs to create a new time-series (HRV_{ep}). Length and position of these epochs were varied around every 10th-min: the 3-min before every 10th-min (B3), the 3-min following every 10th-min (A3), the 3-min splitting every 10th-min (S3), and the 5-min splitting every 10th-min (S5). The dimensionality and complexity of each of these epoched profiles were subsequently analyzed. Tests of equivalence (TOST) were used to compare the raw values of rMSSD, SDNN, and SampEn between epoching methods at the individual level while paired TOST tests were used to examine the dynamics of these epoched profiles between epoching methods.

RESULTS: TOST test between epoching methods of the raw values for rMSSD_{ep} and SDNN_{ep} at the individual level were equivocal ($p>0.05$), whereas SampEn_{ep} showed equality ($p<0.05$). Further analysis of paired TOST test comparing the embedding dimension and complexity of HRV_{ep} showed inequality in the optimal embedding dimension of these time-series and statistical equality ($p<0.01$) between the complexity of these time-series.

CONCLUSIONS: Epoch-by-epoch analysis of rMSSD_{ep} and SDNN_{ep} were not equal whereas SampEn_{ep} was equivalent across epoching methods. Although the optimal embedding dimension of these time-series varied between epoching methods, the complexity of these time-series were similar between methods for all indices of HRV_{ep}.

2130 Board #49 May 28 3:00 PM - 4:30 PM
Exercise Training Improves Cardiac Autonomic Responses In Obese Women Undergoing Bariatric Surgery

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Obesity is associated with cardiovascular autonomic dysfunction. Bariatric surgery improves cardiovascular health, which might be partly attributed to alterations in the autonomic nervous system. However, the benefits from surgery are limited, and it is

currently unknown whether exercise training can further improve cardiac autonomic regulation in post-bariatric patients. **PURPOSE:** To examine the effects of exercise training on cardiac autonomic responses in women undergoing bariatric surgery. **METHODS:** Sixty-two obese women were randomly allocated to receive either bariatric surgery (RYGB) or bariatric surgery followed by exercise training (RYGB+ET). At baseline (PRE), and 3 (POST3) and 9 (POST9) months after surgery, we assessed chronotropic response to exercise (CR%) and heart rate recovery; i.e., the decay of heart rate after 30 (HRR30s), 60s (HRR60s) and 120s (HRR120s) after a maximal exercise test. The 6-month exercise intervention started at POST3 for RYGB+ET, while RYGB followed standard care.

RESULTS: Analysis of relative changes (Δ from POST9-PRE) revealed higher CR% ($\Delta=8.56\%$, CI95% 0.22-19.90, $P=0.0445$), HRR30s ($\Delta=12.98$ beat/min, CI95% 4.29-21.67, $P=0.01$), HRR60s ($\Delta=22.95$ beat/min, CI95% 11.72-34.18, $P=0.01$) and HRR120s ($\Delta=34.54$ beat/min, CI95% 19.91-49.17, $P<0.01$) in the exercised group. Both groups demonstrated similar reduction in the frequency of individuals showed incompetence chronotropic (defined as chronotropic response less than 80%) at POST3 and POST9). The proportion of participants with blunted HRR decreased at POST3 in both groups; interestingly, exercise training further decreased this proportion at POST9 from 56% to 5%. Moreover, the proportion of blunted HRR in RYGB+ET was significantly lower than in RYGB at POST9 (5% vs. 31%, $P=0.045$, respectively). **CONCLUSIONS:** A 6-month exercise training program is an effective strategy to improve cardiac autonomic responses during and post-exercise recovery in obese women undergoing bariatric surgery. These findings reinforce the relevant cardioprotective role of exercise for post-bariatric patients. Clinicaltrials.gov: NCT02441361

2131 Board #50 May 28 3:00 PM - 4:30 PM
Effects Of Weight Stigma On Cardiovascular Reactivity Among Women With High And Normal Blood Pressure

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In a recent systematic review, we reported evidence that exercise and nutrition professionals stigmatize their patients due to their weight in 81% of 31 studies. Being weight stigmatized is associated with adverse cardiovascular health consequences for unclear reasons; but may be due to the heightened cardiovascular reactivity that accompanies obesity and hypertension. **PURPOSE:** We examined the influence of two video exposures, one containing scenes of weight stigma (STIGMA) and the other non-stigmatizing neutral (NEUTRAL) scenes, on cardiovascular reactivity assessed by resting and ambulatory blood pressure (ABP) and heart rate (HR), among women with obesity and high blood pressure (HBP; $n=24$) or normal BP (NBP; $n=25$). **METHODS:** Women completed a screening visit and two randomized visits which involved watching a 10-min STIGMA and NEUTRAL video exposure. Laboratory BP and HR were measured before, during, and after the videos. ABP and HR were measured upon leaving the laboratory for the awake (10hr), sleep (9hr), and 19hr. A repeated measures ANCOVA tested the difference in BP and HR changes from baseline between the BP groups after STIGMA vs NEUTRAL controlling for BMI and baseline BP and HR in the laboratory and over ambulatory conditions. **RESULTS:** Women with HBP (systolic/diastolic BP [SBP/DBP]= 122.9 ± 13.6/73.5 ± 11.2mmHg) were 37.5 ± 9.1yr and obese (Body Mass Index [BMI] = 37.8 ± 6.1kg·m²); women with NBP (SBP/DBP=106.9 ± 7.4/65.0 ± 7.1mmHg) were 34.1 ± 8.9yr and obese (BMI= 33.6 ± 4.9kg·m²). Laboratory SBP/DBP increased 5.5 ± 7.3/2.4 ± 8.8mmHg more in HBP than NBP after STIGMA vs NEUTRAL ($P<0.05$), with no difference in HR ($P>0.05$). ABP increased more in HBP than NBP over sleep (SBP / DBP= 4.2 ± 20.6/4.7 ± 14.2mmHg; $P<0.05$) and 19hr (SBP / DBP = 0.9 ± 15.2/0.4 ± 10.8 mmHg; $P<0.05$) after STIGMA vs NEUTRAL. During sleep, HR increased 7.5 ± 15.7bpm more in HBP than NBP after STIGMA vs NEUTRAL ($P<0.05$). **CONCLUSION:** Exposure to a weight stigma video resulted in greater cardiovascular reactivity in women with obesity and HBP than NBP in the laboratory and under ambulatory conditions, most notably during sleep. Our findings reveal the importance of educating health professionals about weight stigma, and its immediate, yet persistent adverse cardiovascular health effects, and developing interventions to mitigate weight stigma.

2132 Board #51 May 28 3:00 PM - 4:30 PM
The Influence Of Social Evaluation On Heart Rate Variability And Motor Performance: A Study Of “Real-Life” Competition

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It is well known that stress affects performance. Heart rate variability (HRV), which has become a general indicator of stress, can be measured to examine autonomic balance. **PURPOSE:** To examine HRV in participants to determine how competitive stress affects performance. **METHODS:** Participants (n=17) from the University of Maryland Reserve Officers’ Training Corps (ROTC) program completed two testing sessions: a performance alone condition (PA) and a competition condition (C). Participants completed a dry-fire pistol shooting task of 40 shots per condition. PA condition was executed without any evaluation of performance. C condition involved direct comparison to another study participant as well as superior officer observation and monetary compensation. Electrocardiogram (EKG) was collected using a Thought Technology Procomp2 system. EKG was sampled at 256 Hz through a single chest lead. HRV was analyzed through QRSTool and Kubios HRV. HRV measures were SDNN and RMSSD. **RESULTS:** SDNN decreased by condition (F (1, 16) = 3.668, p = .074, d = 0.464). RMSSD decreased by block, but not by condition (F(1, 16) = 4.557, p < .05, d = 0.517). Cortisol response ANOVA revealed a significant main effect of condition (F (1, 16) = 12.02, p = .003, d = 1.05) such that cortisol was higher during C compared to PA. **CONCLUSION:** The decrease in SDNN indicates a decrease in HRV in response to increased stress. This decreased HRV reflects a change in autonomic balance which is negatively correlated with adaptability and resilience. The decrease in RMSSD represents decreased parasympathetic modulation of heart rate. Although not measured directly, it is likely that participants experienced moderate fatigue throughout blocks. As cerebral cortical activity increased during C, one can speculate that the difference observed was influenced by the shift toward lower parasympathetic activity (i.e. reduced afference to the cortex).

2133 Board #52 May 28 3:00 PM - 4:30 PM
Caffeine In Conjunction With Resistance Exercise On Vagal Modulation In Resistance-trained Women

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PURPOSE: To examine the effects of caffeine alone, or in conjunction, with acute resistance exercise, in resistance-trained women on performance and measures of vagal modulation.

METHODS: Eleven resistance-trained women (Age Mean±SD: 24±4yrs) consumed either a placebo (PL) or caffeine (4mg/kg) 72 hours apart, in a double-blind, crossover fashion. Forty-five minutes following supplementation, participants performed two sets of 10 repetitions at 75% 1-repetition maximum (1RM), and one set with repetitions to failure at 70% 1RM on the squat and bench press. Log transformed root mean square of successive differences (lnRMSSD), and high frequency power (lnHF), as well as sample entropy (SampEn), and Lempel-Ziv entropy (LZEn) were assessed at rest (Rest1), 45 minutes post-consumption (Rest2), immediately post-exercise (Post1), and 10 minutes post-exercise (Post2). Two-way ANOVAs were used to analyze the effects of condition (PL, caffeine), across time (Rest1, Rest2, Rec1, Rec2).

RESULTS: The repetitions on the fatiguing set were similar between conditions for the squat (p=1.0), and the bench press (p=0.7). There were no significant condition by time effects for vagal tone. There was a significant main effect of time (p=0.0001) for lnRMSSD (Rest1: 4.52±0.73ms; Rest2: 4.48±0.64ms; Rec1: 2.72±0.66ms; Rec2: 2.28±0.55ms) such that it significantly decreased during Rec1 and Rec2 compared to Rest1 and Rest2. There was a significant main effect of time (p=0.0001) for lnHF (Rest1: 8.12±1.23ms²; Rest2: 8.00±1.09ms²; Rec1: 4.79±2.50ms²; Rec2: 4.02±1.02 ms²) with it decreasing at Rec1, and Rec2, compared to Rest1 and Rest2. There was a significant main effect of time (p=0.0001) for SampEn (Rest: Rest1: 1.43±.19; Rest2: 1.40±0.19; Rec1: 1.09±0.32; Rec2: 1.09±0.31) such that SampEn was significantly decreased compared to Rest at Rest2, Rec1 and Rec2. Additionally, there was a significant main effect of time (p=0.004) for LZEn (Rest1: 0.73±.09; Rest2: 0.77±0.06; Rec1: 0.66±0.13; Rec2: 0.54±0.16) with Rec2 being significantly attenuated compared to Rest2.

CONCLUSIONS: These data demonstrate that 4mg/kg of caffeine consumption does not have an ergogenic effect. In addition, when performed in conjunction with resistance exercise, it does not further decrease measures of vagal modulation in resistance-trained women.

2134 Board #53 May 28 3:00 PM - 4:30 PM
Sleep Quality Is Associated With Nighttime Heart Rate Variability In Young Adults

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Heart rate variability (HRV) reflects autonomic nervous system function, and low nighttime HRV is linked to reduced parasympathetic control. Optimal parasympathetic function is important for the induction and maintenance of sleep, overall wellbeing, and is inversely associated with chronic disease. In young adults, 60% of whom report poor sleep quality, disrupted parasympathetic function may reflect suboptimal health and lifestyle behaviors. While there is an established relationship between physical activity (PA), stress, and nighttime HRV, the associations between HRV and other lifestyle-related factors such as sleep quality and social jet lag (SJL) in young adult populations are yet to be determined.

PURPOSE: The purpose of this study was to determine the relationship between nighttime HRV and sleep characteristics in young adults.

METHODS: Healthy young adults (n=33, 18.6 ± 0.7 years, 69.6% female) wore a chest-strap heart rate monitor for 24 hours and a triaxial accelerometer on the non-dominant wrist for 7 days during free-living PA and sleep. Average sleep duration and SJL were determined from objective sleep data, with SJL calculated as the difference in hours between the midpoint of sleep on weeknights (school) and weekend (free) nights. The Pittsburgh Sleep Quality Index (PSQI) and Perceived Stress Scale were used as subjective measures of sleep quality and stress. Nighttime HRV outcomes were calculated using R-R intervals between the hours of 1:00 AM - 5:00 AM. Linear regression assessed multivariate relationships among sleep duration, quality, SJL, and HRV while controlling for moderate-to-vigorous PA and perceived stress.

RESULTS: Independent of average sleep duration and SJL, perceived sleep quality was associated with the HRV outcomes low frequency (LF; B= -10.62 ± 4.85, 95% CI: -20.56, -.67) and high frequency power (HF; B= 10.55 ± 4.84, 95% CI: .61, 20.49). Following control for PA and stress, these relationships remained significant and the association between SJL and LF/HF ratio approached significance (B= -.33 ± .18, 95% CI: -.69, .04).

CONCLUSIONS: Our findings suggest that both LF and HF HRV components are related to sleep quality in young adults, highlighting a potential relationship between sleep quality and nighttime autonomic nervous system function.

D-61 Free Communication/Poster - Cellular/Molecular

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
 Room: CC-Exhibit Hall

2135 Board #54 May 28 3:00 PM - 4:30 PM
Racial Differences In Selected Mechano-sensitive Micro-RNAs

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(No relevant relationships reported)

Endothelial cells (ECs) are constantly exposed to hemodynamic shear stress that can influence vascular signaling. High laminar shear stress (HLSS), an exercise mimetic, upregulates atheroprotective genes such as Kruppel-like factor 2 (KLF2), whereas disturbed flow and oscillatory SS upregulate proatherogenic genes such as vascular adhesion molecule-1 (VCAM-1). Micro-RNAs (miRs) are small non-coding RNAs that regulate gene expression. Current evidence has identified mechano-sensitive miRs that regulate shear-induced gene expression and ultimately control endothelial function. Moreover, we have previously demonstrated the efficacy of HLSS in attenuating endothelial dysfunction predominantly seen in African American (AA) ECs compared to Caucasian (CA) ECs.

Purpose: To investigate potential racial differences in the expression of selected mechano-sensitive miRNAs in response to HLSS.

Methods: Human umbilical vein endothelial cells (HUVECs) from two AA donors and two CA donors were cultured and exposed to HLSS (20 dynes/cm²) for 24hr using a cone and plate viscometer. Total RNA was harvested to assess the effect of HLSS on the expression of miR-21, miR-126* and miR-92-a.

Results: We report a significant increase in miR-92-a expression with HLSS in both AA and CA HUVECs (~ 2-fold difference, p= .005). Additionally, miR-92-a tended to be higher in AA ECs compared to CA ECs under both conditions. However, there was no significant difference in miR-21 or miR-126* expression between AA and CA ECs nor control and HLSS conditions.

Conclusion: Despite the recognition of miRNAs as important regulators in vascular physiology, evidence is still lacking on their association with higher prevalence of endothelial dysfunction in AA. It is highly important to identify the role they play, as understanding the molecular mechanisms driving racial differences in endothelial function can help develop better targeted prevention and treatment strategies.

2136 Board #57 May 28 3:00 PM - 4:30 PM
Is The Hexosamine Biosynthesis Pathway Affected By Inflammation In Endothelial Cells?

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(No relevant relationships reported)

Excessive addition of β -linked N-acetylglucosamine (O-GlcNAc) via the hexosamine biosynthesis pathway (HBP) occurs with diabetes and decreases in muscles with exercise. HBP flux increases inflammation and may be specifically important in the activation phase of the inflammatory response. Inflammation plays a key role in insulin resistance and hyperglycemia (HG), with the process contributing to the development of diabetes and associated complications. β -cell development and differentiation are affected by the HBP, and O-GlcNAc has been indicated in insulin secretion from the pancreas (1). **PURPOSE:** We explored whether in the absence of HG, an inflammatory insult, can affect key factors in this pathway and total O-GlcNAcylation within the endothelium. Because African Americans are overrepresented in conditions involving chronic inflammation, potential racial differences were also examined. **METHODS:** Human umbilical vein endothelial cells (HUVECs), n=6, were stimulated with 10ng/mL of tumor necrosis factor alpha (TNF α) for 4 hours, or treated as a control. Western blot procedures were used to measure expression of the HBP rate-limiting enzyme (GFAT) and the transferase that adds the end-product onto proteins (OGT). Total protein O-GlcNAcylation (O-GlcNAc) was also measured. **RESULTS:** With TNF α stimulation, there was no difference in GFAT ($0.63 \pm .09$ vs $0.62 \pm .08$, p=.89), OGT ($0.49 \pm .09$ vs $0.41 \pm .08$, p=.56), nor total O-GlcNAc ($1.56 \pm .38$ vs $1.77 \pm .42$, p=.71) expression compared to controls. There were no racial differences found among the various conditions (p>.05) with either of the proteins examined.

CONCLUSIONS: The HBP is not altered with acute inflammation in endothelial cells (ECs), with no racial differences additionally found. Low-grade inflammation vitally contributes to diabetes, atherosclerosis, and their complications, with the HBP playing a role in each. We conclude that HG may be necessary to work in conjunction with inflammation to increase protein O-GlcNAcylation in ECs. Although increased flux through the HBP has been shown to upregulate inflammation, the reverse relationship cannot be confirmed. Future research is needed to examine links between this pathway, various conditions, and the ability of exercise to alter it within the endothelium.

2137 Board #56 May 28 3:00 PM - 4:30 PM
Exercise Preconditioning Alleviate LPS Induced Acute Heart Injury Through GCN2 Pathway

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(No relevant relationships reported)

Exercise preconditioning may protect against cardiac injury induced by lipopolysaccharide (LPS), but the mechanism is unresolved.

PURPOSE: This study aims to explore whether the general control nonderepressible 2 kinase (GCN2) gene is associated with the protective effect of exercise preconditioning.

METHODS: 8 weeks old male GCN2 knockout (KO, n = 40) and wild type control with C57BL/6J background (C57, n = 40) mice were respectively divided into 4 groups: control, LPS (L), exercise preconditioning (E) and exercise preconditioning LPS (EL). Mice in the exercise groups performed exercise for 8 weeks. After exercise, all mice were administered an equal volume of LPS (10 μ g/g body weight) or saline. Heart function were measured by Vevo1100 small animal echocardiography 6 hours later followed by immediately tissue collection for Western blots and histological analysis.

RESULTS: Exercise preconditioning was observed to improve cardiac dysfunction evaluated by ejection fraction (EF) value (C57 L: 50.34 ± 6.94 vs. C57 EL: 59.32 ± 3.63 , p<0.05) and also significantly decreased the expression levels of GCN2, phosphorylation of eukaryotic translation initiation factor 2 α (p-eIF2 α) and activating transcription factor 4 (ATF4) in C57 mice induced by LPS (p<0.05). Moreover, GCN2 KO decreased cardiac dysfunction induced by LPS in sedentary mice. The cardiac dysfunction in the GCN2 KO EL group were lower than that in C57 EL group, and the expression of GCN2, p-eIF2 α and ATF4 in the GCN2 KO EL group was significantly lower than that in C57 EL group (p<0.05).

CONCLUSION: Exercise preconditioning alleviated cardiac injury induced by LPS. GCN2 KO also improved cardiac injury. Exercise preconditioning promoted the effect of GCN2 KO in alleviating cardiac injury, GCN2 and eIF2 α /ATF4 pathway play an important role in the process.

2138 Board #57 May 28 3:00 PM - 4:30 PM
Abstract Withdrawn

2139 Board #58 May 28 3:00 PM - 4:30 PM
Postnatal Growth Restriction In Mice Alters Cardiac Mitochondrial Energetics

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(No relevant relationships reported)

Postnatal growth-restriction (PGR) is associated with increased risk of cardiovascular mortality. We hypothesize that nutrient restriction alters metabolism leading to cardiac failure. **PURPOSE:** To determine the effect of PGR on mitochondrial respiratory capacity (JO₂). **METHODS:** FVB mouse dams were fed a control(CON: 20% protein), or a low-protein(LP: 8% protein) isocaloric diet 2-weeks before mating. LP-dams produce 18% less milk and pups nursed by LP-dams undergo growth restriction. At postnatal day (PN) 1, pups born to dams fed the CON diet were crossed to LP-dams(PUN; postnatally undernourished) or a different CON-dam. At PN21, all mice were weaned to the CON-diet. On PN22 or PN80, mice were weighed, euthanized, and hearts removed. Hearts were weighed and cardiac mitochondria were isolated via differential centrifugation. Respiration was measured through high-resolution respirometry in the presence of 5 mM pyruvate and 1 mM L-malate(PM). Two-way ANOVAs were performed with the main effects of diet (CON vs. PUN) and age(PN22 vs. PN80) to compare, body-mass, heart-mass, and JO₂. An α level of 0.05 was set *a priori*, and if necessary, a Tukey's HSD post hoc test was used for multiple comparisons. **RESULTS:** PGR caused significant diet and age effects (p<.001) on final body-mass between CON (PN22: 12.01 ± 0.83 g; PN80: 23.51 ± 2.95 g) and PUN groups (PN22: 8.45 ± 0.61 g; PN80: 21.32 ± 3.42 g). Heart-mass was also significantly reduced (p<.001) in PUN (PN22: 0.06 ± 0.01 g; PN80: 0.11 ± 0.012 g) compared to CON (PN22: 0.08 ± 0.007 g; PN80: 0.12 ± 0.01 g) across the lifespan. LEAK state JO₂ was significantly higher (p<.001) at both time-points in PUN (PN22: 46.48 ± 4.25 nmol/mg/min, PN80: 48.74 ± 8.34 nmol/mg/min) compared to CON (PN22: 36.15 ± 5.60 nmol/mg/min, PN80: 38.23 ± 2.74 nmol/mg/min). The respiratory control ratio (RCR) was significantly reduced (p=0.0005) in PUN (PN22: 7.81 ± 0.48 , PN80: 7.32 ± 1.48) compared to CON (PN22: 9.25 ± 0.73 , PN80: 9.14 ± 0.74). **CONCLUSIONS:** PGR decreased body and heart-mass across the life span and increased LEAK state JO₂ in the presence of PM, indicating mitochondrial impairment at PN22 and PN80. PGR caused reductions in RCR, which may cause CVD, thus PGR increases CVD risk through uncoupling of mitochondria. Exercise may improve mitochondrial function in PGR mouse hearts.

2140 Board #59 May 28 3:00 PM - 4:30 PM
The Role Of Exercise Intensity In Cell Signaling: Is There A Repeated-bout Effect?

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(No relevant relationships reported)

PURPOSE: Acute exercise elicits a temporary change in redox balance resulting in activation of antioxidant related gene expression and enzymes. We have previously shown in men that the type of acute exercise stimulus, constant workload (CW) vs. high intensity interval protocol (HIIP) results in different redox responses despite no differences in mean VO₂. The present study tested whether these results translate to women. In addition, we asked whether the responses are amplified through a repeated bout effect, by comparing the responses after 1 bout to those after 3 bouts. It was hypothesized that HIIP would render greater cell signaling response compared to CW and that differences would be amplified after 3 sessions.

METHODS: Healthy women ages 30-45y participated in this study in a randomized, cross-over design (n=12, projected) with a 2-week washout period between trials. Each participant completed a VO₂max on a cycle ergometer to establish the workload for the exercise trials. Subjects were randomized to complete either CW or HIIP sessions first. Each trial occurred every other day for 5 days. A second VO₂max was performed prior to the second trial to ascertain that VO₂max had not changed from baseline. CW consisted of 30-min of cycling at 70% VO₂max. HIIP consisted of a 9-min ramp-up, 7 intervals of 1-min "all out" intervals at 90-100% VO₂max followed by 2-min recovery for a total of 30-min of cycling. Blood draws were taken pre-, and 10-, 30-, and 60-min post exercise during the first and third exercise session of each trial. Cell signaling was measured by nuclear localization of Nrf2 as well as protein abundance of GCLC and GSR in PBMCs. GR enzyme activity was measured in erythrocyte lysate.

RESULTS: To date, 5 women have enrolled in the study and testing is still underway. The average intensity of the CW trial is 70.3% and the average intensity of the HIIP intervals is 91.7% $\dot{V}O_{2\max}$. The early data show a trend for increased nuclear Nrf2 and GSR protein abundance HIIP compared to CW, and an amplification of the response after 3 sessions.

CONCLUSION: These preliminary data suggest that delivering an exercise stimulus in short "pulses" of high intensity such as the HIIP elicits a greater protective signaling response as compared to a block of moderate CW exercise, and furthermore that these effects are amplified by a repeated bout effect.

2141 Board #60 May 28 3:00 PM - 4:30 PM
Cholesterol Efflux Gene Expression In Peripheral Blood Mononuclear Cells Following High Intensity Interval Exercise

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(No relevant relationships reported)

Reverse cholesterol transport (RCT) is critical to the regulation of blood cholesterol levels and prevention of macrophage foam cell formation. A critical step in RCT is the efflux of cholesterol from macrophages to high-density lipoprotein (HDL). Numerous studies have shown exercise to regulate HDL quantity and function, but little is known about how exercise affects the expression of cholesterol efflux genes in circulating monocytes. **Purpose:** To determine changes in mRNA expression of cholesterol efflux genes (ATP-Binding Cassette A1, ABCA1; ATP Binding Cassette G1, ABCG1; mitochondrial sterol 27-hydroxylase, CYP27A1) in peripheral blood mononuclear cells (PBMCs) following a single bout of high intensity interval exercise. **Methods:** Six (Female = 4, Male = 2) healthy participants (Age = 25 ± 6 yr, BMI = 26.1 ± 4.1 kg/m², $\dot{V}O_{2\max}$ = 36.4 ± 7.4 ml x kg x min⁻¹) completed a single bout (work load = 300 kcal) of high intensity interval exercise (repeated intervals of 3 min @ 55% $\dot{V}O_{2\max}$ + 1 min @ 110% $\dot{V}O_{2\max}$). RNA was isolated from PBMCs from whole blood prior to (PRE), immediately following (POST), two hours following (POST-2) and 24 hours following (POST-24) exercise. Expression levels of ABCA1, ABCG1, and CYP27A1 were analyzed via RT-qPCR. Gene expression fold changes, in comparison to PRE, were determined via the delta-delta C_t method and analyzed via Student T-Tests. Significance was set a priori as alpha = 0.01 to correct for multiple testing. **Results:** Exercise did not significantly modify ABCA1 (Fold Change = 0.8 ± 0.5 (POST), 0.9 ± 0.7 (POST-2), and 1.3 ± 1.1 (POST-24)) at any time point following exercise. ABCG1 expression was elevated POST (1.6 ± 0.9; p < 0.001), POST-2 (1.4 ± 0.8; p = 0.01), and POST-24 (1.5 ± 0.5, p = 0.001) following exercise. CYP27A1 expression was unaltered by exercise at all time points (0.8 ± 0.2, 1.4 ± 1.2, 1.5 ± 2.3; all p > 0.01). **Conclusion:** ABCG1 plays a significant role in maintaining cellular cholesterol levels through the efflux of cholesterol from the intracellular compartment to HDL. Our results show elevations in PBMC ABCG1 expression following a single bout of high intensity interval exercise. Along with improved lipid profiles (e.g. increased HDL concentrations), exercise may promote increased cholesterol efflux from monocytes and macrophages by upregulation of cholesterol efflux genes.

2142 Board #61 May 28 3:00 PM - 4:30 PM
Effect Of Cardiac Muscle Cells Secretome, With And Without Loading Preconditioning, On Hypoxia/Reoxygenation Injury

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(No relevant relationships reported)

Reperfusion after myocardial infarction (MI) can worsen cardiac tissue damage and in vitro models of hypoxia/reoxygenation (H/R) have been developed to simulate the in vivo ischemia/reperfusion injury. Cardiac muscle stem cells have been used for regeneration after MI due to their paracrine actions in improving myocardial cell survival and function, while interestingly, mechanical loading of cardiac muscle cells may modulate their secretome. **PURPOSE:** The present study investigated the cardiac muscle cells' paracrine effects in H/R, by treating them with the secretome of mechanically loaded or unloaded cells, in vitro.

METHODS: H9C2 cardiomyoblasts were cultured on elastic membranes and underwent a cyclic stretching (12% elongation at 0.25 Hz for 12h) and then their secretome was collected (stretch media, SM). Secretome of unstretched cardiomyoblasts were also collected (non-stretch media, NSM). Cardiomyoblasts were subjected to 6 h of hypoxia followed by 8 or 4 h of reoxygenation (H/R) while during reoxygenation, they were treated either with SM or NSM. Cell apoptosis was subsequently assessed by MTT assay and flow cytometry.

RESULTS: After the hypoxia period, cell viability rate was 98±9%, without differing from the normoxia group (p>0.05). However, after 8 or 4 h of reoxygenation, the

viability rate was reduced to 51±10% (p<0.01) and 74±10% (p<0.001), respectively. In addition, the percentage of early apoptotic cells was 36% (p<0.001) after 6 h of hypoxia/4 h of reoxygenation (H/R) as assessed by MTT assay. The viability rates in the same H/R protocol increased from 74±10% to 92±10% and 80±2% in SM- and NSM-treated cells, respectively, without exhibiting differences with the normoxia group (p>0.05). Interestingly, a significantly higher viability was observed only in the cells treated with the SM compared to the non-treated cells after H/R injury (p<0.05). **CONCLUSIONS:** Our findings suggest that cardiomyocytes are susceptible to H/R-induced injury, while the cell death rate depends on the duration of reoxygenation. Moreover, cardiomyoblasts' secretome inhibits their apoptosis after H/R injury while their mechanical load "preconditioning" appears to boost the anti-apoptotic effects of their secretome, implying the beneficial paracrine action of cardiac muscle cells due to mechanical loading.

2143 Board #62 May 28 3:00 PM - 4:30 PM
EFFECT OF REGULAR EXERCISE ON EXPRESSION OF K_{ATP} CHANNELS IN HEART OF DIABETIC RATS

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(No relevant relationships reported)

There is abundant evidence that ATP sensitive potassium (K_{ATP}) channels play cytoprotective role in cardiac myocytes, allowing the cell to couple metabolic state to electrical activity of the cell membrane. In cardiac myocytes Kir6.2/SUR2A are the major subunits expressed. However, expression or function of K_{ATP} channels has been found to be impaired in the presence of persistent hyperglycemia in diabetes mellitus (DM). While regular exercise can improve hyperglycemic status in DM, its impact on the expression of KATP channels subunits in heart is unknown.

PURPOSE: To assess the effect of regular exercise on expression of K_{ATP} channel subunits in heart of streptozotocin-induced diabetic rats.

METHODS: Male Wistar rats (25 days old) were randomly divided into four groups, among them: sedentary control, trained control, sedentary diabetic, trained diabetic. Diabetes was induced by a single streptozotocin injection (100 mg/kg body weight), animals with fasting blood glucose levels ≥ 300 mg/dL were considered as diabetic. Groups with training program performed exercise on a treadmill (30 minutes daily, 5 days/week) for 8 weeks. At the end of the intervention, two subunits of cardiac KATP channel (SUR2A and Kir 6.2) were analyzed as indicators and quantitative analysis of these subunits was achieved with real-time RT-PCR.

RESULTS: In control conditions, the regular exercise reduced Kir6.2 subunit mRNA levels significantly (76%; p=0.045) in heart. In diabetes, reduced Kir6.2 expression was also observed, and there was no difference in expression levels between sedentary diabetic and trained diabetic groups (P > 0.05). Otherwise, relative mRNA expression of the subunit SUR2A was increased in both sedentary diabetic and trained diabetic groups (80.33% and 86.08%, respectively).

CONCLUSION: Collectively, our data demonstrate that the regular exercise modifies expression of K_{ATP} channel subunits of heart only in control conditions. However, the gene expression patterns of K_{ATP} channel subunits are different during diabetes, by increased SUR2A and decreased Kir6.2, which was not modified by exercise. These results may provide an opportunity to understand mechanisms leading to diabetic cardiomyopathy during stress and exercise in DM.

D-62 Free Communication/Poster - Health Interventions in Youth

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
 Room: CC-Exhibit Hall

2144 Board #63 May 28 2:00 PM - 3:30 PM
Patient-Child Obesity Program Causes Delayed But Significant Improvement In Body Composition Among At-Risk Youth

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(No relevant relationships reported)

More than 13 million U.S. children are obese; complications are expected to progress throughout adulthood, increasing the risk of premature mortality. Although proper nutrition and exercise provide short and long-term health benefits, translating this information to a community-setting has been largely ineffective. It is important to identify programmatic variables that demonstrate success in weight management.

PURPOSE: To observe the effect of a family-oriented exercise and nutritional intervention on body composition in overweight and obese children and adolescents. **METHODS:** Twelve subjects (ages 7-16) were enrolled in a childhood obesity program upon referral by their primary care physician. Subjects engaged in 45 min of aerobic and flexibility training twice weekly for 18 weeks. Each exercise session was followed by 30 min of nutritional counseling. Body mass index (BMI), waist circumference (WC), hip circumference (HC), and body fat percent (BF%) were measured throughout the intervention. One-way repeated measures ANOVA determined anthropometric differences at baseline, midpoint, and at the end of the intervention. **RESULTS:** Subjects were 12.3±2.4 years old and 44.4% were obese, having a mean BMI of 29.8±4.5 kg/m², BF% of 38.6±6.8%, HC of 99.85 cm, WC of 96.10 cm, and hip-to-waist ratio of 0.96. From baseline to follow-up, subjects decreased BMI by 1.0 kg/m² (p=0.011), WC by 4.69 cm (p=0.031), and hip-to-waist ratio by 0.05 (p=0.043); the reduction in BF% failed to reach significance (p=0.060). Repeated measures ANOVA identified reductions in bodyweight (1.09 kg; p<0.001), WC (3.44 cm; p=0.049), and hip-to-waist ratio (.05; p=0.037) between weeks 9 and 18. Differences for the same measurements between weeks 1 and 9 were insignificant (p>0.05). **CONCLUSION:** Despite our small sample, a combined exercise and nutritional counseling intervention improved anthropometric profiles of obese and overweight children and adolescents over the course of 18 weeks. The greatest improvements took place after 9 weeks, indicating the importance of perseverance when seeking body composition improvement in this demographic.

2145 Board #66 May 28 2:00 PM - 3:30 PM
**Influence Of Sports Games On Children's
 Coordination Ability And Lower Limb Muscle Strength**

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 (No relevant relationships reported)

PURPOSE: to explore the influence of the developed sports game intervention programs on children's physical coordination and lower limb strength, and to compare the effects of routine gymnastics and sports game intervention, so as to better develop children's physical coordination and lower limb strength, and provide effective intervention programs in line with the characteristics of children's physical and mental development. **METHODS:** 48 children aged 4-5 were selected and randomly divided into two groups based on teaching classes - sports game group and gymnastics group - each with 24 children. The developed sports game programs were adopted to intervene children of the sports game group. The intervention period was 4 weeks, 3 times a week, 30 minutes each time. In the same intervention cycle and intervention time, children in the gymnastics group did basic gymnastics. **RESULTS:** repeated measures of variance were analysed to compare the changes of children's physical coordination and lower limb strength in different groups before and after the intervention. The results showed that both the children in the sports game group and the gymnastics group took less time in the continuous jumping test after the intervention than before the intervention (sports game group: 8.94s±1.86s vs. 5.78±0.99s, p<0.05; gymnastics group: 10.04s±2.66s vs. 7.74s±1.60s, p<0.05), but the sports game group took significantly less time for continuous jumping test after intervention than the gymnastics group (5.78s±0.99s vs. 7.74s±1.60s, p<0.05). **CONCLUSION:** compared with children's basic gymnastics, the developed sports game programs are more targeted to the development of children's physical coordination and lower limb strength, therefore more effective for that purpose.

2146 Board #65 May 28 2:00 PM - 3:30 PM
**ACUTE EFFECTS OF EXERGAMING ON URBAN
 MIDDLE SCHOOL CHILDREN'S AFFECTION BETWEEN
 SMALL-GROUP AND WHOLE-CLASS SETTINGS**

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PURPOSE: With the goal of developing effective exergaming programs at school sites, the present study investigated the differences in urban middle school children's situational feeling states between small-group and whole-class settings. **METHODS:** Forty-seven participants (25 females; M_{BMI} = 24.3 kg/m², SD = 3.1) completed two separate 15-minute exergaming sessions on the same day: (1) Xbox One Kinect Just Dance in a small-group (n = 3-4) setting; and (2) Xbox One Kinect Just Dance in a whole-class (n = 23-24) setting. Participants' affection and emotional states were measured by the established Exercise-Induced Feeling Inventory (EFI) and Subjective Exercise Experience Scale (SEES). The 15-item EPI (5-point Likert scale ranged 0-4) included four constructs: positive affect, negative affect, fatigue, and tranquility, and the 12-item SEES (7-point Likert scale ranged 1-7) with included three

constructs: positive well-being, psychological distress, and fatigue. Dependent *t*-tests were used to detect mean differences for all outcomes between the two exergaming sessions, with the significance level being set at *p* < 0.05. **RESULTS:** Dependent *t*-test indicated significant differences on children's negative affect between two sessions (*t* = -1.77, *p* < 0.05, Cohen's *d* = 0.32). The lower mean score referred to less feeling of negative affect. Participants in small-group exergaming session (M = 0.20, SD = 0.44) experienced less negative affect in comparison to the whole-class session (M = 0.43, SD = 0.95). However, there was no significant difference in other feeling outcomes between two sessions. **CONCLUSIONS:** Findings indicated urban middle school children playing exergaming in small-group setting may experience fewer negative feelings such as crummy, discouraged, and miserable compared to the whole-class setting. Notably, there was no significant differences for other outcomes between two sessions. Future longitudinal studies are needed to examine long-term affection and emotional effects of exergaming across various settings.

2147 Board #66 May 28 2:00 PM - 3:30 PM
**The Relationship Between Physical Activity And
 Inflammatory Markers In Youth With Overweight/
 obesity**

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While physical activity is known to have beneficial effects in youth, little is known about the mechanisms responsible for these effects, including how it affects inflammatory markers among youth. This is especially true in youth with overweight or obesity. Furthermore, it has not been definitively established that changes in physical activity can elicit changes in inflammatory markers among youth with overweight and obesity. **PURPOSE:** To determine the effect of a one-year lifestyle intervention on markers of inflammation in youth with overweight or obesity. **METHODS:** Eighty-three children (mean age 8.7 yrs ±1.2, 53% male, 46% with overweight, 53% with obesity) participating in a longitudinal intervention to increase physical activity and improve diet, provided data on physical activity (via accelerometer), body composition (via DXA), and fasting inflammatory markers (adiponectin, TNF-α, resistin, IL-6). *T*-tests were conducted to examine changes over time, and linear regression analyses were employed to assess the influence of changes over time [moderate-to-vigorous physical activity (MVPA), percent body fat] on year-one inflammatory marker values while controlling for baseline levels. **RESULTS:** Our results indicated significant decreases (all *p* < .001) at year-one from baseline in adiponectin (10.1 μg/mL to 6.6 μg/mL), TNF-α (22.1 pg/mL to 4.4 pg/mL), IL-6 (18.7 pg/mL to 10.7 pg/mL), while resistin increased significantly (3.7 ng/mL to 6.8 ng/mL). Changes in percent body fat did not significantly predict inflammatory markers at follow up. Increased MVPA over time predicted lower resistin levels at follow up. **CONCLUSIONS:** A physical activity intervention successfully reduced two inflammatory markers, and greater MPVA may protect against increases in resistin among youth with overweight or obesity.

2148 Board #67 May 28 2:00 PM - 3:30 PM
**Is It Possible To Increase Physical Activity Levels In
 Youth? A Randomized Controlled Trial**

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The potential of school-based interventions to positively impact young people's physical activity (PA) level is uncertain. A recent meta-analysis concluded that current school-based interventions do not positively impact young people's accelerometer assessed PA over the full day. **PURPOSE:** To investigate the effect of a school-based PA intervention on PA levels in 14-year-old adolescents. **METHODS:** In the School in Motion intervention study (ScIM), 29 secondary schools (N=2084) in Norway were cluster-randomized to the Physical active learning (PAL) group (n=10), the Don't worry-Be Happy (DWBH) group (n=10) or the control group (n=9). The target dose was 120 min of additional PA per week in both intervention groups. PA was assessed by ActiGraph accelerometers at baseline (spring 2017) and after one year (spring 2018). We used a linear mixed model with the means as a function of time and group-by-time interaction, with schools as random effects. **RESULTS:** No intervention effect

was observed on the students' PA level during the full day, however, an intervention effect was observed during school hours. Girls in the PAL-group, had a mean change in PA level during the intervention period that was 92 counts per minute (cpm) (95% CI: 52; 133, $p < 0.001$) higher than the control group. Girls in the PAL-group increased time spent in moderate-to-vigorous intensity physical activity (MVPA) with 6.3 min/day (95% CI: 3.8; 8.8, $p < 0.001$) more than the controls, and reduced time spent sedentary with 7.3 min/day (95% CI: -11.8; -2.8, $p = 0.001$). Boys in the PAL-group increased their mean PA-level with 77 cpm (95% CI: 19; 134, $p = 0.009$) and time spent in MVPA with 5.1 min/d (95% CI: 1.6; 8.6, $p = 0.005$) more than control boys. In the DWBH-group, no intervention effect was observed on mean PA level or time spent in MVPA, however, the DWBH-group increased their sedentary time during school hours more than their counterparts in the control group. **CONCLUSIONS:** We found no effect of a nine-months PA-intervention on 14-year-olds PA level over the full day. However, we found an effect on PA during school hours for adolescents in the PAL-intervention. As both intervention models were targeting the school hours in particular, the results might indicate that future interventions need to target after school hours to increase adolescents' PA level over the full day.

2149 Board #68 May 28 2:00 PM - 3:30 PM
Abstract Withdrawn

2150 Board #69 May 28 2:00 PM - 3:30 PM
Association Between Birth Weight, Physical Activity, Sedentary Time And Body Fat In 11-13-year-old Hispanic Children
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Birth weight and gestational age are early life factors linked to health characteristics during childhood and adolescence, such as obesity, physical activity (PA), sedentary time (ST). It has been suggested that birth weight is not as important as PA in the prediction of childhood obesity. However, these associations have been inconsistent across different studies, and suggestions of potential population specific differences have been proposed. **PURPOSE:** To describe and compare birth weight, gestational age, percent body fat (% fat), PA, and ST in a group of 11-13-year-old Hispanic children in Puerto Rico; and evaluate associations between these variables. **METHODS:** Ninety-six children (boys=55, girls=41) volunteered to complete anthropometric measurements (height, sitting height, weight, % fat, and arm and waist circumferences), accelerometer-based PA and ST, and a nutrition and quality of life questionnaire. Also, parents completed a sociodemographic and family health questionnaire that included the children's birth weight and gestational age. Independent t-test and correlation analyses were conducted to detect sex differences, and determine associations between variables. **RESULTS:** Mean birth weight (7.0±1.4 lbs) and gestational age (37.5±3.8 weeks) were not different between sex ($P > 0.05$), and fell within the normal range for growth standard. However, compared with boys, girls had higher % fat (17.2±1.0 vs. 28.0±1.1 %, $P < 0.0001$), lower moderate to vigorous PA (264.2±22.7 vs. 132.6±14.9 min/week, $P < 0.0001$), and higher ST (9.9±0.2 vs. 10.9±0.3 hrs/day, $P = 0.001$). No association between gestational age, % fat, PA and ST was observed. Those with higher birth weight had higher ST ($\rho = 0.22$, $P = 0.04$), but PA and % fat were not associated with birth weight. Those with higher PA and lower ST had lower % fat ($\rho = -0.34$, $P = 0.001$; $\rho = 0.24$, $P = 0.02$; respectively). **CONCLUSIONS:** These preliminary observations suggest that body fatness is not influenced by birth weight (a biological factor) but by PA and ST (behavioral factors) in our Hispanic youth participants. Supported by UPRRP/DEGI and Puerto Rico Health Department.

2151 Board #70 May 28 2:00 PM - 3:30 PM
Association Between Physical Activity, Sedentary Time, And BMI Percentile Among Hispanic Pre-school Children
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For healthy growth and development, physical activity (PA) guidelines for preschool-aged children suggest at least 3 hours/day of combined structured and unstructured PA. Prevention of childhood overweight and obesity is another health priority in this population. Among 1-6-year-old Hispanic children in Puerto Rico, the prevalence

of overweight and obesity is approximately 60%. However, the association between obesity and accelerometer-based PA and sedentary time (ST) in this population have not been previously documented. **PURPOSE:** To describe PA and ST, and test the association between obesity and PA, and between obesity and ST in Hispanic pre-school children. **METHODS:** A group of 25 children (Boys = 10, Girls = 15, aged 3 to 5 years old) attending a pre-school at the University of Puerto Rico (UPR) and their parents volunteered to participate. Children's measures of height and weight, and 7-day waist-worn accelerometer data were obtained. Parents completed a socio-demographic, and family health and home environment questionnaire. Mann-Whitney U test, and Spearman correlation analyses conducted to test for sex differences and associations between variables. **RESULTS:** Light PA (1.6±0.4 hr/day), moderate PA (0.9±0.2 hr/day), vigorous PA (0.2±0.1 hr/day), ST (11.3±0.7 hr/day), and BMI percentile (63.8±30.6) were not different between boys and girls. Overweight (13%) and obesity (22%) was lower in our children participants compared to previous reports in pre-school aged Hispanic children. A significant and inverse correlation between BMI percentile and vigorous PA ($\rho = -0.46$, $P = 0.04$), and BMI percentile and number of household TV sets ($\rho = -0.55$, $P = 0.008$) was observed. **CONCLUSION:** Combining light, moderate and vigorous PA/day (2.7 hr/day); pre-school children in this study approached PA guidelines. Nonetheless, ST was high. Our results also show that those who engage in more vigorous PA have lower BMI percentile, suggesting that PA intensity might be relevant for obesity prevention in this young age group. The inverse association between number of TV sets per household and BMI percentile was unexpected; thus, requiring further analyses.

2152 Board #71 May 28 2:00 PM - 3:30 PM
The Comparison Of Children Physical Activity Time In Different Parent Income Level
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(No relevant relationships reported)

There are enough researches that can prove the importance of physical activity for children's health. It's necessary to keep enough physical activity time during children's growth and development of their bodies. There are already have some researches about parent income and children's physical activity time, but those researches are all in developed countries and no studies in a developing country, such as China. **PURPOSE:** By comparing the physical activity time of children with the different parent income level and show the income level impact on children's physical activity time. **METHODS:** There are four schools selected in this study and every two schools from urban and suburbs areas in Beijing. We used the CLASS questionnaire (Children Leisure Activities Study Survey) to acquire the data about parent income (yuan/per month) and the time of children's physical activity (mins). All total of 408 students (boys=217, age=10.78±0.93yrs) and 384 parents (male=198, age=39.65±5.62yrs) are involved in this study. We divide the parent income into four levels: The low-income (0-5000yuan/per month), the middle-income (5000-10000yuan/per month), the high-income (10000-15000yuan/per month) and the highest-income (over 15000yuan/per month). The data were analyzed using one-way ANOVA. **RESULTS:** By comparing the children physical activity time in different parent income levels, with middle-income and low-income (146.43±92.94mins vs. 116.60±56.57mins, $P < 0.05$); With middle-income and high-income (146.43±92.94mins vs. 112.11±61.48mins, $P < 0.05$); With middle-income and highest-income (146.43±92.94mins vs. 105.83±62.50mins, $P < 0.05$). **CONCLUSIONS:** Parent income may have an impact on children physical activity time, the children which their parent income at a middle level have the most physical activity time. This study was conducted in a developing country and the result may differ from the developed countries. In the future, the studies should consider more factors that may impact the children's physical activity time.

2153 Board #72 May 28 2:00 PM - 3:30 PM
Associations Between Bedroom Television And Child Versus Parent-reports Of Youth Screen Time And Sleep Duration
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(No relevant relationships reported)

INTRODUCTION: Child self-report and parent proxy-report are frequently used for assessing youth sleep duration (SLP) and screen time (ST) behaviors; however, discrepancies in the reporting of youth SLP and ST between children and parents are not well understood. **PURPOSE:** The purpose of this study was to examine if family ST rules and child bedroom televisions (BTV) were associated with discrepancies between child and parent reports of youth SLP and ST behaviors.

METHODS: Children aged 8-11 self-reported their SLP and ST behaviors, if they had a BTV, and demographic information. Parents reported information about their child's SLP and ST behaviors, family ST rules, and family characteristics (i.e. income, marital status, etc.). The prevalence of parents reporting less healthy, similar, or healthier behaviors compared to child-reports was calculated. Separate linear regression models examined if BTV and family ST rules were predictive of the discrepancies in the reporting of youth's SLP and ST between parents and children.

RESULTS: Parents reported healthier child behaviors (less screen time and more sleep) compared to child reports. Linear regression models identified child BTV as a significant predictor of discrepancies in child-parent reporting for both, SLP and ST ($p=.01$ and $p=.03$, respectively), but not family ST rules (both $p < .05$)

CONCLUSIONS: The presence of a child BTV contributes to discrepancies in child and parent reporting of youth's SLP and ST behaviors. Future work evaluating youth SLP and ST behaviors using survey tools and national data collection protocols should capture information about the presence of a child BTV.

2154 Board #73 May 28 2:00 PM - 3:30 PM

Impact Of Situational Games Intervention On Fitness Outcomes Among 6-7 Years Old Chinese Children

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PURPOSE: To examine the impact of a 10-week situational games intervention on aerobic fitness, muscular strength and speed among 6-7 years old Chinese children. **METHODS:** A total of 128 6-7 years old Chinese children were randomly divided into intervention group (IG; 31 boys, 30 girls) and control group (CG; 31 boys, 36 girls). The IG received ten-week situational games (SG) lessons (35 mins per lesson, twice a week), including acting as a main character in the movie 'zootopia', offending and defending in ball games, and exploring in the forest, while CG took conventional PE lessons (35 mins per lesson, twice a week). Participants took 20-m shuttle run (20-m SRT), grip, vertical jump (for muscular strength) and 50-meter dash (for speed) tests before and after intervention. VO2max was estimated from 20-m SRT using Leger's equation. Mixed model Repeated Measures ANOVAs were conducted to determine differences in fitness variables from baseline to post-intervention across intervention groups.

RESULTS: The performance of 20-m SRT (laps), Grip(kg), Vertical jump (cm) and 50-meter dash(s) were significantly improved among IG while no change among CG after intervention in boys. There was also a significant group-by-time interaction was observed for Grip(kg), Vertical jump (cm) and 50-meter dash(s) in girls, no difference between IG and CG at baseline, but vertical jump performance was significantly improved among IG while no change among CG after intervention. Although 20-m SRT scores of both IG and CG participants increased from baseline to after intervention, there was no group difference in the improvement, $p < 0.05$. (Table 1)

CONCLUSIONS: Although both conventional PE and SG specific lessons can increase muscular strength and speed, 10-week SG training also effectively improves aerobic fitness among 6-7 years old Chinese children. There was different improvement between genders.

Table1 Comparison between IG and CG on Fitness

		CG Boys(n=31)	IG Boys(n=31)	CG Girls(n=36)	IG Girls(n=31)
20-m SRT(laps)	Pre	14.1±7.5	15.8±6.2	14.6±4.7	15.0±2.3
	Post	14.1±5.0	17.6±7.4*	15.3±4.3	15.5±3.5
Grip(kg)-left	Pre	7.5±1.9	7.2±1.8	6.7±1.6	6.5±1.5
	Post	7.5±2.1	7.7±1.7*	6.2±1.8	7.1±1.2*##
Grip(kg)-right	Pre	8.0±2.5	7.6±1.9	7.2±1.5	6.8±2.2
	Post	7.6±2.3	8.3±2.1*#	6.5±1.4	7.5±1.3*##
Vertical jump (cm)	Pre	23.2±6.4	23.3±6.1	23.8±4.2	23.4±4.1
	Post	23.8±7.8	27.0±7.5**	25.9±5.8*	27.1±5.1**
50-meter dash(s)	Pre	12.1±1.5	12.2±1.4	12.5±1.3	12.2±0.8
	Post	12.2±1.3	11.9±1.3*##	12.6±1.3	12.0±0.6*#

Note: the comparison between before and after, * $p < 0.05$, ** $p < 0.01$; the comparison between IG and CG, # $p < 0.05$, ## $p < 0.01$

2155 Board #74 May 28 2:00 PM - 3:30 PM

Genu Valgus Association Between Physical Activity Level Anthropometry And Sedentary Behavior In Schoolchildren From Ilhabela

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Objective: To analyze the relationship between the valgus knee and the level of physical activity and anthropometry in students of both sexes. **Methods:** In this cross-sectional study, 96 students with an average of 9.75 ± 0.78 years-old, 56 female students ($X \ 9.78 \pm 0.78$ years) and 40 males ($X \ 9.7 \pm 0.78$ years) aged 9 to 11 years, residing in Ilhabela, São Paulo. The genu valgus was evaluated using the goniometer, classifying the intermalleolar distance (cm) as mild, moderate and severe. The level of physical activity was evaluated by accelerometer (ActiGraph GT3X-BT, Freedson P.S) given in counts per week, being classified into physical activity: mild, moderate, moderate to vigorous, vigorous and sedentary time. The anthropometric variables included: body weight (kg), height (cm), BMI (kg / m^2), mean skinfold thickness (mm), femur diameter (cm), and waist circumference (cm), according to CELAFISCS standardization. **Statistical Analysis:** It was used the Person correlation, a software SPSS 20.0, adopting as significance level a $p < .05$. **Results:** Of the 96 students, 53% presented mild valgus, 21% with moderate valgus, and 22% with severe valgus, with positive and significant associations ($p < .05$). In both sexes, there was no correlation between mild, moderate, moderate to vigorous, vigorous physical activity and sitting time. In girls there was a positive, moderate and significant correlation between genu valgus, weight, height and waist circumference and skinfolds. In boys there was a positive, weak, and significant correlation between genu valgus and femur diameter. **Conclusion:**, it seems that the genu valgus was not associated with physical activity levels and sitting time, but shows that the greater the valgus, the greater the sedentary time. It was also observed an association with anthropometry in males, with femur diameter and in the female with the weight and waist and hip circumference.

Variables		Male Genu valgus		Female Genu valgus	
		r	p	r	p
LIGHT PHYSICAL ACTIVITY	(counts/sem)	-0,06	0,69	0,19	0,14
MODERATE PHYSICAL ACTIVITY	(counts/sem)	-0,06	0,68	-0,18	0,18
MODERATE VIGOROUS PHYSICAL ACTIVITY	(counts/sem)	-0,04	0,79	-0,17	0,19
VIGOROUS PHYSICAL ACTIVITY	(counts/sem)	0,03	0,83	-0,02	0,85
SAT TIME	(counts/sem)	0,08	0,61	0,05	0,69
WEIGHT	(Kg)	0,15	0,34	0,54**	0,00
BMI	(Kg/m ²)	0,09	0,56	-0,05	0,69
WAIST CIRCUMFERENCE	(cm)	0,09	0,56	0,36**	0,008
HIP CIRCUMFERENCE	(cm)	0,09	0,56	0,46*	0,00
X 7 CUTANE FOLDS	(mm)	0,12	0,43	0,32*	0,01
FEMOR DIAMETER	(cm)	0,31*	0,04*	0,19	0,14

2156 Board #75 May 28 2:00 PM - 3:30 PM

PHYSICAL ACTIVITY LEVEL SEDENTARY BEHAVIOR AND SLEEP TIME ASSOCIATED TO BODY COMPOSITION IN ILHABELA SCHOOLCHILDREN

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 (No relevant relationships reported)

Purpose: To associate the physical activity level, sedentary behavior, and sleep time with the body composition of students. **Methods:** The study is part of the Ilhabela Mixed-Longitudinal Growth and Development Project. A convenience sample consisted of 97 schoolchildren, 50 boys, and 47 girls, 9 to 11 years-old ($9.8 \pm .7$) with at least one complete evaluation in the analyzed period (2015 and 2019), all of them at pre-pubertal sexual maturation. The variables analyzed were: body weight (kg); body mass index BMI (kg/m^2); average of 3 skinfolds: triceps, subscapular, and suprailiac, adiposity (mm); and waist-to-hip ratio WHR (cm). Physical activity level, sedentary

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behavior, and sleep time were measured by accelerometer (ActiGraph GT3X, analyzed with Freedson 1998) given in counts per minute. Data normality was measured by Kolmogorov-Smirnov, and a Spearman rho correlation was used to determine the associations among variables. Level of significance adopted was $p < .05$. The software used was SPSS 20.0. **Results:** In boys, light physical activity presented a significant low to moderate correlations with BMI ($r = .29$), adiposity ($r = .29$), WHR ($r = .39$). A correlation of ($r = .39$) was observed between sedentary time, and WHR. Among girls, sedentary time correlated significantly with body weight ($r = .41$), BMI ($r = .29$) adiposity ($r = .47$). Moderate to vigorous PA presented an inverse, significant, and moderate correlations with body weight ($r = .39$), and adiposity ($r = .40$). **Conclusion:** Present data suggest a significant association among light PA (in boys) and moderate/vigorous PA (in girls), and body composition, while sedentary time showed a significant association with body weight, BMI, and adiposity (in girls), and with WHR (in boys).

Table: Association between physical activity level, sedentary behavior and sleep time to body composition in students from Ilhabela

	Boys				Girls			
	Weight (kg)	BMI (kg/m ²)	Adiposity (mm)	WHR	Weight (kg)	BMI (kg/m ²)	Adiposity (mm)	WHR
Sedentary Time	.04	-.06	.01	.39*	.41*	.29*	.47*	.32
Light PA	-.24	-.29*	-.29*	.39*	-.04	.15	.03	-.06
Moderate/vigorous PA	-.20	-.11	-.15	.16	-.39*	-.11	-.40*	-.01
Sleep time (hours/day)	.14	.16	.05	-.19	-.07	-.06	-.13	-.15

Body Weight (Weight) Light physical activity level (Light PA) Moderate to vigorous physical activity level (Moderate/vigorous PA) * $p < .05$.

2157 Board #76 May 28 2:00 PM - 3:30 PM
Dissemination Of Motivational Interviewing Training: Use In Extension Outreach And School Health Programming

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PURPOSE: Motivational interviewing (MI) is a popular conversational strategy used to evoke intrinsic motivation for behavior change. Although a number of training programs have been described to build MI skills, there are few that evaluate the fidelity of training. The present study evaluated MI fidelity following a brief online training. **METHODS:** This study was conducted as an ancillary component of a school wellness training initiative (SWITCH) that focused on building capacity for schools to plan and lead school wellness programming. A quasi-experimental design was used to evaluate the impact of brief MI training on a sample of 16 extension field specialists (EFS) that facilitated the SWITCH implementation process. EFS were provided guidelines and suggestions for using MI to elicit change talk and promote goal setting by school leaders. A subsample of 8 EFS voluntarily agreed to participate in supplemental MI training prior to interacting with the schools. All EFS recorded phone calls with the schools as part of the standard practice in the SWITCH project, and a trained assistant blinded from group allocation coded them for MI proficiency levels using the Motivational Interviewing Treatment Integrity Coding Manual 4.2.1. **RESULTS:** A one-way ANOVA followed by Bonferroni post-hoc corrections were conducted to examine differences in MI techniques between trained and untrained EFS. No statistically significant results were found. However, differences between groups for technical global scores ($F(1, 14) = 8.9, p = 0.05, d = 1.5$) and reflection-to-question ratios ($F(1, 14) = 5.3, p = 0.19, d = 1.15$) were approaching statistical significance with large effect sizes. Relational global components ($d = 0.76$) and total adherence ($d = 0.38$) demonstrated moderate group differences. **CONCLUSIONS:** This study indicates that a brief MI training protocol is effective for teaching the spirit and relational components of MI. Although proficiency levels were not achieved by the majority of EFS, trained individuals were better at using technical and relational aspects of MI than untrained individuals. Future work should focus on ways to enhance skill acquisition with this type of distributed online training model as well as testing applications with other professionals and diverse settings.

2158 Board #77 May 28 2:00 PM - 3:30 PM
Comparison Of Anthropometric Methods And Physical Activity In Preschoolers

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Previous work reports a counterintuitive finding that preschoolers categorized as overweight or obese engage in more physical activity (PA) than their healthy weight peers. The majority of studies with preschoolers however, used age- and sex-specific body mass index (BMI) percentiles to classify children according to their weight status. However, BMI may underestimate obesity prevalence. More recently, there has been an emphasis on anthropometric alternatives to BMI such as waist-to-height ratio. Waist circumference (WC) to height ratio (WC/HT) is relatively independent of gender, age, and race and may be more sensitive than BMI to identify those with central obesity, a cardiometabolic risk factor.

PURPOSE: Examine 1) the overlap of risk based on BMI and WC/HT and 2) the associations between preschoolers' PA and both BMI and WC/HT **METHODS:** Weight, height, and WC were obtained by trained study staff and PA was objectively measured by accelerometry during the school day for up to 10 days. BMI was calculated as body weight divided by height squared (kg/m²). Weight status was determined using age- and sex-specific Centers for Disease Control (CDC) BMI percentiles. Two BMI percentile overweight/obese risk categories were created based on CDC categories (not at risk: $< 85^{th}$; at risk: $\geq 85^{th}$). Two central obesity risk categories were created for WC/HT (not at risk: < 0.5 ; at risk: ≥ 0.5). A total of 69 children ($M_{age} = 3.95 \pm 0.6, 34$ males, 35 females) with ≥ 3 days of valid accelerometer data were included in analyses. Percentage of time spent in light, moderate-to-vigorous (MVPA) and total PA (light + MVPA) were calculated using the child's total wear time as the individual divisor. Significance was set at $p < 0.05$.

RESULTS: When comparing BMI and WC/HT risk categories, only 21 children (30%) were considered at risk using BMI whereas 40 (58%) were considered at risk using WC/HT. Significant, positive associations were observed between BMI percentile and light ($r = 0.27$), MVPA ($r = 0.25$) and total PA ($r = 0.27$); no significant associations were observed between WC/HT and PA.

CONCLUSIONS: More preschoolers were identified at risk using WC/HT as compared to BMI. Moreover, higher levels of PA were only linked with risk based on BMI, not WC/HT. Future work with preschoolers should explore a variety of methods for measuring risk for obesity and PA.

2159 Board #78 May 28 2:00 PM - 3:30 PM
Abstract Withdrawn

2160 Board #79 May 28 2:00 PM - 3:30 PM
Can We Play Outside? Social-emotional Learning And Preschooler Physical Activity

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Can we Play Outside? Social-Emotional Learning and Preschooler Physical Activity Marcia A. Rosiek, Benedict P. Dyson, Erin J. Reifsteck, & Diane L. Gill, FACSM Coastal Carolina University & UNC at Greensboro Despite the benefits of physical activity (PA) for their development, preschoolers (age 3-5) do not meet recommendations and spend the majority of their day indoors engaged in sedentary behaviors (Pate et al., 2008). Outdoor environments promote PA (Cerrin et al., 2016), and active play is considered important for social and emotional learning (SEL), which involves self-regulatory and problem-solving skills, making good decisions, and developing positive relationships. Early childhood SEL is associated with school readiness and academic achievement (Denham & Brown, 2010). Research on the role of outdoor play for SEL in early childhood development is limited. **PURPOSE:** To identify and describe PA and SEL behaviors practiced by preschoolers in the outdoor environment. **METHODS:** This case study used mixed methods to identify and describe SEL and PA behaviors in preschoolers (ages 3-5) at an early childhood education center (ECEC). Participants included 28 children, two teachers and the ECEC director. PA accelerometry data, daily observations, and teacher interviews were collected over 4 weeks. Inductive analysis and constant comparison were used to analyze the qualitative data (Miles, Huberman, & Saldana, 2014). **RESULTS:** Accelerometry data indicate that preschoolers were engaged in sedentary behavior 46.53%, MVPA 30.81%, and light activity 21.19% of the time when outdoors; on average, preschoolers were active for 29.34 minutes during an average 56.45-minute outdoor period. Qualitative data uncovered three themes: 1) the outdoor environment provides opportunities to practice SEL, 2) social interaction

during outdoor play promotes SEL, and 3) teachers support SEL during outdoor play.

CONCLUSION: The outdoor environment promotes PA through multiple forms of active play, providing an ideal setting for preschoolers to practice SEL in their preferred environment.

2161 Board #80 May 28 2:00 PM - 3:30 PM
Changes In Physical Health Status Of Students In China From 2016 To 2018

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The Ministry of Education of China has carried out spot check and review of the test data of "National Standards for Students' Physical Health" for many years, however, the effect of the investigation and the changes of students' physical health are unclear. **PURPOSE:** To analyze the changing characteristics of students' physical health from 2016 to 2018.

METHODS: We used 2016-2018 National Students Physical Health Sample Survey data for students from grade one in primary school to senior student (N= 221,053; 220330; 227,160). National norm reference standard was adopted to evaluate students' test scores of various items in body shape, function, constitution, and the total score was calculated after the scores of all the items were weighted. According to the total score, students were evaluated by four grades (excellent, good, pass and fail), BMI was used for obesity evaluation, which was divided into obesity, overweight, normal and low weight.

RESULTS: (1) From 2016 to 2018, the overall failure rate decreased from 12.0% to 11.3%, the favorable rate increased from 21.9% to 24.1%, and the excellent rate rose from 4.6% to 6.2% year by year. (2) The average proportion of primary students who reached the standard within three years was 93.0%, middle school students was 88.0%, high school students was 89.1% and college students was 73.7%. (3) The average proportion of overweight and obese students in China in the past three years is 21.6%, among which the average proportion of overweight was 13% and the obese was 8.6%. As a result, more than one fifth of the students' BMI were overweight or obese. In addition, from 2016 to 2018, the proportion of students who are obese was 7.9%, 8.9% and 9.0%, and the proportion of students who are overweight was 12.3%, 13.4% and 13.4%, respectively. The proportion of students who are overweight and obese increased year by year.

CONCLUSIONS: In the past three years, students' physical health has been gradually improved. The overall level of students' physical health decreased with the increase of learning period. The proportion of overweight and obesity in Chinese students is on the rise year by year. **Acknowledgment:** This study was supported by special project and laboratory of Ministry of Education in BSU.

2162 Board #81 May 28 2:00 PM - 3:30 PM
Abstract Withdrawn

2163 Board #82 May 28 2:00 PM - 3:30 PM
Moderate-to-vigorous Physical Activity Trajectories During Adolescence And Young Adulthood Predict Adiposity In Young Adulthood: The Iowa Bone Development Study

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Purpose: The purpose of this study was to examine the association between MVPA patterns throughout adolescence described by trajectory models and adiposity indicators (i.e., fat mass index (FMI) and visceral adipose tissue (VAT) mass index) at young adults aged 23 years.

Methods: Study participants aged 15, 17, 19, 21, and 23 years from the Iowa Bone Development Study were included. Accelerometry-measured MVPA (min/day), and FMI (kg/m²) and VAT mass index (g/m²) derived from dual-energy X-ray absorptiometry scans were collected at each age. FMI and VAT mass index as outcome variables were converted to z-scores. Group-based trajectory analyses (N = 297; Females = 168; 94% white) classified the MVPA patterns into sub-groups (group 1: 'moderately active with decreasing MVPA' vs. group 2: 'consistently active and maintaining high MVPA') and sex (females vs. males).

Results: A trajectory model identified that MVPA levels declined over time in both males and females, and the decline was more remarkable in females. The multivariable linear regression analyses showed that trajectory group (either group 1 or 2) was associated with FMI ($\beta = -.44, p = .042, R^2 = .64$) and VAT mass index ($\beta = -.52, p = .48, R^2 = .47$) z-scores.

Conclusion: This study concluded that individuals who are consistently active with maintaining their MVPA during adolescence up until early young adulthood are less

likely to accumulate total body and visceral adiposities in young adulthood. This study suggests that adopting a consistently active lifestyle throughout adolescence to achieve healthy body compositions in emerging adulthood.

Table 1. Fat mass index z-score at age 23 years prediction multivariable linear regression model.

	β	SE	p-value	R ²
Intercept	-1.14	.26	.000	
MVPA_Group	-.44	.21	.042	
Sex	-.35	.32	.278	.64
Group \times Sex	.37	.26	.158	
FMI at wave 5	.25	.01	.000	

Table 2. Visceral adipose tissue mass index z-score at age 23 years prediction multivariable linear regression model.

	β	SE	p-value	R ²
Intercept	-1.05	.32	.001	
MVPA_Group	-.52	.26	.048	
Sex	.10	.40	.801	.47
Group \times Sex	.48	.32	.133	
FMI at wave 5	.21	.02	.000	

MVPA, Moderate-to-vigorous physical activity; MVPA_Group, MVPA trajectory latent group (1 or 2); FMI, Fat mass index; β , Unstandardized coefficient; SE, Standard error.

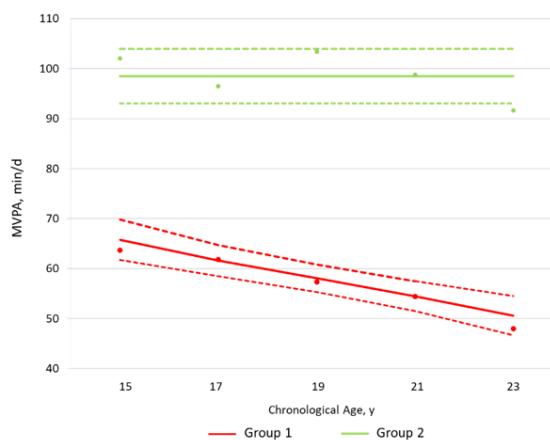


Figure 1. Moderate-to-vigorous intensity physical activity trajectory groups. Dots indicate actual mean MVPA minutes, solid lines indicate estimated MVPA minutes, and dotted lines indicate 95% confidence intervals of estimated MVPA minutes. Group 1, Moderately active with decreasing MVPA levels; Group 2, consistently active and maintaining MVPA levels.

2164 Board #83 May 28 2:00 PM - 3:30 PM
The Association Of Fitness With Middle-distance Running Performance In Chinese Boys

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(No relevant relationships reported)

There has been a paucity of evidence pertaining to the discussion whether the effect of fitness on CRF is independent of physical activity (PA).

PURPOSE: The objective of this study was to examine the association of fitness with middle-distance running performance (MDRP) in Chinese boys.

METHODS: A cross-sectional study was conducted among 180 (8th grade) boys recruited from 3 junior middle schools in Shanghai, China. Participants completed height and weight measurement, and MDRP (1000 m running). PA and sedentary behavior (SB) were measured in 7 consecutive days by accelerometers. Based on the criteria set by the Working Group on Obesity in China, the participants were categorized into either overweight and obese or normal weight according to the body mass index (BMI). Likewise, MDRP was categorized into pass or no pass by using the 2014 revised Chinese National Student Physical Fitness Standard. Independent *t* test was employed to compare the difference of the time to complete MDRP between

overweight and obese boys and normal weight boys. Correlation coefficients were computed to examine the relationship between BMI and the time to complete MDRP. The association of fatness and MDRP were examined, through multiple logistic regressions, after controlling for age and SB, light physical activity (LPA), moderate and vigorous physical activity (MVPA).

Results: 89 boys (age: 13.4±0.5 years, weight:59.3±12.7 kg, height:166.5±6.2 cm, BMI: 21.4±4.3 kg/m²) provided the valid accelerometer data (defined as ≥ 2 days, ≥10 h/day) and were included in the study. The time to complete MDRP of overweight and obese boys was significant longer than normal weight boys (320.1±42.1 s vs 270.8±35.3 s, P<0.001). BMI was significantly positively correlated with the time to complete MDRP (r=0.581, P<0.001). The overweight and obese boys were more likely to not pass the MDRP compared with the normal weight boys (adjusted odds ratio = 4.64; 95% confidence interval: 1.74-12.4), after adjusting age, SB, LPA, MVPA.

CONCLUSION: The results uncovered that boys' BMI was negatively correlated with MDRP. More importantly, compared with normal weight boys, overweight and obese boys had a higher risk to not pass the MDRP, independent of PA.

2165 Board #84 May 28 2:00 PM - 3:30 PM

COORDINATION IS NOT RELATED TO A PARENT'S PERCEPTION OF ABILITY OR SUPPORT FOR PHYSICAL ACTIVITY

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(No relevant relationships reported)

PURPOSE: To examine the relationships between parental support for children's physical activity and perceptions of the child's athletic competence with their child's gross motor development.

METHODS: 28 parents (36 + 11 yrs) completed a survey to assess indicators of support for their child's physical activity and child's athletic competence in relation to the child's peers. 41 children (20 males, 20 females, 1 unreported gender, 6.72 + 3.13 yrs, BMI 16.43 + 2.85) completed the Test of Gross Motor Development (TGMD2) which was converted to an age adjusted percentile score for both locomotor ability and object control. Bivariate correlations and independent sample t-tests were performed to identify relationships between variables and child gender differences.

RESULTS: No relationship was found between parental perception of coordination and child's object control skills (r = -0.001) or locomotor ability (r = 0.069). Parental support for physical activity was not related to the child's object control (r = 0.016) or locomotor ability (r = -0.118). A moderate positive relationship exists between parental perceptions of boys coordination and their object control scores (r = 0.414) and a moderate negative relationship exists for girls (r = -0.497). There were no differences between boys and girls for object control scores (boys: 61.65 + 24.57; girls: 57.95 + 21.75; t = 0.504, df = 38, p = 0.617), locomotor ability (boys: 74.75 + 22.31; girls: 75.75 + 20.51; t = -0.148, df = 38, p = 0.883) or parental support (boys: 8.68 + 3.45, girls: 9.44 + 3.65; t = -0.651, df = 35, p = 0.519).

CONCLUSIONS: Parental support for physical activity and how parents perceive their child's ability are not reliable indicators of their child's demonstrated motor ability. This may be especially true for young girls whose parents perceive them as less coordinated than they are.

D-63 Free Communication/Poster - Physical Activity and Health: Children and Adolescents

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
Room: CC-Exhibit Hall

2166 Board #85 May 28 2:00 PM - 3:30 PM

Psychosocial Correlates Of Physical Activity In Children And Adolescents: A Meta-analysis

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(No relevant relationships reported)

PURPOSE: This study investigated the association between physical activity (PA) and Theory of Planned Behavior (TPB, Ajzen, 1991)-based variables among children and adolescents.

METHODS: We evaluated the association between PA and TPB-based variables (intention, attitude, subjective norms, and perceived behavioral control / self-efficacy to engage in PA) among children and adolescents, and the moderation effects of geographical region of study between PA and TPB-based variables. A total of 36 articles met the inclusion criteria and were meta-analyzed. **RESULTS:** Intention

significantly correlated with and had a medium effect on PA in children. TPB displayed a good fit in path analysis. Moderator analyses showed that subjective norms and perceived behavioral control / self-efficacy had a larger effect on children in the rest of the world, compared to their North American counterparts.

CONCLUSIONS: The results provide a summary of current scientific findings about the association between TPB-based variables and PA in children and adolescents, and support TPB as a feasible conceptual framework to study psychosocial factors that underpin PA.

2167 Board #86 May 28 2:00 PM - 3:30 PM

Global Accelerometer-derived Physical Activity Levels From Preschoolers To Adolescents: A Meta-analysis And Meta-regression

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PURPOSE: It is essential to document people's PA levels worldwide with accurate information. The importance needs to focus on understanding how PA pattern changes at different time periods. One of the major measurement issues of using accelerometers is the selection of cut points to determine PA intensity such as moderate to vigorous PA (MVPA). Studies calibrating accelerometers generated large variability in cut points especially for the intensity of MVPA which need to be controlled to generate more accurate and meaningful data. Thus, we systematically reviewed and meta-analyzed global MVPA change across different age groups (preschool ages to adolescence) using data derived from accelerometer while accounting for two most popular cut points [i.e., Freedson, 1998; Everson, 2008] and continents.

METHODS: We searched major data base from inception until Aug, 2019 including cross sectional or longitudinal PA tracking studies in which daily MVPA were measured by accelerometer and determined by the two aforementioned cut points for preschoolers, children, and adolescents. Random-effect models were used for meta analyses. Multiple meta regression analyses were conducted to investigate how age relates to daily MVPA from preschooler to adolescents while controlling for cut points and continents.

RESULTS: The final data includes 91 studies representing 42338 participants across six continents. Findings revealed that for the combined studies, participants accumulated 74.44 minutes of MVPA each day (95% CI = 68.86 - 80.02, p < .001). Findings from meta regression revealed that when cut points and continents were controlled, participants' daily MVPA levels tend to decrease significantly from preschool years to adolescents (β = -8.23, p < .0001, R² = 0.4), from preschool years to children (β = -11.54, p < .0001, R² = 0.39), or from children to adolescents (β = -6.83, p < .0001, R² = 0.48).

CONCLUSIONS: Globally, individuals' daily MVPA tends to decrease from a very young age after controlling for cut points and continents. These declines were more prominent from preschoolers to childhood.

2168 Board #87 May 28 2:00 PM - 3:30 PM

A Meta-analysis Protocol Among Active Healthy Kids Report Cards' Indicators In East Asian Regions

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Insufficient physical activity (PA) is one of the leading risk factors for mortality. Evidence related to PA in children and youth has been assessed comprehensively in the Active Healthy Kids Report Cards worldwide. However, the association between influence indicators and behavioral indicators among Report Cards are yet to be critically appraised and synthesized using the method of meta-analysis. **PURPOSE:** We aim to perform meta-analyses for indicators in overall PA, sedentary behaviors, school, family & peers, and community & environment among East Asian regions with very high Human Development Indices.

METHODS: We conducted literature search in six international databases, including CENTRAL, MEDLINE, EMBASE, PsycINFO, Global Health, and BIOSIS. Observational studies with at least one influence indicator and one behavioral indicator will be considered eligible and data will be extracted for meta-analyses. The strength of association between influence indicators and behavioral indicators will be synthesized. The pooled effect sizes and their 95% confidence intervals for each association will be calculated. Newcastle-Ottawa Scale will be used for the risk of bias assessment among included observational studies. **RESULTS:** Twenty eligible observational studies including cohort studies and cross-sectional studies were included. From these 20 included studies, twelve, seven, and one were from Hong Kong, South Korea, and Japan respectively. Ten studies addressed behavioral indicators, e.g. the association

between screen time and obesity. The other ten studies addressed influence indicators, e.g. the association between parents' exercise frequency and the children's intention to participate in PA. **CONCLUSIONS:** Results of meta-analyses may inform better decision-making in tackling complex public health crisis created by physical inactivity and sedentary behaviors among children and youth in East Asian regions, triggering the engagement with relevant stakeholders among sectors of the community, as well as their joint cooperation in the development of a more friendly environment for children and youth to perform PA.

2169 Board #88 May 28 2:00 PM - 3:30 PM
Accelerometer-measured Physical Activity And Sedentary Behavior In Chinese Children And Adolescents: A Meta-analysis
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 (No relevant relationships reported)

PURPOSE: To assess moderate-to-vigorous physical activity (MVPA) and sedentary behavior (SB) levels of Chinese children and adolescents using accelerometer and to examine the differences between different populations according to gender, age/grade, day (weekdays and weekends) and geographical region.
METHODS: Four online databases were searched for studies published from January 2009 up to February 2019 (PROSPERO2019: CRD42019129888). These studies reported accelerometer-measured daily minutes of MVPA and/or SB among Chinese children and adolescents. Random-effects meta-analysis was used to separately pool the time spent in MVPA and SB.
RESULTS: Out of 4754 records, 20 studies were considered to be suitable for inclusion in the meta-analysis. Sample sizes ranged from 96 to 2163. The meta-analysis found that Chinese children and adolescents spent 41.11 min/day, 529.83 min/day in MVPA and SB, respectively. Boys spent more time in MVPA compared with girls (boys' vs girls: 45.57 vs 36.37 min/day, $p = 0.01$). Children accumulated significantly more minutes of MVPA than adolescents (children vs adolescents: 43.37 vs 37.52 min/day, $p = 0.05$), and children spent less time in SB than adolescents (children vs adolescents: 508.79 vs 553.51 min/day, $p = 0.05$). Unlike weekdays, SB was lower on weekends (weekdays vs weekends: 530.94 vs 486.57, $p = 0.02$). There were significant differences in Children and adolescents' MVPA time in regions (Hong Kong vs North China vs South China: 60.55 vs 43.21 vs 36.49 min/day, $p < 0.001$).
CONCLUSIONS: While their SB level is high, MVPA level in Chinese children and adolescents is well below international recommendations. The analyses suggested that boys spent more time in MVPA compared to girls. The MVPA level of Children is higher than adolescents. Children and adolescents living in Hong Kong are more active than in North China and South China. SB level of children is lower than adolescents. Compared with weekdays, SB level of Chinese children and adolescents is lower on weekends.

2170 Board #89 May 28 2:00 PM - 3:30 PM
The Effect Of Physical Exercise Intervention On Brain Development In Adolescent: A Systematic Review And Meta-analysis
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 (No relevant relationships reported)

The relationship between physical activity (PA) and exercise with brain development in adolescents has seen a growing interest during the past two decades. Previous systematic reviews and meta-analyses have shown the effectiveness of PA interventions on improving adolescents' brain cognition. **PURPOSE:** The study aimed to assess the effect of physical activity (PA) interventions and adolescents' brain development.
METHODS: We systematically searched MEDLINE, Web of Science, and Pubmed database from their inception to June 30th, 2019. Intervention studies aimed at examining the exercise-brain interaction at a developmental age were included in this systematic review and meta-analysis. Random-effects models were used to calculate pooled effect size (ES) values and their corresponding 95% CIs. Subgroup analyses were conducted to examine the effect of participants' and PA programs' characteristics.
RESULTS: A total of 25 studies were included in this systematic review and meta-analysis. Pooled ES estimations were as follows: working memory 0.45 (95% CI = 0.28-0.61), inhibition 0.08 (95% CI = 0.02-0.14), attention 0.61 (95% CI = 0.44-0.78) and brain psychological functions 1.05 (95% CI = 0.67-1.43).
CONCLUSIONS: PA benefits several domains of working memory, inhibition, attention and brain neurophysiology functions in youth. Physical activity interventions and programs designed to increase the number of PA per day after school seems to be the most effective. (The last author as the corresponding author; This study was supported by the NPOPSS Grant 15CTY011)

2171 Board #90 May 28 2:00 PM - 3:30 PM
The Effectiveness Of Physical Activity On Motor Skills In Children With Neurodevelopmental Disorders: A Meta-analysis
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 (No relevant relationships reported)

Background: Researchers of epidemiological studies in recent years have witnessed the expansion of children with neurodevelopment disorders (NDDs), particularly of children with attention-deficit/hyperactivity disorder (ADHD), autism spectrum disorder (ASD), Down syndrome (DS), developmental coordination disorder (DCD), Cerebral palsy (CP). Noticeable motor deficits are among common characteristics of children with NDDs, which indicate the need for interventions to promote optimal motor and overall development. While physical activity (PA) has been widely used in the rehabilitation of children with NDDs to improve their motor performance, questions remain whether or not the beneficial effects of PA are conclusive. The purpose of this study was to conduct a systematic review and meta analysis of the studies investigating the effects of PA on motor skill performance in children with NDDs. **Methods:** Relevant articles were sourced from PubMed, the Web of Science, EBSCO, the Cochrane Library, CNKI and Wanfang data. **Results:** Twenty studies with 269 subjects met inclusion criteria for this review and were included. Compared with pre-interventions, there was a significantly improve in motor skills (Fig.1 & 2), the gross motor skills (SMD [standardized mean difference] = 0.64, 95%CI [coefficient interval]: 0.29 to 0.99), fine motor skills (SMD = 1.33, 95%CI: 0.57 to 2.09) respectively. **Conclusion:** PA could effectively improve gross and fine motor skill performance in children with NDDs. Although the findings were based on a small number of studies, the results of this meta-analysis still suggest that researchers and clinicians should consider including PA in their rehabilitation programs for children with NDDs. Future studies should clarify which type and what intensity of PA intervention might be most effective in promoting motor development based on individual children's needs and treatment characteristics.

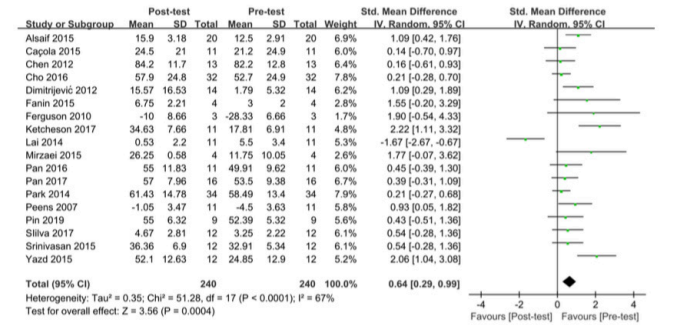


Fig. 1 Forest plot for change in gross motor skills

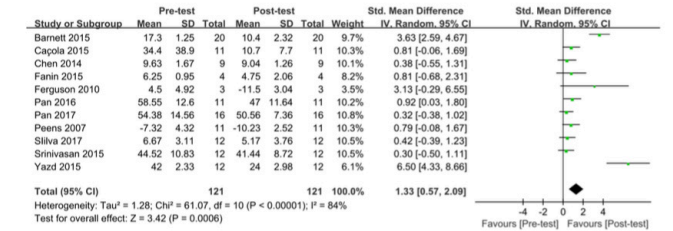


Fig. 2 Forest plot for change in fine motor skills

2172 Board #91 May 28 2:00 PM - 3:30 PM
Prenatal Exercise And Cardiorespiratory Health And Fitness: Systematic Review And Meta-analysis
 Margie H. Davenport¹, Stephanie-May Ruchat², Allison Sivak¹, Chenxi Cai¹. ¹University of Alberta, Edmonton, AB, Canada. ²Université du Québec à Trois-Rivières, Trois-Rivières, QC, Canada.
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Purpose: To examine the influence of prenatal exercise on maternal cardiorespiratory health and fitness during pregnancy. **Methods:** Online databases were searched up to February 25, 2019. Studies of randomized controlled trials (RCTs) were

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eligible, which contained information on the relevant population (pregnant women), intervention (subjective or objective measures of frequency, intensity, duration, volume, or type of exercise), comparator (no exercise intervention), and outcomes (maternal cardiorespiratory fitness, including VO_{2max} , submaximal VO_2 , VO_2 at anaerobic threshold, and cardiorespiratory health, including resting heart rate, resting systolic and diastolic blood pressure during pregnancy). **Results:** From 2699 unique citations, 26 RCTs (N= 2292 women) were included. "Low" to "high" certainty evidence revealed that exercise was associated with improved VO_{2max} (five RCTs, n=430; mean difference [MD]=2.77 mL/kg/min; 95% confidence interval [CI]: 0.32 to 5.21, $I^2=69\%$), reduced resting heart rate (nine RCTs, n=637; MD= -1.71 bpm; 95% CI: -3.24 to -0.19, $I^2=13\%$), resting systolic blood pressure (16 RCTs, n=1672; MD: -2.11 mmHg, 95% CI: -3.71 to -0.51, $I^2=69\%$) and diastolic blood pressure (15 RCTs, n=1624; MD: -1.77 mmHg, 95% CI: -2.90 to -0.64, $I^2=60\%$). **Conclusion:** Prenatal exercise interventions improve maternal VO_{2max} and reduce resting heart rate and blood pressure. PROSPERO registration number: CRD42019131249.

2173 Board #92 May 28 2:00 PM - 3:30 PM
Effects Of Multidimensional Lifestyle Interventions On Children's Body Composition And Blood Pressure: A Network Meta-analysis

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PURPOSE: A variety of clinical trials with various lifestyle intervention programs are available to address pediatric obesity and chronic diseases. Yet, no known research has used network meta-analysis to synthesize the findings simultaneously. In response, this network meta-analysis aimed to compare the effectiveness of multiple lifestyle interventions on children's body composition and blood pressure changes. **METHODS:** A total of 312 published studies on lifestyle intervention programs were retrieved with 37 studies meeting the following inclusion criteria: (1) data-based articles published in English between 2009 and 2019; (2) used randomized controlled trial design; (3) subjects aged between 1 to 12 years old and did not suffer from any physical or mental illness; and (4) investigated some type of intervention on body mass index (BMI), BMI z-score (BMIz), body fat percentage, systolic blood pressure (SBP) and diastolic blood pressure (DBP) among children. Data extraction for comparisons was completed for 10 intervention categories: (1) control (T1; no intervention); (2) physical activity (PA)/exercise only (T2); (3) knowledge education in various dimensions (T3); (4) nutrition (T4); (5) environment changes (T5); (6) PA plus education (T6); (7) nutrition plus education (T7); (8) environment changes plus education (T8); (9) PA with nutrition and education (T9); and (10) PA with environment changes and education (T10). Package "pnetmeta" in R software was mainly used to carry out the analysis. **RESULTS:** Based on mean difference (MD) comparison, nutrition plus education and physical activity (PA)/exercise only appeared to be two most effective ways in reducing children's body fat percentage compared with treatments 3, 5, 6 and 10 (Effect Size(ES) = -2.33, 95%CI: (-4.17, -0.44); ES = -1.61, 95% CI: (-2.47, -0.68) respectively). For children's BMI, T9 was the most effective approach compared with seven other treatments. T2 demonstrated the best scores in both BMIz and SBP (ES = -5.57, 95%CI: (-8.37, -2.64)) in final estimation. **CONCLUSIONS:** PA intervention ranked top two of the most effective approaches among 9 types of lifestyle interventions in all 5 MD comparisons, suggesting that promoting PA participation is crucial in childhood obesity control.

2174 Board #93 May 28 2:00 PM - 3:30 PM
Physical Activity, Sedentariness And Metabolic Risk In Portuguese Children

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It has been suggested that physical activity (PA) and sedentariness are associated to metabolic risk (MR) factors in children.

PURPOSE: To study the relationship between different PA intensities [moderate to vigorous PA (MVPA) and light PA (LPA)] and sedentariness with children MR.

METHODS: The sample comprises 388 Portuguese children, from both sexes (219 girls; mean age 10.5 years). MR indicators included fasting glucose, triglycerides, HDL-cholesterol, as well as waist circumference and mean arterial blood pressure; MR score (zMR), adjusted for maturity offset, was computed. MVPA, LPA, and sedentariness were measured with the GT3X+ Actigraph accelerometer with at least 4 days (with one weekend day) of at least 10 hours/day of monitoring. Linear regression, by sex, was used to identify correlates of zMR. **RESULTS:** In girls, none of the variables included in the model were significantly related to zMR ($p>0.05$); however, in boys a negative and significant effect of MVPA was observed ($\beta=-0.026$; $p=0.011$), where those who spent more time in MVPA had a better zMR profile, but no significant effect was observed for LPA or sedentariness. **CONCLUSIONS:** The role of PA on MR in children differs according to gender. In girls no significant link was observed, suggesting that other factors (namely biological and nutritional) may be associated with girls' metabolic health. In boys MVPA is a relevant predictor in their metabolic health, suggesting that MVPA should be promoted. Study funded by The Portuguese Foundation of Science and Technology (individual grant SFRH/BPD/1231452016).

2175 Board #94 May 28 2:00 PM - 3:30 PM
Parent Physical Activity Is More Associated With Child Sport Participation Than Accelerometer-Assessed Child Physical Activity

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Parent physical activity (PA) levels may influence the PA levels of their children, either through general activity or sport participation. However, the strength of those associations needs further exploration. Moreover, factors such as child PA self-efficacy, family support of PA, and family structure may also influence these associations and research is lacking among rural families. **PURPOSE:** To examine the associations between parent PA levels and child PA levels including sport participation, and to further explore the role of the aforementioned variables in the relationship. **METHODS:** Baseline data were analyzed on 105 child-parent dyads (child age = 8.95 ± 1.1 years, parent age = 37.9 ± 5.4 years) from the NU-HOME study, a childhood obesity prevention, RCT in a rural community. Data included parent self-reported PA (daily total PA and daily total moderate-to-vigorous PA (MVPA)), family structure (child to adult ratio), and child sport participation in the past year; child-reported PA self-efficacy and family support for PA; and objective child PA levels from accelerometry (daily total PA and daily total MVPA). Child daily total MVPA did not meet acceptable normality and was log transformed for analyses. Multivariate regression models controlling for economic assistance were analyzed using SAS 9.4. **RESULTS:** Children participated in 2.4 ± 1.5 sports in the past year. Mean child daily total MVPA was 44.9 ± 18.6 minutes, while mean parent daily total MVPA was 25.5 ± 25.3 minutes. Parent PA was not significantly associated with child daily total PA or child daily total MVPA. However, after adjusting for economic assistance, parent PA was significantly associated with child sport participation separately ($p<0.005$) and in models that included child PA self-efficacy, family support of PA, and family structure ($p<0.02$). **CONCLUSIONS:** Present study findings that parent PA was significantly associated with child sport participation, but not objective measures of child PA suggests that active parents may encourage and support their children's sport participation. Sport participation may provide personal, social, as well as physical benefits for children. The findings of this study highlight the importance of exploring sport participation when investigating activity behavior particularly among rural children.

2176 Board #95 May 28 2:00 PM - 3:30 PM
DIABETES RISK STATUS AND PHYSICAL ACTIVITY IN WOMEN OF CHILDBEARING AGE: U.S. BRFS

Bethany Grace Rand, Tammie M. Johnson, Michelle L. Stone, Michael R. Richardson, James R. Churilla, FACSM. University of North Florida, Jacksonville, FL. (Sponsor: James Churilla, PhD, FACSM)
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PURPOSE: Women of childbearing age with prediabetes (PD) or gestational diabetes (GD) can reduce their odds of diabetes by engaging in physical activity (PA). This study examined the odds of meeting the current United States aerobic activity (AA), muscle-strengthening activity (MSA), both, or neither recommendation(s), according to diabetes risk status (DRS).

METHODS: Women (N=282,302) ages 18-44 who participated in the 2011, 2013, 2015, or 2017 Behavioral Risk Factor Surveillance System survey were categorized by DRS: no diabetes (ND), diabetes (DM), or high risk for diabetes (HRD). Logistic

regression models stratified by body mass index (underweight [<18.5], desirable weight [$18.5-24.9$], overweight [$25.0-29.9$], and obese [≥ 30.0]) were fitted, controlling for potential confounders.

RESULTS: Compared to the ND referent group, overweight women with DM had significantly ($p \leq 0.05$) lower odds of meeting the AA recommendation (OR 0.83, CI 0.67-1.00). Overweight women considered HRD were less likely to meet the MSA recommendation (OR 0.81, CI 0.68-0.97) and more likely to not meet either recommendation (OR 1.20, CI 1.03-1.40). Among women in the desirable weight group, those considered HRD had lower odds of meeting MSA only (OR 0.72, CI 0.61-0.85) or both recommendations (OR 0.77, CI 0.64-0.93). Desirable weight women with DM had greater odds of not meeting either recommendation (OR 1.43, CI 1.12-1.82). **CONCLUSIONS:** Increased AA and MSA in women at risk for diabetes may benefit maternal outcomes. Strategies targeting the determinants of PA should be considered to increase participation.

2177 Board #98 May 28 2:00 PM - 3:30 PM
Exploring Associations Between Household Chaos With Sedentary Behavior And Screen Time In Rural Children

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Household chaos is perceived home disorganization caused by noise, crowding, and traffic patterns. It has been shown to be linked to weight-related behaviors such as sleep and nutritional behaviors (i.e., family meals). However, the relationship between sedentary behavior and household chaos has not been explored. Examining this association could allow us to better understand how family milieu contributes to behavioral risk factors for childhood obesity. **PURPOSE:** To examine associations between household chaos with sedentary behavior and screen time in rural children. **METHODS:** Participants ($n=105$ parent/child dyads) were enrolled in the NU-HOME study, a family-based, obesity prevention RCT in rural Minnesota. Parents reported baseline data on sociodemographics, household chaos, and child screen time. Household chaos was measured with a 15-item scale about home disorganization ($\alpha=0.83$; higher scores indicate more chaos). Children's sedentary behavior was assessed via accelerometry. Regression analyses using SAS 9.4 were performed to assess associations between household chaos and sedentary behavior and screen time, controlling for child-parent ratio, economic assistance, child BMI z-score and age. Normality of screen time was not met, so a transformed variable was used in analyses. **RESULTS:** Child mean age was 8.95 ± 1.05 years; 59% were female; mean BMI z-score = -0.92 ± 0.94 . Mean daily sedentary time and screen time were 8.33 ± 77.5 and 2.06 ± 1.42 hours, respectively. Household chaos scores had a mean of 5.04 ± 3.6 , which is comparable to other studies. Household chaos scores were not significantly associated with child sedentary behavior but were positively associated with child screen time ($p=0.002$). **CONCLUSIONS:** In other studies, household chaos has been associated with negative health behaviors, which aligns with our current findings. The association between screen time and household chaos may be explained by parents using electronics to entertain children in chaotic environments. Parents in chaotic homes may also have more difficulty managing a child's screen time than those in less chaotic homes. The relationship between household chaos and sedentary behavior should be further explored to increase our understanding of how the home environment may affect health-related behaviors.

2178 Board #97 May 28 2:00 PM - 3:30 PM
Meeting 24-hour Movement Guidelines: Prevalence, Correlates And Relationships With Overweight And Obesity Among Chinese Children And Adolescents

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There is a lack of research on meeting 24-hour movement guidelines, including physical activity (PA), sedentary time (ST) and sleep, among Chinese children and adolescents. **PURPOSE:** To investigate the prevalence of meeting the 24-hour movement guidelines, related correlates, or the relationships with body mass index (BMI) among Chinese children and adolescents. **METHODS:** Cross-sectional data were derived from the Physical Activity and Fitness in China—The Youth Study (PAFACTYS) 2017. A nationally representative sample with 114,072 children and adolescents (9-18 years-old, mean age 13.75 years, 49.2% boys) completed a self-report questionnaire regarding PA, ST and sleep. The prevalence of meeting the 24-hour movement guidelines and World Health Organization (WHO) weight status

categories was determined. Generalized linear models were used to determine the correlates of meeting the movement guidelines and the relationships of meeting the movement guidelines with overweight and obesity (OW/OB). **RESULTS:** Only 5.12% of Chinese children and adolescents met the 24-hour movement guidelines and 22.44% were classified as OW/OB. Children and adolescents meeting the 24-hour movement guidelines showed lower odds ratios for OW/OB. Compared with meeting the 24-hour movement guidelines, boys of 4-6th grades (9-12 years old) meeting none of the recommendations (OR = 1.22), ST recommendation only (OR = 1.13) and sleep recommendation only (OR = 1.14) had significantly higher odds ratios for OW/OB. Similar trends were observed in girls of 4-6th grades meeting none of the recommendations (OR = 1.35), sleep recommendation only (OR = 1.23) and PA + sleep recommendations (OR = 1.24), and in girls of 7-9th grades (13-15 years old) meeting none of the recommendations (OR = 1.30). **CONCLUSIONS:** Very few Chinese children and adolescents met the integrated health-related 24-hour movement guidelines. Age (negative), parental educational level and family income (both positive) were correlates of meeting the 24-hour movement guidelines. Children and adolescents meeting the 24-hour movement guidelines were more likely to have healthier body weight, especially in the youngest age group, and girls in middle age group. **Funding:** Supported by the General Project of the National Social Science Foundation of China (19BTY077).

2179 Board #98 May 28 2:00 PM - 3:30 PM
The Association Between Socioeconomic Status And Access To Physical Activity Related Built Environment In Children

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 (No relevant relationships reported)

Minorities and those with lower socioeconomic status (SES) are at higher risk for chronic diseases compared to their Caucasian counterparts and those with higher SES. Establishing life-long physical activity (PA) behavior in childhood could lower the risk for chronic disease in adulthood. Access to opportunities for PA in the built environments is associated with increased PA behavior in children. Understanding patterns of access to these opportunities for minority and low SES children would be useful in developing interventions to increase PA in these populations. **PURPOSE:** To investigate the relationship among race, SES, proximity to public parks for children and adolescents in a mid-sized city. **METHODS:** ArcGIS Online was used to map public parks with 10-minute walking buffers, census tract-level demographics (race of children and adolescents [≤ 19 yrs], household poverty status, and population density). Central city neighborhoods were also mapped. Partial correlations between the variables were performed, controlling for all other variables. Hierarchical cluster analysis identified homogeneous census tracts with regard to race, SES, park proximity, and population density. One-way ANOVA measured differences in the variables used to construct the clusters. Significance was set at $p < 0.05$. **RESULTS:** Poverty correlated with black race ($r^2=0.60$, $p < 0.001$) and park proximity ($r^2=0.53$, $p=0.54$), but there was no significant correlation between race and park proximity. Population density correlated with black race ($r^2=0.63$, $p < 0.001$), but not with any other variables. Two census tract clusters were identified. Parks in cluster 1 corresponded with neighborhoods centrally located in the city. Compared to cluster 2, cluster 1 showed higher percentages of households below the poverty level (36.1 ± 13.2 vs 4 ± 8.6), children and adolescents of black race (63.4 ± 18.6 vs 30.3 ± 18.3), and children and adolescents living within 10-minute walking distance to a park (76.7 ± 16.7 vs 8.0 ± 11.4). **CONCLUSIONS:** Abundant proximity to parks may provide opportunities for physical activity interventions for at-risk children and adolescents in urban areas. Future directions should include the investigation of additional aspects of access in these subgroups such as patterns of PA-promoting park amenities.

2180 Board #99 May 28 2:00 PM - 3:30 PM
Association Of Household Food Security And Physical Activity Among Youth And Young Adults With Diabetes

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Physical activity (PA) is so essential in diabetes management that it is usually prescribed as a lifestyle change in addition to medications. Food insecurity may cause youth and young adults (YYAs) with diabetes to be more fatigued, thereby negatively impacting their PA.

PURPOSE: The purpose of this study is to examine the association between household food security and PA in YYAs with diabetes.
METHODS: Data from 2,195 YYAs with diabetes (1,855 type 1, 340 type 2, mean age: 21.4 years) were analyzed from the SEARCH for Diabetes in Youth Study. Household food security status was measured with the 18-item U.S. Household Food Security Survey Module by adult participants or parents of minors. Households that affirmed ≥ 3 food insecure conditions or behaviors were considered food insecure. PA was measured with the International Physical Activity Questionnaire Short Form. Walking, moderate (excluding walking) intensity physical activity (MPA), and vigorous intensity physical activity (VPA) minutes/week were multiplied by 3.3, 4.0, and 8.0, respectively, to obtain metabolic equivalent minutes (MET min/wk), and summed to calculate total PA MET min/wk. We conducted median regression analyses, adjusting for socioeconomic, demographic and clinical covariates, for both the full sample and by diabetes type.

RESULTS: 20% of the sample (15% type 1, 5% type 2) was food insecure. The median amount of walking, MPA, VPA, and total PA were 991, 481, 955, and 2,967 MET min/wk, respectively. In the unadjusted analysis, food insecurity was significantly associated with less VPA (β : -480; $p=0.0067$) and more walking (β : 399; p -value=0.0006) MET min/wk. The effect for walking persisted after covariate adjustment (β : 242; $p=0.0238$). There was no significant difference observed by diabetes type.

CONCLUSION: Household food security was not associated with MPA, VPA, or total PA MET min/wk in adjusted analyses. Food insecurity was associated with more walking MET min/wk. Future research should consider walking for travel vs. walking for leisure among food insecure YYAs with diabetes. Future research should also consider use of an objective measure of PA in contrast to the present study which relied on subjective recall.

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2181 Board #100 May 28 2:00 PM - 3:30 PM
Metabolic Syndrome And Muscular Strength In Youth: NHANES 2011-2014

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Muscular strength has recently been identified as a potential target of cardiometabolic risk-factor reduction strategies in youth. Initial explorations have indicated links between muscular strength and individual components of metabolic syndrome, but large, nationally-representative research on the topic is limited. **PURPOSE:** To investigate the relationship between metabolic syndrome and muscular strength in a nationally representative sample of U.S. youth. **METHODS:** The analysis included 409 boys and 415 girls from the 2011-2014 National Health and Nutrition Examination Survey between 12-18 years of age. Metabolic syndrome was defined by the Jolliffe and Janssen criteria and based on having 3 or more of the following components: abdominal obesity, high triglycerides, low HDL cholesterol, elevated blood pressure, or high fasting glucose. Muscular strength was assessed via handgrip dynamometer and expressed as age- and sex-specific z-scores of relative strength (kg strength/kg body mass). Low strength was defined as a relative grip strength below the 25th age- and sex-specific percentile. Logistic regression was used to estimate the odds of metabolic syndrome based on relative strength z-score. An additional model compared the odds of metabolic syndrome between youth in low and adequate strength groups. All analyses controlled for age, sex, race/ethnicity, physical activity status, and weight status. **RESULTS:** The prevalence of metabolic syndrome was 5.3% (95% CI 3.9% to 7.3%). The logistic regression indicated that for every 1 unit decrease in strength z-score, the odds of metabolic syndrome increased by 2.6 (95% CI 1.7 to 4.1). Further, adolescents with low strength were more likely to have metabolic syndrome than those with adequate strength (odds ratio = 2.2, 95% CI 1.1 to 4.3). **CONCLUSIONS:** Muscular strength is predictive of adolescent metabolic syndrome. Youth with low strength are more than twice as likely to have metabolic syndrome than those above the bottom strength quartile, irrespective of physical activity and weight status. These results highlight the relevance of muscular strength in the prevention of youth cardiometabolic disease and metabolic syndrome.

2182 Board #101 May 28 2:00 PM - 3:30 PM
Physical Activity And Sedentary Behaviors Vary According To Fitnessgram Bmi Classification In Youth

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(No relevant relationships reported)

FITNESSGRAM has established criterion standards for aerobic fitness, as well as body composition and body mass index (BMI) according to gender and age in youth. **PURPOSE:** The purpose of this study was to determine the variation in reported amounts of physical activity (PA) and sedentary behaviors (SB) according

to FITNESSGRAM BMI classification in youth. **METHODS:** Subjects were 1,643 boys and girls, ages 11-17 years, who participated in the 2014 FLASHE Study, a national epidemiological survey regarding psychosocial, general, and environmental factors of various health behaviors. Participants' responses regarding levels of PA and SB were compared across FITNESSGRAM BMI classifications, more specifically between participants categorized as either Very Lean (VL) or within the Health Fitness Zone (HFZ) versus those participants in the Needs Improvement (NI) categories. **RESULTS:** Participants classified as NI for BMI reported significantly less PA outside of school ($p = .004$), as well as significantly greater sedentary time outside of school ($p = .003$) than participants classified as either VL or within the HFZ. Participants classified as NI for BMI also reported significantly greater predicted time (minutes) per week in SB outside of school ($p < .001$), significantly greater predicted time (minutes) per day in SB outside of school ($p < .001$), and significantly greater predicted proportion of time (percentage) in SB outside of school ($p < .001$) than participants classified as either VL or within the HFZ. No significant difference in responses between participants classified as NI compared to those classified as either VL or within the HFZ were observed for predicted time per day or week in moderate-to-vigorous PA at school or during the weekend. **CONCLUSIONS:** FITNESSGRAM BMI classifications have been shown to be consistent with ratings of aerobic fitness. These data suggest that youth classified as NI according to FITNESSGRAM BMI standards have similar in-school and weekend PA and SB patterns as youth classified as either VL or within the HFZ; however, youth classified as NI engage in less PA and more SB outside of school. To reverse the trend toward greater overweight and obesity among youth, it may be important to address PA and SB patterns.

2183 Board #102 May 28 2:00 PM - 3:30 PM
What Determine Physical (In)Activity In Brazilian Adolescents?

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Increases in physical inactivity has being pointed as one of the most relevant public health problems, especially among youth. Once physical (in)activity is a multifactorial trait, determined by different variables, such as biological and environmental, understanding the role of these variables in youth physical activity (PA) guidelines compliance seems to be of relevance, especially in Brazilian context, given the diversity observed among its region. **PURPOSE:** To describe differences in adolescent's PA guidelines compliance among Brazilian regions and to investigate the determinants related to these differences.

METHODS: Data comes from the National Adolescent School-based Health Survey (PENSE). Sample comprises 99570 Brazilian students (51.7% girls), enrolled in the 9th grade of Elementary School (mean age 14.29±0.93y). Information related to daily PA guidelines compliance was self-reported (based on the number of days, in last week, adolescents were engaged in at least 60 minutes of moderate to vigorous PA), as well as mother educational level; further, school context information (school size and availability of sports court) was obtained. Logistic regression analysis was computed in SPSS 24, with a significance level of 95%.

RESULTS: More than 2/3 of the adolescents did not comply the PA guidelines on any given day of the week; more, the North region presented the highest compliance percentage (9.8%), followed by the Midwest (9.6%), South (8.6%), Southeast (8.3%), and Northeast (7.8%) regions. Regarding predictors of PA guidelines achievement, boys (OR: 3.33, $p<0.001$), older adolescents (OR: 1.08, $p<0.001$), those with mother with higher educational level (OR: 1.33, $p<0.001$), and those enrolled in schools without sports court (OR: 0.92, $p=0.007$) were more prone to be active than girls, young adolescents, those with mothers with lowest educational level, and those enrolled in schools with sports court, respectively. No significant result was found for school size ($p = 0.558$). **CONCLUSIONS:** Sex, age, mother educational level, and the presence of sports court at school were significant predictors for compliance of PA guidelines among Brazilian adolescents. These results reinforce that biological and environmental characteristics, namely school context, play important roles in youth health habits.

2184 Board #103 May 28 2:00 PM - 3:30 PM
Physical Activities Status Of Yi Nationality Pupils In China

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Regular physical activity in children and adolescents promotes health and fitness and youth who are physically active are healthier, have less body fat, and exhibit improved cognition and mental performance. Youth need at least 60 minutes of moderate-to-vigorous physical activity each day for good health. **PURPOSE:** Many researches have been done about physical activity levels among youth in China, but most of them

focused on urban children, less known about rural ones, especially minority in poverty areas in China. The main purpose of this article is to investigate the levels of physical activity among Yi nationality pupils in Sichuan province of China. **METHODS:** 7-Day Physical Activity Recall Questionnaires were used to investigate the amount of physical activities among 123 Yi Nationality Pupils (53 boys, 51 girls) aged 9 to 17 (born in 2002-2009) in grade 4 and grade 6.

RESULTS: For the participants, their average total amount of physical activities is 1088 minutes per week, and boys are more physically active than girls (boys in grade 6 is 1376 and girls is 791, boys in grade 4 is 1209 and girls is 979); their average total amount of physical activities at school is 375 minutes per week, and boys are relatively more physically active than girls at school (boys in grade 6 is 394 minutes per week and girls is 285, boys in grade 4 is 366 minutes per week and girls is 363); their average total amount of house work activities at home is 15 minutes per week, and boys are relatively more than girls (boys in grade 6 is 17 minutes per week and girls is 10, boys in grade 4 is 18 minutes per week and girls is 13); only there are 16.2% of pupils whose daily PA amount are below to the recommended daily physical activities of WHO and ACSM (boys in grade 6 is 6 and girls is 3, boys in grade 4 is 4 and girls is 5). **CONCLUSIONS:** Boys are more physically active than girls; Most of pupils reached the recommendation of daily physical activity.

2185 Board #104 May 28 2:00 PM - 3:30 PM

Behavioral Factors For Adolescents' Obesity And Overweight: Physical Activity, Sleep, Sedentary Behavior, And Diet

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PURPOSE: To investigate the risk factors in weight status among adolescents regarding dietary habits and movement behavior.

METHODS: Primary data were derived from the CDC Youth Risk Behavior Survey (YRBS), a nationally representative sample of 40,130 grade 9-12 students (N=20,340 boys and 19,790 girls) from 2011 to 2017. The prevalence of overweight and obesity was examined using by BMI percentile and then compared based on various demographics (i.e., sex, age, race) and behavioral factors (i.e., physical activity, sedentary time, sleep, soda consumption). Logistic regression analysis was conducted to illustrate the differences in weight status within each group of physical activity levels after control the behavioral and demographic factors.

RESULTS: Overall, African-American adolescents had the highest prevalence of overweight or obesity (36%), followed by Hispanics (35%), others (29%), and White (27%). Female students had significantly lower obesity rate than male students (-6.4 ± 0.2%), but also spend less time for behavioral activities (e.g., sedentary time: -0.372 ± 0.015 hours, MVPA -20.4 ± 0.4%, and strength training -20.9 ± 0.3%). The self-diagnosis was relatively accurate, with 69% of true positive and 13% of true negative in comparison to actual overweight and obesity status. For the PA group, students who satisfied both PA recommendations had less likely to be obese compared to non-PA group: Odds Ratio (OR) for PA = 0.89, 95% CI [0.825, 0.961], p = 0.003; OR for strength training = 0.92, 95% CI [0.865, 0.996], p = 0.039. Students who consumed soda on more than one day were more likely to be obese (OR = 1.13, 95% CI [1.049, 1.223]), and students who had more sedentary time tended to be obese (OR=1.03, 95% CI [1.011, 1.041]).

CONCLUSIONS: Students who were meeting PA recommendations were less likely to be obese, while students who had more sedentary time and higher levels of soda consumption were more likely to be obese. In addition, African American and Hispanic students were more likely to be overweight and obese.

2186 Board #105 May 28 2:00 PM - 3:30 PM

Peak Height Velocity Maturity Offset Estimated From Cross-sectional Vs. Longitudinal Growth Data

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Appropriate evaluation of pediatric health indices relies on assessment based on physical maturity status. Regression equations have been developed to estimate maturity offset (MO) relative to age at peak height velocity (aPHV) using cross-sectional anthropometric data, with extensive application in pediatric exercise research.

PURPOSE: We evaluated agreement of these estimates against standards calculated using superimposition by translation and rotation (SITAR) models of longitudinal data, targeting specific time windows relative to PHV and menarche. **METHODS:** Height data were drawn from a longitudinal dataset evaluating female bone growth in 141 participants for whom SITAR-based aPHV had been calculated using ≥ 3

data points. Two subsamples were selected based on available repeated measures in target maturity ranges based on SITAR aPHV and menarche: prePHV (-2.5 to -1.5yr), postPHV (+1.5 to +2.5yr); circaPHV (-0.5 to +0.5yr) & postMEN (0 to +1.0yr). Mirwald et al. and Moore et al. regression equations were used to calculate aPHV and MO, yielding MO1 and MO2 (respectively) for comparison against sitarMO. Bland-Altman plots evaluated agreement with sitarMO in each target maturity range. **RESULTS:** For prePHV and postPHV comparisons, n= 58, with mean sitarMO -2.1yr (sd 0.3) and +2.1yr (sd 0.3), respectively. For circaPHV & postMEN comparisons, n=108, with mean gynecological ages -1.1yr (sd 0.7) and +0.6yr (sd 0.3) and mean sitarMO -0.1yr (sd 0.4) and +1.6yr (sd 0.7), respectively. Except postMEN, on average, MO₁ underestimated sitarMO [prePHV -1.5yr, postPHV -2.8yr; circaPHV = -2.3yr, postMEN = +0.5yr]. Mean discrepancies for MO₂ vs. sitarMO were subtle, near zero [prePHV = +0.4yr, postPHV = +0.1yr; circaPHV = -0.1yr, postMEN = -0.01yr]. **CONCLUSION:** MO₁ maturity estimates are flawed; <50% of estimates were within 1yr of sitarMO for assessed maturity ranges. MO₂ provides better sitarMO estimates using cross-sectional data. However, it is unclear whether MO₂ is an improvement over chronological age for most individuals, as MO₂ effectively assesses whether girls are short or tall for their age. In many cases, height for age may primarily reflect genetic height potential rather than maturity status, particularly at older maturity stages.

D-64 Free Communication/Poster - Population-based Surveillance

Thursday, May 28, 2020, 2:00 PM - 4:30 PM

Room: CC-Exhibit Hall

2187 Board #106 May 28 2:00 PM - 3:30 PM

Extent Of Childhood Participation In Ultramarathon Running Does Not Negatively Impact Continued Running

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(No relevant relationships reported)

PURPOSE: It is unclear if "excessive" exercise is harmful, particularly at a young age. While childhood participation in ultramarathons has increased exponentially over the past 20 years, less than 25% of these individuals continue running ultramarathons in adulthood. This raises concern that childhood ultramarathon runners may suffer complications from their young participation in the sport. The purpose of this work was to examine if the extent of ultramarathon participation among those under 19 years of age is related to the cessation of running into adulthood due to running related injuries.

METHODS: Individuals having completed an ultramarathon when under 19 years of age were recruited via announcements on running-related websites and Facebook advertisements. Qualified participants were also identified from race results databases, and directly recruited when online publicly available contact information was found. Participants completed an online survey including questions on running history, whether or not they are currently running and reasons for not if that was the case, and their opinions about how childhood ultramarathon running had impacted their health. Group comparisons were made with an unpaired t-test or the Mann-Whitney test.

RESULTS: There were 69 participants (9 women and 60 men) completing the survey with median age of 34 years (range 18-67 years). Those who had stopped running regularly due to running-related injury (12%) had not completed more ultramarathons when under 19 years of age compared with those who had either stopped for other reasons (28%) or continued to run regularly (median 1 vs. 2, p=.13). The age of these two groups was also similar (p=.51). All but one respondent (1%) indicated that they believed running an ultramarathon as a child had either a positive (67%) or no (32%) effect on their physical health. **CONCLUSIONS:** Cessation of running into adulthood due to running related injuries was unrelated to the number of ultramarathons completed while under 19 years of age. Childhood ultramarathon runners also largely felt that ultramarathon running as a child had a favorable effect on their health. These findings suggest that the extent of childhood ultramarathon running does not adversely affect running into adulthood. Supported by the Ultra Sports Science Foundation

2188 Board #107 May 28 2:00 PM - 3:30 PM

SLEEP DURATION AND OBESITY INDICES IN U.S. ADOLESCENTS (NHANES 2015-2016)

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Adolescent obesity continues to be a major public health concern among developed nations. Sleep duration has been hypothesized as a contributing factor to this increase. **PURPOSE:** This study examined the sleep-obesity relationship in U.S. adolescents. **METHODS:** Data from the 2015-2016 National Health and Nutrition Examination Survey ($n=454$; ages 16-18 years) was used to consider the effect of sleep duration (hours) on body mass index (BMI) and waist circumference (WC) by gender. Linear regression was used to determine the relationship between sleep duration and BMI and WC. Sleep hours were then categorized as Under Recommended (<7 hours), Recommended (8-10 hours), and Over Recommended (>10 hours) and an ANCOVA was used to examine differences in BMI and WC by sleep category. Finally, logistic regression considered the influence of sleep category on overweight classification. **RESULTS:** Approximately 21% of the total participants were overweight or obese while 53.3% met the recommendations for sleep duration. Linear regression revealed a significant ($p<0.05$) main effect across sleep duration categories in the total sample for WC only. Longer sleep duration was associated with an increased WC in both males ($p=0.030$) and females ($\beta=0.143-0.148$, $p<0.05$) and with an increased BMI in males ($\beta=0.136-0.113$, $p<0.05$), but not females. Logistic regression analyses yielded no significant influence of sleep category assignment on overweight BMI classification. **CONCLUSIONS:** For both males and females, excessive sleep was related to higher WC. However, excessive sleep only impacted BMI in males. In contrast, the greater number of females achieving the recommended amount of sleep, and thus, smaller proportion getting insufficient or more than the recommended amount, may contribute to the absence of influence on BMI in females. Likewise, the categories used to classify sleep duration may not be sensitive enough to adequately identify risk differences weight-related maladies in females.

2189 Board #108 May 28 2:00 PM - 3:30 PM

Association Between 90° Push-up And Cardiorespiratory Fitness: Cross-sectional Evidence Of Physical Fitness Surveillance In Youth

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PURPOSE Musculoskeletal and cardiorespiratory fitness is strongly associated with better health among children, affecting mental and physical outcomes like depression, anxiety, cardiovascular disease risk and body mass indices. It has been shown that fit children with low abdominal adiposity had increased odds of superior academic achievement. To-date there is no adequate surveillance in the US when it comes to monitoring physical fitness. This study investigated associations between musculoskeletal fitness measures (including 90° push-up), cardiorespiratory fitness, and weight. **METHODS** Two hundred and ten students (9.7 ± 1.08 years; 138.6 ± 9.4 cm; 42.3 ± 14.4 kg) across third through fifth grades were tested for cardiorespiratory (i.e., Progressive Aerobic Cardiovascular Endurance Run (PACER)) and musculoskeletal (90° push-up, trunk lift, sit-and-reach and curl-up) fitness. The relationships between the two measures were modeled using a series of linear regression analyses. Models were adjusted for age, sex, and weight status. Significant two-tailed tests were set at $P < .05$. **RESULTS** Of the four musculoskeletal fitness measures, only 90° push-up was significantly associated ($\beta = .35$; $P < .001$) with PACER test scores (i.e., cardiorespiratory fitness). The related model ($R^2 = .32$; $F(4,205) = 26.1$; $P < .001$) accounted for 32% of the variance in cardiorespiratory fitness. 90° push-up was associated with sit-and-reach ($\beta = .29$; $P < .001$) and curl up ($\beta = .41$; $P < .001$) test scores. When individually modeled, 90° push-up ($\beta = -.46$; $P < .001$) and PACER ($\beta = -.44$; $P < .001$) were inversely associated with weight. **CONCLUSION** The 90° push-up test was associated with cardiorespiratory fitness, anterior trunk muscle strength, endurance, lower back and posterior thigh muscle flexibility. Our study concluded that the 90° push-up test is a tractable tool for physical fitness surveillance by clinicians, physical education teachers, parents, and children. We need more studies with larger samples from diverse settings and wider age range to support our findings. Incorporating a surveillance mechanism of fitness in schools, primary care settings and educating parents of its correct use can make an impact on the youth population and decrease the incidence of the growing pandemic of childhood obesity and its associated health risks.

2190 Board #109 May 28 2:00 PM - 3:30 PM

Youth Sports Participation In The United States, 2016-2017

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PURPOSE: The *National Youth Sports Strategy* was released in 2019 with an aim to expand participation in sports among US youth. Our study examines differences in the prevalence of youth sports participation by selected characteristics to better understand disparities in participation and how they may vary across age groups. **METHODS:** Nationally representative data from the 2016-2017 National Survey of Children's Health ($N=49,952$) were analyzed. Parents with children aged 6-17 years were asked whether their child participated in a sports team after school or on weekends during the previous 12 months. Prevalence of participation was estimated overall, by age, and sex, race/ethnicity, highest level of parental education, and household income (percentage of the Federal Poverty Level [FPL]). Significant differences and trends, assessed using pairwise t tests and orthogonal polynomial contrasts, are reported ($p<0.05$). **RESULTS:** Overall, 58.4% of youth aged 6-17 years participated in sports. Youth aged 10-13 years had the highest prevalence of sports participation (61.9%) compared to those aged 6-9 years (56.6%) and 14-17 years (56.5%). Prevalence of participation was higher among boys (61.3%) than girls (55.2%) and among non-Hispanic whites (65.4%) compared to non-Hispanic blacks (48.1%), Asians (55.6%), and Hispanics (49.8%). Prevalence increased with increasing parental education level (from 31.9% [highest education level of high school or less] to 73.1% [college degree or higher]) and household income (from 41.1% [household incomes <100% FPL] to 75.7% [$\geq 400\%$ FPL]). Patterns were similar across age groups, although differences by race/ethnicity, parental education, and household income were generally more pronounced in the youngest age group. For example, among youth aged 6-9 years the range in prevalence of participation from lowest to highest income level was 35.4% to 80.6%, while among youth aged 14-17 years it was 43.2% to 68.5%. **CONCLUSION:** While about 6 in 10 youth in the United States participate in sports, important disparities exist particularly by household income and are generally more pronounced among younger children. Identifying and overcoming barriers, such as cost and accessibility, may help increase youth sports participation to support the aims of the *National Youth Sports Strategy*.

2191 Board #110 May 28 2:00 PM - 3:30 PM

National Monitoring Of Youth Physical Activity With Two Surveillance Systems: Healthy People 2030

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Healthy People 2030 will include a new objective to increase the proportion of younger youth (6-13 years) who meet the aerobic physical activity guideline (guideline). The current objective monitors meeting the guideline in older youth (grades 9-12). Monitoring these two physical activity objectives necessitates the use of two surveillance systems: National Survey of Children's Health (NSCH) and the national Youth Risk Behavior Survey (YRBS). It is unclear how youth physical activity prevalence estimates compare in these surveillance systems. **PURPOSE:** To describe and compare prevalence estimates of youth meeting the guideline, particularly where ages overlap (14-17 years), in the NSCH and the YRBS. **METHODS:** Youth were classified as meeting the guideline if they exercised, played a sport, or participated in physical activity (adult proxy report, NSCH) or were physically active (self-report, YRBS) for at least 60 minutes/day during the past week (NSCH) or 7 days (YRBS). Data from 2016-2017 NSCH ($n=50191$, ages 6-17) and 2015-2017 YRBS ($n=29483$, grades 9-12) were analyzed to estimate prevalence of youth meeting the guideline overall and by age, sex, and race/ethnicity. **RESULTS:** Overall, 25.9% of children aged 6-13 (NSCH) and 26.6% of adolescents grades 9-12 (YRBS) met the guideline (Table). Prevalence differed by sex for all age groups. There were differences by race/ethnicity in youth 6-13 years (NSCH) but not in youth 14-17 years (NSCH and YRBS). When comparing youth 14-17 years, there was a 9.6 percentage point difference in prevalence; patterns by sex and race/ethnicity were similar.

Table. Prevalence with Standard Error (SE) of Youth Meeting Aerobic Physical Activity Guideline by Age Group, NSCH 2016-2017 and YRBS 2015-2017

Characteristics	NSCH, % Meeting Guideline (SE)		YRBS, % Meeting Guideline (SE)	
	6-13 years	14-17 years	Grades 9-12 ^a	14-17 years
Total	25.9 (0.6) ^b	17.4 (0.7)	26.6 (0.7)	27.0 (0.7)
Sex ^c				
Male	28.5 (0.8)	22.6 (1.1)	35.7 (0.8)	36.5 (0.9)
Female	23.2 (0.9)	11.9 (0.7)	17.6 (0.6)	17.9 (0.7)
Race/Ethnicity ^d				
White, non-Hispanic	^v 27.7 (0.6)	16.5 (0.6)	28.1 (1.0)	28.5 (1.0)
Black, non-Hispanic	27.5 (1.8)	20.7 (2.3)	24.3 (1.2)	25.0 (1.5)
Hispanic/Latino	^w 22.9 (1.7)	17.2 (2.0)	25.2 (0.9)	25.5 (0.9)
Other, non-Hispanic	^w 22.5 (1.4)	16.9 (1.9)	25.3 (1.1)	25.7 (1.2)

Abbreviations: NSCH, National Survey of Children’s Health; YRBS, Youth Risk Behavior Survey

^a Mostly aged 14-18 years, but also includes high school students 13 years or younger and over 18 years.

^b Significant difference (p < 0.001) between age groups 6-13 years and 14-17 years.

^c Significant difference (p < 0.001) between males and females overall and for each age group.

^d Within subgroup, values with different superscript letters (v, w) are significantly different from each other (Bonferroni corrected p < 0.05).

CONCLUSION: Our findings suggest similar sex and race/ethnicity patterns but different prevalence estimates of youth meeting the guideline in the NSCH and the YRBS, limiting direct comparability of estimates for the *Healthy People 2030* youth objectives. This could be due to methodological differences between the two systems, such as respondent and aerobic physical activity question.

2192 Board #111 May 28 2:00 PM - 3:30 PM
Higher Education And Income Level May Lead To A Better Chance Of Meeting The Physical Activity Guidelines

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PURPOSE: Studies have shown that individuals that participate in physical activity on a daily basis are less likely to develop chronic illnesses than those who do not. The Physical Activity Guidelines for Americans is an essential resource for health professionals to provide recommendations on how everyone can improve their health through regular physical activity. However, little was known about its effectiveness and the factors behind meeting the physical activity guidelines. Thus, the aim of this study was to explore and determine the population that is more likely to meet the physical activity guidelines and offer practitioners and policymakers more insight.

METHODS: The data were derived from the California Behavioral Risk Factor Surveillance Survey (BRFSS). The percentage of adults meeting Aerobic Physical Activity guidelines in California were calculated and weighted to the 2010 California Department of Finance population statistics. Comparison analysis was conducted, and the factors associated with meeting the Physical Activity Guidelines were determined.

RESULTS: The results showed that there’s no significant difference in meeting the physical activity guidelines with respect to age, sex and other factors except education and income level. The percentage of the population meeting the physical activity guidelines increased with higher income and education level.

Factor		2013 Percentage (95%CI)	2015 Percentage (95%CI)	2017 Percentage (95%CI)
Education	Less than high school	50.99 (47.15, 54.84)	52.58 (46.95, 58.21)	49.57 (42.70, 56.44)
	High school graduate	64.58 (61.31, 67.85)	64.56 (60.32, 68.80)	63.74 (57.83, 69.65)
	Some college	70.94 (68.25, 73.64)	72.00 (68.49, 75.50)	71.19 (65.24, 77.13)
	College graduate	78.60 (76.47, 80.73)	81.48 (78.72, 84.24)	78.98 (75.33, 82.64)
Income	Less than \$20,000	58.28 (55.32, 61.25)	61.32 (56.93, 65.71)	60.04 (53.23, 66.84)
	\$20,000 to \$34,999	61.95 (58.18, 65.72)	62.79 (57.30, 68.28)	58.83 (51.54, 66.13)
	\$35,000 to \$49,999	66.57 (61.96, 71.19)	70.88 (65.20, 76.56)	59.37 (47.77, 70.97)
	\$50,000 to \$74,999	71.78 (67.81, 75.75)	69.87 (63.71, 76.03)	73.33 (66.58, 80.09)
	\$75,000 to \$99,999	78.16 (74.20, 82.13)	77.44 (72.30, 82.58)	77.92 (70.41, 85.44)
	\$100,000 and above	84.05 (81.36, 86.75)	85.34 (82.32, 88.36)	85.76 (82.33, 89.20)

CONCLUSION: More efforts should be put into improving the physical activity level of the population that has less income and lower education levels.

2193 Board #112 May 28 2:00 PM - 3:30 PM
Device-Assessed Sedentary Time Sex Comparison By Time Of The Day Analysis

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Sedentary time (ST) has been linked with obesity in children and studies have shown that girls are more sedentary than boys. However, data about ST by specific periods of the day are necessary to determine when girls are more sedentary compared to boys. **PURPOSE:** To determine how US youth ST at different periods of the weekday (before school, during school, afterschool, and evening) and weekend day (morning, afternoon, and evening) differ by sex. **METHODS:** Youth between 6 and 18 years old from NHANES 2003 - 2006 (N = 2,972) were included. Accelerometry restricted dataset was used to determine ST; and to obtain hourly ST (min/hour) we used the Web App for processing NHANES accelerometer data. For the weekday we calculated a mean for the following periods: before school (6:00-7:59 am), during school (8:00 am-2:59 pm), afterschool (3:00-5:59pm), and evening (6:00pm-9:00pm). For the weekend day we calculated a mean for the morning (7:00 - 11:59 am), afternoon (12:00 - 5:59pm), and evening (6:00 - 10:00pm). T-tests were conducted to compare ST during each period for the weekday and weekend day. SAS 9.4 was used to conduct statistical analyses. **RESULTS:** US youth had 885.6 ± 137.1 min/week of ST. T-tests revealed no significant differences in ST before school (Boys: M=47.3±12.8 min/hour; Girls: M=47.0±12.9 min/hour; P = 0.8), afterschool (Boys: M=26.0±8.7 min/hour; Girls: M=28.3±8.6 min/hour; P = 0.7), and evening (Boys: M=28.0±9.0 min/hour; Girls: M=29.6±8.7 min/hour; P = 0.2) during the weekday; neither in the morning (Boys: M=33.6±13.9 min/hour; Girls: M=34.2±13.3 min/hour; P = 0.1), afternoon (Boys: M=26.6±10.0 min/hour; Girls: M=28.6±10.1 min/hour; P = 0.9), and evening (Boys: M=28.7±10.9 min/hour; Girls: M=30.0±10.6 min/hour; P = 0.2) during the weekend. A significant difference in ST was observed during school in which girls (34.4±8.1 min/hour) had more ST compared to boys (31.6±8.8 min/hour); t (2969) = -9.3, p = 0.003). **CONCLUSION:** Findings support the idea that differences in ST by sex in US youth occur during school time and suggest that school interventions may be a potential way to reduce this gap in girls.

THURSDAY, MAY 28, 2020

2194 Board #113 May 28 2:00 PM - 3:30 PM
Social Jetlag And Cardiometabolic Disease Risk In Pre- Adolescents
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 (No relevant relationships reported)

PURPOSE: Social jetlag (SJL), the inconsistency between an individual's circadian clock and social clock, has been associated with cardiometabolic diseases (CMD) in adults. In pre-adolescents, SJL has been associated with overweight-obesity, but no previous studies have examined associations with CMD risk. The objective of the current study was to determine the associations between sleep duration, sleep disturbances and SJL with CMD risk among preadolescent children. **METHODS:** This cross-sectional study recruited 392 children (50% F) aged 8-10 years from three representative sample sites across New Zealand. Three sleep quality variables were measured: Sleep duration, as reported by caregivers for seven days; sleep disturbances, estimated by the Children's Sleep Habits Questionnaire; and SJL, measured as the absolute difference between midpoints of sleep on weekdays versus weekend days. Eleven CMD risk factors were measured: central and peripheral systolic blood pressure (BP), heart rate, augmentation index, diastolic BP, low density lipoprotein levels, high density lipoprotein levels, total cholesterol, triglycerides, fasting blood glucose, and glycated hemoglobin. Factor analysis identified underlying CMD risk factors. Linear regression models determined the associations between the sleep variables and the CMD risk factors. Models were adjusted for age, sex, and socio-economic status. Effects sizes (ES) were calculated by dividing the beta coefficient (β) by the standard deviation of β , where <0.20 was considered small, > 0.20 to < 0.50 moderate, and > 0.80 large. **RESULTS:** Complete data was available for 332 children (49% F, mean [SD] age = 9.6 [1.13] years old, WHO-BMI = 0.421 [1.17]). Factor analysis revealed four underlying CMD risk factors: blood pressure, cholesterol, vascular health, and carbohydrate-metabolism. Following adjustment for covariates, there was a small association between SJL and the cholesterol factor ($P=0.025$, $ES=0.11$), and a small association between SJL and the carbohydrate-metabolism factor ($P=0.027$, $ES=0.10$). In fully-adjusted multivariate models, sleep duration nor sleep disturbances associated with any CMD factor. **CONCLUSIONS:** Social jetlag is a modifiable and potentially important contributor to cardiometabolic risk in children.

2195 Board #114 May 28 2:00 PM - 3:30 PM
Relationship Between Body Composition And Motor Skills In 3-5 Year Olds: National Youth Fitness Survey
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Factors such as obesity and motor skill development are associated with the health and development of young children and tend to track into adulthood. Early childhood is considered a critical time period for obesity incidence and motor skill development. **PURPOSE:** This study examined the associations between weight status and motor skills in children. **METHODS:** Data from 3-5 years old children (N=342, 51% males) who participated in the 2012 National Youth Fitness Survey were analyzed. Body mass index (BMI), along with age- and sex-adjusted BMI percentiles were calculated. Scores were placed into categories of underweight/healthy weight, overweight, or obese. Skinfold measurements (calf and triceps) were taken and percent body fat (%BF) was calculated using sex-specific equations. Motor skills were determined by the Test of Gross Motor Development-2nd Edition. Linear regression analyses were performed to determine the associations among BMI category and Locomotor, Object Control, and overall Gross Motor Quotient (GMQ) controlling for sex, race, and poverty index ratio. Regression analyses were also conducted between %BF and Locomotor, and Object Control Motor Skills and GMQ controlling for sex, race, and poverty index ratio. **RESULTS:** Most children were classified as underweight/healthy weight (69%) and 31% were overweight or obese. Average BF% was $M(SE)=17.02 (0.27)$. In regard to GMQ, the mean percentile was 41.43 (1.36). Neither BMI category or BF% was related to Locomotor, Object Control, or GMQ ($p=0.32-0.71$, and $p=0.18-0.63$, respectively). **CONCLUSIONS:** Given the inconsistent findings in the literature, additional research is needed to elucidate these relationships between body composition and motor skill development. Using different measures of weight status may provide additional insight into associations between weight status and motor skill development in young children.

2196 Board #115 May 28 2:00 PM - 3:30 PM
Abstract Withdrawn

2197 Board #116 May 28 2:00 PM - 3:30 PM
Abstract Withdrawn

2198 Board #117 May 28 2:00 PM - 3:30 PM
High Relative Handgrip Strength Is Inversely Associated With The Incidence Of T2DM In Adults
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Several studies indicated that handgrip strength, which is a measuring tool for muscle strength, is associated with type 2 diabetes mellitus (T2DM). However, the results have been conflicting and few studies that used data from adults in Korea have been conducted. In addition, an increase in body weight usually precedes the development of DM and research an adjustment of handgrip strength to body weight is needed. **Purpose:** We investigated whether relative handgrip strength (RHS) is associated with development of type 2 DM in a subset of data with Korean Genome and Epidemiology Study. **Method:** We included 76,465 participants (25,870 male) aged between 40 and 79 years who had undergone a handgrip test from 39 community health examination centers located in 14 urban areas in Korea between 2004 and 2013. DM was defined as an fasting blood glucose ≥ 126 mg/dl or use of an oral hypoglycemic agent as diagnosed by a physician. The RHS was calculated by dividing maximal handgrip strength by body mass index and further grouped into age- and sex-specific tertiles. **Result:** During an average follow-up 5 years, 1,214 (1.7%) of the 69,725 participants with normoglycemia at baseline had newly developed DM. The hazard ratio and 95% confidence interval (CI) of incident DM in the lowest tertiles of RHS versus the middle and highest were 0.82 (95% CI 0.67 to 0.99) and 0.69 (95% CI 0.55 to 0.86) in male and 0.84 (95% CI 0.70 to 1.00) and 0.56 (95% CI 0.45 to 0.69) in female, respectively, after adjusting for potential confounders, including age, family income and education level, marry status, smoking, alcohol consumption, hypertension, baseline fasting blood glucose, family history of diabetes and physical activity. The participants with sustained high RHS had significant 50% lower risk of DM incidence (male, HR 0.50, 95% CI : 0.35-0.71, female HR 0.49, 95% CI : 0.36-0.67) compared with the those with the remained low RHS during 5 years of follow-up. **Conclusion:** The current finding suggests that RHS predicts incidence of type 2 DM independent of potential confounders in Korea middle-aged and older adults and maintaining of high RHS may be important for prevention of the development of the DM.

2199 Board #118 May 28 2:00 PM - 3:30 PM
Comparing And Explaining Membership Length And Attendance Behaviour Of Women In Female-only And Mixed-gender Gyms
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PURPOSE: Physical inactivity is a global health concern, further magnified by gender disparity, with women being less active than men. Gyms may be optimal environments to engage in physical activity, however, perceived gendering describe a major barrier for women to become and stay members. Therefore, our aim was to compare attendance behaviour over the first 12 months and membership length (ML) of female gym members in mixed-gender gyms to a female-only gym, to identify factors explaining both behaviours. **METHODS:** Data from one female-only (n=1,881) and eight mixed-gender gyms (n=21,133 women) across England were analysed, including demographics, membership characteristics, and each member's visits at the gym between 2008-2019. Data were analysed via t-tests and mixed-effect regression analyses using SPSS and R, with significance set at $p=0.05$. **RESULTS:** Women in female-only gyms showed a higher average ML (19.59±21.91 v. 14.30±16.03 months, $p<0.001$) and higher average attendance frequency (4.33±3.29

v. 2.70±3.15 visits/month, $p<0.001$), compared to women in mixed-gender gyms. In female-only gyms, monthly visits and ML were inversely related ($r=-0.441$, $p<0.001$) and the calendar month in which the membership commenced ($r=-0.065$, $p<0.001$), while a higher age increased attendance ($r=0.031$, $p<0.001$) ($R^2=0.147$). An increase in ML was associated with a higher number of membership freezes ($r=3.660$, $p<0.001$), and higher attendance frequency during the 11th ($r=0.619$, $p<0.001$) and 12th ($r=0.598$, $p<0.001$) month of membership ($R^2=0.191$). In mixed-gender gyms, attendance also decreased with ML and increased with age ($r=-0.217$, $p<0.001$ and $r=0.011$, $p<0.001$). A multitude of factors were associated with ML in women in mixed gender gyms, including age ($r=-0.066$, $p<0.001$), attendance frequency during the first month ($r=-0.062$, $p<0.05$), month 11 ($r=0.241$, $p<0.001$) and month 12 ($r=0.400$, $p<0.001$) ($R^2=0.103$). **CONCLUSIONS:** Women in female-only gyms show a higher attendance frequency during the first 12 months and a longer ML than women in mixed-gender gyms. Demographic and membership-related factors only explained a small proportion of the heterogeneity in both outcomes. However, observed R^2 's were higher in female-only gyms, indicating that other factors have a stronger impact on women in mixed-gender gyms.

2200 Board #119 May 28 2:00 PM - 3:30 PM
Lifestyle Risk Factors Associated With Non-Alcoholic Fatty Liver Disease (NAFLD) Among Mexican-Origin Men

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Background: Mexican-origin men have the highest rates of non-alcoholic fatty liver disease (NAFLD) among men in the U.S. Current evidence regarding the effects of lifestyle behaviors and risk for NAFLD among Mexican-Origin men is scarce. **Purpose:** To assess the influence of lifestyle behaviors risk for NAFLD, in a sample of Mexican-origin men from the Cameron County Hispanic Cohort (CCHC). **Methods:** The CCHC is a randomly selected cohort of community-dwelling Mexican Americans living in the U.S-Mexico border. Participants completed physical assessments and questionnaires on demographics, medical/medication use history, and lifestyle factors. Liver elastography (FibroScan®) was performed for the assessment of liver steatosis based on controlled attenuation parameters (CAP, dB/m) scores. Survey-based linear regression for CAP score or logistic regression analyses for mild steatosis (CAP \geq 260) were conducted to examine the relationships of lifestyle and cardiometabolic factors to NAFLD. **Results:** 207 Mexican-origin men (mean age: 53.5 (SE 2.5) years; mean BMI: 31.4±0.5. kg/m²; 43.9 % Spanish monolingual; 44.0 % born in U.S.) were included in the analysis. Mean CAP score was 290.4 (SE 7.3) dB/m and the prevalence of steatosis was 66.9% (SE 4.5%). There was no significant relationship of education, marital and uninsured status, smoking history, healthy/unhealthy eating indices, and physical activity levels to steatosis (p -values >0.05). There were significant associations between cardiometabolic risk factors including log transformed glucose OR= 8.20, 95%CI 1.63-41.25, $p=0.0108$), HbA1c (OR=1.43, 95%CI 1.08-1.90, $p=0.013$), HDL-C (OR=0.96, 95%CI 0.93-0.996, $p=0.029$) and log transformed triglyceride levels (OR=7.21, 95%CI 2.58-20.16 $p<0.001$), and steatosis. A one-unit increase in BMI was significantly associated with 36% increase in odds of steatosis (OR=1.36, 95%CI 1.18-1.55, $p<0.001$). Having metabolic syndrome (OR=4.93, 95%CI=1.84-13.19, $p=0.0016$) was significantly associated with steatosis in age- and BMI adjusted models. **Conclusion:** NAFLD was associated with cardiometabolic risk factors among Mexican-origin men in a community-based sample. Efforts to develop health promotion programs to address these risk factors, particularly body weight, are warranted.

2201 Board #120 May 28 2:00 PM - 3:30 PM
The Association Between Hydration And Obesity Is Dependent On How Hydration Status Is Assessed

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PURPOSE: Several studies have reported obesity is associated with hypohydration at the population level. However, these studies typically used simple urine osmolality thresholds to assess hydration, which may be inappropriate given that the amount of body mass a person has impacts urine solute (creatinine, uric acid) levels. To address this issue, our study compared differences in hypohydration prevalence using common urine methods (osmolality, flow rate, their combination) and examined whether obesity was differentially associated with these measures. **METHODS:** Data of 6,999 adults from the 2009-2012 National Health and Nutrition Examination Survey (NHANES) were analyzed. Hypohydration status was categorized using five thresholds; 1) absolute

urine osmolality (850 mOsm/L), 2) age-specific urine osmolality, 3) urine flow rate (850 mL/day), 4) a combination of absolute urine osmolality and flow rate, and 5) a combination of age-specific urine osmolality and flow rate. Logistic regression was used to examine whether body mass index ≥ 30 kg/m² (vs. less) was associated with the various hypohydration definitions. **RESULTS:** The prevalences of hypohydration were as follows: 21.7% (absolute urine osmolality), 36.8% (age-specific urine osmolality), 37.1% (urine flow rate), 13.0% (absolute urine osmolality and flow rate combined), and 21.1% (age-specific urine osmolality and flow rate combined). Obesity was associated with increased likelihood of hypohydration when using absolute (odds ratio [OR]: 1.63; 95% confidence interval [95CI]: 1.39, 1.92), and age-specific (OR: 1.78; 95CI: 1.48, 2.13) urine osmolality. However, associations were not significant when using urine flow rate (OR: 0.95; 95CI: 0.81, 1.12) or the combination of absolute urine osmolality and flow rate (OR: 1.26; 95CI: 0.98, 1.60). The association was weak, but significant, when using the combination of age-specific urine osmolality and flow rate (OR: 1.29; 95CI: 1.06, 1.58). **CONCLUSIONS:** Common methods used in epidemiological research to assess hydration status result in substantially different prevalences of hypohydration. The association between hypohydration measures and obesity is strongest for urine osmolality measures, though this is perhaps a product of increased urine solutes and not actual differences in hydration.

2202 Board #121 May 28 2:00 PM - 3:30 PM
Abstract Withdrawn

2203 Board #122 May 28 2:00 PM - 3:30 PM
Predicting Gross Motor Skills In Children: Data From The 2012 NHANES National Youth Fitness Survey

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 (No relevant relationships reported)

Gross motor skills are a key component of childhood development and are characterized by locomotion (movement of the body through space) and object control (manipulation of objects). Collectively, these constructs provide a representation of overall gross motor skill ability. Various factors may influence gross motor skills, specifically measures of fatness and muscular fitness. **PURPOSE:** Determine if measures of fatness, birth weight, and muscular fitness are significant predictors of gross motor skills in children 3-5 years old. **METHODS:** Data from 177 boys and 178 girls from the 2012 National Health and Nutrition Examination Survey National Youth Fitness Survey were used in the analysis. Waist-to-height (WtHR) ratio, sum of skinfolds, and BMI were calculated and used as measures of fatness, birth weight was obtained from parent report, and a timed plank test was used as a proxy measure of fitness. Locomotor (LOC) and object control (OC) skills were evaluated through the Test for Gross Motor Development-2 (TGMD-2). The sums of the standard scores obtained from LOC and OC were then converted to the gross motor quotient which is used as a representation of overall gross motor skill ability. Multiple linear regression models were used with age, standing height, race/ethnicity, and annual household income (AHI) as co-variables. WtHR, sum of skinfolds, BMI, birth weight, and muscular fitness were used as predictor variables. **RESULTS:** After adjustment for age, race/ethnicity, and AHI, birth weight was a significant predictor of the GMQ in young girls ($\beta=1.74$, $p=.044$). In the fully adjusted model, muscular fitness was a significant predictor of the gross motor quotient in both young girls and boys ($\beta=450$, $p<.001$; $\beta=375$, $p<.001$, respectively). **CONCLUSION:** Our results revealed that birth weight was a significant predictor of overall gross motor skill ability in young girls. Additionally, in both young girls and boys, muscular fitness was a significant predictor of overall gross motor skill ability, which further highlights the important role that physical fitness plays on gross motor skills in children. However, the association found between birth weight and gross motor skills is not well known and should be examined further.

2204 Board #123 May 28 2:00 PM - 3:30 PM
A Standardized Model Of Bodyweight Classification For European-american Adults From The 20012006 National Health And Nutrition Examination Survey

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BACKGROUND: Obesity is a major public health issue in the United States (US) that affects an estimated 78 million US adults each year. Since the 1970's, obesity rates have more than tripled and have been associated with a higher prevalence of developing cardiometabolic and renal disease. However, body mass index (BMI) alone may be an imprecise measurement of body weight classification as it does not account for either visceral or total body fat. Furthermore, the current fitness categories for body composition are not standardized to the World Health Organization's (WHO) general population guidelines and limit their use in clinical practice.

PURPOSE: To perform a large-scale population-based cross-sectional analysis from the (2001-2006) National Health Assessment and Nutrition Examination Survey (NHANES). **METHODS:** Our population included 12,667 European-American men and women who self-reported their age and sex, and who had complete anthropometric and body composition data from NHANES. Body composition variables included BMI, waist circumference, and total body fat percentage, measured with dual-energy x-ray absorptiometry (DXA). All study participants provided written informed consent prior to enrollment. Descriptive statistics, frequency distributions and percentiles were computed for the total population, and by age, sex and BMI.

RESULTS: Of the included population, 48.8% were men and 51.2% were women. Those with a BMI between 18.0-24.9 kg/m² (normal weight) had a total body fat between 19.6-31.8% and a waist circumference between 64.5-88.0 cm (18th - 54th percentile). Those with a BMI between 25.0-29.9 kg/m² (overweight) had a total body fat between 31.9-39.3% and a waist circumference between 88.1-102.3 cm (55th and 78th percentile). Those with a BMI \geq 30 kg/m² (obese) had a total body fat \geq 39.4% and a waist circumference \geq 102.4 cm (79th - 99th percentile).

CONCLUSIONS: We performed a large-scale population-based cross-sectional analysis from NHANES to standardize metrics of waist circumference and body fat percentage to the WHO's general population guidelines for body weight classification. Our findings may provide healthcare practitioners with a more comprehensive assessment of body composition and serve as a supplemental resource to BMI when determining body weight status for Americans.

2205 Board #124 May 28 2:00 PM - 3:30 PM
Longitudinal Changes Of Kindergarten Children's Physical Fitness In Japan Across Three Years

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PURPOSE: The physical fitness of Japanese children has shown a downward trend after its peaking after 1985. Because of implementing various fitness programs, it has been increasing since 2007, but it has not yet recovered to the previous level. Bipolarization in fitness has also been identified as a new issue. Therefore, it is imperative to promote efforts that lead to increased children's health and fitness status. The purpose of this study, therefore, was to examine the longitudinal changes in health-related physical fitness to inform future intervention programs aimed at improving children's fitness. **METHODS:** A total of 273 kindergarten children (boys: 138, girls: 135, Mean age = 4.6) were analyzed. Height and weight, and physical fitness (25m run, standing long jump, ball throw, body support continuation time, both feet consecutive jump time, ball catch) were measured for 3 consecutive years. The longitudinal changes were analyzed by paired t-tests. The statistical significance level was 5%. **RESULTS:** All of children's fitness outcomes improved significantly as they aged for both boys and girls. From 3 years old to 4 years old, boys and girls showed significant improvements in 25m run (-2.6+0.2 vs. -1.1+0.1, t=-5.47, p<0.05, -3.0+0.2 vs. -1.0+0.1, t=-8.36, p<0.05) and standing long jump (26.8+2.1 vs. 20.3+1.5, t=2.15, p<0.05, 26.2+1.8 vs. 17.8+1.3, t=3.17, p<0.05). Girls increased in height (6.9+0.1 vs. 6.3+0.1, t=2.92, p<0.05) and improved both feet consecutive jump time (-2.1+0.3 vs. -1.2+0.2, t=-2.64, p<0.05). From 4 to 5 years old, the boys' ball throw and body support continuation time improved significantly. Yet, there was no differences in the amount of changes in weight and ball catch between boys and girls. **CONCLUSION:** Children's fitness in early childhood was highly correlated with physical development. However, the time of improvement was quite different. Therefore, although it is not necessary to train children based on physical fitness factors, we may consider age and gender differences in physical fitness while planning intervention programs in kindergarten children.

2206 Board #125 May 28 2:00 PM - 3:30 PM
The Influence Of Weather Conditions, Ambient Air Temperature On Sedentary Time In Chinese Adults

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PURPOSE: This study aimed to quantify the association between weather conditions, ambient air temperature and sedentary time in Chinese adults.

METHODS: The participants were 3270 Chinese users of a wrist-worn activity tracker. The data of participants' daily activities were collected from July to October 2015 in 33 out of 34 provinces, autonomous regions and municipalities in China. The inclusion standards for data analysis were set as: 1) aged 18 or above; 2) without disability and critical diseases; 3) wear time \geq 18 h per day and \geq 4 consecutive days; 4) Global Positioning System (GPS) data are available; 5) meteorological data are available. Two-level linear regression analyses were conducted to investigate the association between weather condition, ambient air temperature and sedentary time.

RESULTS: The results of two-level linear regression analyses showed that weather conditions had a significant but weak influence on sedentary time in Chinese adults after adjusting for some covariates. If the weather condition changes from rainy days to sunny days and cloudy days, sedentary time may decrease by about 6.89 minutes (95%CI: 11.45-2.34) and 5.60 minutes (95%CI: 9.33-1.86) respectively. The sedentary time would decrease by 6.12 minutes (95%CI: 9.33-1.86) if air temperature changed from \geq 25°C to < 22.1-24.9°C. However, the influence was not significant if gender, air quality and weather condition was adjusted.

CONCLUSIONS: In conclusion, weather conditions have significantly but weakly influence on sedentary time in Chinese adults. Compared with the rainy days, the daily sedentary time was shorter in sunny and cloudy days. When other environmental and individual factors were adjusted, no significant association between ambient air temperature and sedentary time was found.

2207 Board #126 May 28 2:00 PM - 3:30 PM
Prevalence And Risk Factors For Premenstrual Syndrome In Korean Female National Athletes

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Premenstrual syndrome is common in female athletes, and related symptoms, such as anxiety, anxiety, breast tenderness, and bloating, can negatively affect performance. However, there are very few studies on premenstrual syndrome in female athletes worldwide. A survey of PMS is needed to provide proper medical support and to improve performance. **Purpose :** The purpose of this study was to investigate the prevalence of premenstrual syndrome and related risk factors in elite female athletes. **Methods :** A survey about premenstrual syndrome was conducted among female athletes training at national training centers. Premenstrual syndrome was diagnosed using the Premenstrual Symptom Screening Tool (PSST). Mann-Whitney test was performed to determine differences in age, training time, and body mass index (BMI) according to premenstrual syndrome. The chi-square test was performed to investigate differences in alcohol and coffee intake, diet for weight loss, stress fracture, and menstrual regularity according to premenstrual syndrome. **Results :** The average age of 124 female athletes across 17 sports was 24.36 (\pm 4.68) years, and the mean BMI was 22.19 (\pm 3.81). Of the 124 patients, 17 met criteria for moderate to severe PMS, and one met the criteria for premenstrual discomfort. Athletes diagnosed with moderate to severe PMS complained of fatigue (100%), irritability (78%), difficulty concentrating (78%), joint and muscle pain (56%), bloating (56%), and weight gain (56%). Age, type of sport, BMI, training time per week, menarche age, and coffee and alcohol consumption were not significantly related to the prevalence of premenstrual syndrome. Overall, 76.6% of the female athletes felt that premenstrual symptoms interfered with their performance; however, only five out of the 18 athletes with moderate to severe PMS visited their doctors to discuss it. **Conclusions :** This cross-sectional study of the prevalence of and risk factors for premenstrual syndrome in Korean female athletes found that 18 (14.55%) of 124 athletes had moderate to severe PMS, and no risk factors for developing premenstrual syndrome were discovered.

2208 Board #127 May 28 2:00 PM - 3:30 PM
Levels And Patterns Of Physical Activity And Sedentary Time Among Low Income Brazilian Preschoolers

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Knowledge of physical activity in preschool populations is important for public health promotion. However, little is known about physical activity and sedentary patterns in low-income children, suggesting an urgent need for data covering this population. Purpose: to describe physical activity levels and sedentary time of low-income preschool children during preschool time; to describe physical activity patterns of actives during preschool time at public preschools in João Pessoa/Brazil. Method: a representative sample of 237 preschool was randomly selected and 204 provided valid accelerometer measurements (boys: 4.5 \pm 0.8years, girls: 4.5 \pm 0.7years). Measured levels of physical activity and sedentary time, and physical activity patterns were observed during preschool time (7am to 5pm) (Actigraph, WGT3-X). Data were presented in quartiles of total physical activity by sex and age. Univariate General Linear Model with Bonferroni's post-hoc was used to analyze differences between the quartiles. Data were performed using SPSS (version 25, Inc., Chicago, USA), level of significance: 95%. Results: physical activity at preschool range from 68 to 114% of total physical activity daily's recommendation and from 28 to 83% of moderate

to vigorous physical activity recommendation. For the two most active quartiles, the daily total physical activity recommendation was achieved during preschool time. Physical activity patterns were similar between the least and the highest actives, and all the evaluated children were more active outdoors than indoors. For the least actives, preschool time correspond 30% of daily moderate to vigorous physical activity recommendation. Physical activity patterns are quite similar between the least and the highest actives. Conclusion: this information is important for tailoring interventions.

2209 Board #128 May 28 2:00 PM - 3:30 PM
Abstract Withdrawn

D-65 Free Communication/Poster - Carbohydrate Metabolism

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
Room: CC-Exhibit Hall

2210 Board #129 May 28 3:00 PM - 4:30 PM
The Effects Of High Molecular Weight Carbohydrate Supplementation On Skeletal Muscle Performance

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(No relevant relationships reported)

Athletes continue to seek new and improved strategies to preserve skeletal muscle strength and attenuate effects of skeletal muscle fatigue during resistance training. The ingestion of carbohydrates prior-to and during resistance training was hypothesized to improve both skeletal muscle performance and attenuate fatigue. VitargoS2™ is a high molecular weight carbohydrate supplement that promotes enhanced performance with its consumption prior-to and during physical activity. **PURPOSE:** To examine the influence of high molecular weight carbohydrate (HMC) consumption on skeletal muscle performance and fatigue following exhaustive lower-limb resistance training exercise. **METHODS:** Five-female and seven-male (n = 12) healthy college-aged individuals participated (26.1 ± 3.8 yrs) in a double-blinded crossover trial. Participants took part in three sessions across the study period: familiarization, Test Day 1 and Test Day 2. Participants were randomly assigned to one of two conditions [control (CON) or high molecular weight carbohydrate supplement (HMC)] for each of the two testing sessions. Lower-limb isometric and isokinetic concentric strength was assessed prior-to and immediately following a resistance-training session on two occasions. Outcome measures included lower-limb isometric and isokinetic concentric peak torque, blood glucose concentration, and rate of perceived exertion (RPE). **RESULTS:** The HMC condition elicited a significant increase in blood glucose concentration from Pre-Workout to Post-Workout (Pre-Workout: 92.1 ± 14.4 mg/dl and Post-Workout: 118.3 ± 15.2 mg/dl) compared to the control condition (Pre-Workout: 95.6 ± 15.6 mg/dl and Post-Workout: 108.1 ± 14.5 mg/dl). Isometric strength was reduced by 25.4 Nm (HMC) and 35.0 Nm (CON) following the lower-limb resistance training session; however, no ergogenic effect was found (p > 0.05). Isokinetic concentric strength did not differ (p > 0.05) following the HMC supplementation compared to the CON condition. No difference was found in RPE between the HMC and CON condition (p > 0.05). **CONCLUSIONS:** The consumption of HMC supplementation prior to and during resistance-training exercise did not improve skeletal muscle performance and attenuated skeletal muscle fatigue following a lower-limb resistance-training exercise session.

2211 Board #130 May 28 3:00 PM - 4:30 PM
Effect Of Pre-Sleep Low Glycemic Modified Starch On Morning Metabolism And Endurance Running Performance

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(No relevant relationships reported)

Consumption of carbohydrates (CHO) likely influences athletic performance, and further evidence suggests that pre-sleep nutrition may positively affect subsequent morning physiologic responses and exercise performance. **PURPOSE:** To determine the effects of pre-sleep ingestion of a novel low glycemic index (LGI) CHO supplement on next morning endurance running performance, substrate utilization,

and gastrointestinal distress (GID). **METHODS:** Using a double-blind, randomized, crossover design, 14 endurance athletes (age, 28 ± 9 yrs; peak oxygen consumption (VO_{2peak}), 55 ± 7 ml/kg/min) consumed either a high GI (HGI), LGI, or placebo (PLA) beverage ~30 min prior to sleep and 7-9hrs before a morning exercise trial. Resting energy expenditure (REE), gas exchange derived substrate utilization (%FAT, %CHO), blood glucose (BG), heart rate (HR), satiety (SAT), and GID were assessed at baseline. After a warmup, an incremental exercise trial (IET) was performed at 55, 65, and 75% VO_{2peak}, while HR, GID, rating of perceived exertion (RPE), and substrate utilization were obtained. After a 3-min recovery, participants completed a 5km treadmill time trial (TT), during which HR, RPE, and GID were recorded. HR, RPE, GID, satiety, and BG were assessed immediately post TT, and BG was recorded again 10min post TT. **RESULTS:** No differences were found in baseline REE, BG, GID, HR, or SAT (all, p > 0.05). At rest, there was an interaction of supplement and sex for substrate utilization (CHO and FAT, p < 0.05). During IET, LGI tended to utilize less FAT (HGI, 40 ± 12, PLA, 44 ± 11, LGI, 38 ± 11%FAT, p = 0.06) and more CHO (HGI, 60 ± 12, PLA, 56 ± 11, LGI, 63 ± 12%CHO, p = 0.08). There was no effect of condition on GID at any point (p > 0.05). There was no effect of condition on 5km TT (PLA, 21.6 ± 9.6; HGI, 23.0 ± 7.8; LGI, 24.1 ± 4.5 min, p > 0.05). **CONCLUSIONS:** The current study demonstrates that pre-sleep CHO supplementation did not affect resting substrate utilization, BG, GID, or 5km TT performance, though effects on substrate utilization might be sex specific. The trend towards higher CHO utilization after pre-sleep LGI CHO consumption might suggest that pre-sleep LGI CHO supplementation increases morning CHO availability, though more research is needed.

2212 Board #131 May 28 3:00 PM - 4:30 PM
Carbohydrate Before Resistance Exercise Doesn't Alter Performance, Blood Glucose, Or Muscle Glycogen Despite Hormonal Changes

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Purpose: The purpose of this study was to investigate changes in resistance exercise performance, serum insulin, epinephrine, glucose, and muscle glycogen from carbohydrate supplementation. **Methods:** Participants completed four sets to failure at 70% of 1-RM with 45s rest on angled leg press with or without pre-exercise carbohydrate (2g/kg) after a 3hr fast. Serum glucose, epinephrine, and insulin were assessed at baseline, 30 min post-ingestion, immediately after, and 1hr post-exercise with or without carbohydrate supplementation. Muscle glycogen was measured at baseline, immediately after exercise, and 1hr post exercise. **Results:** There was no main effect of supplement on resistance exercise performance (F = 2.169, p = .18). There was a main effect for set on repetitions showing a decrease over sets completed (F = 26.18, p < .001) There was no interaction between supplement and set on reps to fatigue (F = .337, p = .79). There was a time effect showing glycogen decreased immediately post-exercise for both groups and remained lower than baseline after 1hr (F = 14.305, p < .001). No main effect of supplement on glycogen concentration was found (F = 2.847, p = .13). No supplement time interaction was found on glycogen (F = 1.191, p = .33). There was an interaction showing pre-exercise carbohydrate supplementation led serum glucose to be utilized more during exercise (F = 3.791, p = .026). No main effect for supplementation on blood glucose was found (F = .072, p = .79). Pairwise comparisons indicated no time effect on serum glucose (p > .05). An interaction occurred showing insulin decreased during exercise in the carbohydrate condition (F = 47.14, p = .003). Also, there was a main effect of insulin being elevated with carbohydrate consumption (F = 7.72, p = .027). Pairwise comparisons indicated there was no time effect on insulin concentration (p > .05). There was a main effect of carbohydrate supplement decreasing epinephrine (F = 7.924, p = .023). No time effect was found on epinephrine concentration (F = 1.475, p = .258). No interaction effect was found on epinephrine (F = 1.94, p = .181). **Conclusions:** Carbohydrate supplementation before resistance exercise does not improve leg press performance to fatigue or glycogen recovery during 1hr rest despite increased glucose availability.

2213 Board #132 May 28 3:00 PM - 4:30 PM
Effect Of Different Glycemic Index Beverage On Substrate Oxidation During Moderate Intensity Exercise.

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PURPOSE: To investigate the effect of low or high glycemic index (GI) beverage on substrate utilization during moderate intensity exercise. **METHODS:** This research design utilized a randomized and counterbalanced crossover approach with ten male participants (Age: 24.6 ± 0.8 yr; BMI: 22.8 ± 1.3 kg/m²;

) engaged in three times (separated by 1 week) of 1-hour ergometer cycling (Monark 839E, Sweden) at 60% $\dot{V}O_{2max}$ intensity while ingesting two types of beverages with different GI values (LGI=47, HGI=90), and water only. Carbohydrate intake was set at 0.2g/kg every 15 minutes, and blood samples were collected pre-exercise and 0h-, 1h-, 2h-post-exercise for glucose, insulin, free fatty acid (FFA) and triglyceride analyzing. Substrate utilization was measured using metabolic cart (Cortex MetaLyzerII-R2, Germany) at 5min, 30min, 50min during exercise.

RESULTS: There was no significant difference of carbohydrate oxidation rate between LGI and HGI beverage treatment ($p=0.36$). Fat oxidation rate was significantly higher in LGI (0.22 ± 0.08 g/min) compared to HGI treatment (0.18 ± 0.07 g/min) and water (0.16 ± 0.06 g/min) at 30 minutes during exercise ($P<0.05$). Blood glucose concentration was higher in HGI (5.64 ± 0.72 mmol/L) and LGI (5.35 ± 1.06 mmol/L) compared with water treatment (4.82 ± 0.76 mmol/L) 0h-post-exercise ($P<0.05$). Plasma insulin concentration in HGI treatment increased significantly 1h-post-exercise ($15.11\pm 5.94\mu\text{U/mL}$) compared with LGI ($9.64\pm 2.10\mu\text{U/mL}$) and water ($3.53\pm 1.22\mu\text{U/mL}$) ($P<0.05$). Plasma triglyceride (0.97 ± 0.30 mmol/L) and FFA (0.48 ± 0.18 mmol/L) concentration were lower in LGI treatment compared to water treatment 0h-post-exercise ($P<0.05$), but not in HGI treatment ($P>0.05$).

CONCLUSIONS: Compared with HGI beverage before and during exercise supplementation, LGI beverage consumption may elevated fat substrate utilization during moderate intensity exercise.

2214 Board #133 May 28 3:00 PM - 4:30 PM
Effects Of Carbohydrate-Electrolyte Solution Supplementation On Fluid Retention And Aerobic Capacity After Exhaustive Exercise

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Rehydration, or restoration of fluid spaces, is important when exhaustive endurance exercise (EEE) has compromised hydration status. Previous studies only investigated the effects of carbohydrate-electrolyte solution (CE) supplementation to facilitate replacement after exercise induced dehydration. CE supplementation for 1 hour before and 1 hour after EEE may play an important role in fluid retention and enhancing aerobic capacity.

PURPOSE: To examine the effects of CE supplementation on fluid retention and aerobic capacity after EEE.

METHODS: In a double-blind, crossover and counterbalanced designed study, nineteen health male participants were asked to intake ORS-SH[®], an oral rehydration solution, (150 mL four times within an hour) or placebo (water) for 1 hour before and 1 hour after EEE. All participants completed graded exercise test to exhaustion on treadmill for determination of maximal oxygen consumption ($\dot{V}O_{2max}$) before supplementation, and then completed the exhaustive endurance exercise test at the intensity of 70% $\dot{V}O_{2max}$ for 60 min. Then, the exercise intensity increased at 90% $\dot{V}O_{2max}$ until exhaustion after supplementation. The average heart rate, maximal heart rate, running time to exhaustion and peak oxygen uptake were recorded during the exercise period. The body weight was recorded 15-min, 30-min, 45-min and 60-min of after EEE to calculate the dehydration rate and beverage hydration index (BHI).

RESULTS: The dehydration rates in participants with ORS-SH[®] treatment at 15-min, 30-min and 45-min of after EEE were significantly lower than with placebo treatment ($-1.77\pm 0.50\%$ vs. $-2.06\pm 0.66\%$; $-1.69\pm 0.54\%$ vs. $-1.95\pm 0.66\%$; $-1.48\pm 0.51\%$ vs. $-1.76\pm 0.65\%$, respectively, $p < .05$). In addition, the BHI in participants with ORS-SH[®] treatment at 15-min, 30-min and 45-min of after EEE (1.19 ± 0.36 , 1.22 ± 0.43 and 1.27 ± 0.54) were significantly higher than with placebo treatment ($p < .05$). However, there were no significant differences in other variables between treatments.

CONCLUSIONS: ORS-SH[®] supplementation can effectively enhance fluid retention after EEE. However, ORS-SH[®] supplementation had no benefits on aerobic capacity. Supported by Panion & BF Biotech Inc. (Grant No: A-107-077)

2215 Board #134 May 28 3:00 PM - 4:30 PM
Effects Of Repeated Carbohydrate Rinse On Lacrosse Performance

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While carbohydrate rinse has been demonstrated to be an effective strategy for improving endurance performance, the effects of rinse on anaerobic performance, particularly within team sport athletes, are equivocal. Additionally, it is not yet known whether repeated carbohydrate rinses in the context of a high intensity training session may provide additional benefit. **PURPOSE:** The purpose of this investigation was to determine the effect of repeated carbohydrate rinse during a typical lacrosse

team practice on lacrosse performance. **METHODS:** A randomized, double-blind, placebo-controlled design was used to determine the effects of carbohydrate rinse on 11 male, division I lacrosse players. Shot velocity and accuracy, 40-yard dash time, and concentration (measured via Trail Making Test) were assessed prior to a typical practice, and the test battery was completed again following practice on two subsequent days of similar intensity/duration. During both practice sessions, the athletes completed 4 rinses (carbohydrate- CHO or placebo-PLA), equally spaced throughout the session, and practice intensity was measured using RPE and HR. Changes from pre-post were calculated for each test and paired t-tests were used to determine differences between groups. **RESULTS:** Shot velocity and accuracy were significantly reduced following practice, however the reduction in shot accuracy was blunted in the CHO v. PLA ($9.01\%\pm 14.4$ v. $19.49\%\pm 21.7$, $p = 0.01$). 40-yard dash was not significantly reduced by the training session, and no differences were detected between groups (CHO: 5.057 ± 0.25 sec v PLA 5.051 ± 0.27 sec). RPE was significantly lower for CHO (9.90 ± 3.41 v. 12.72 ± 2.76 , $p=0.04$) at timepoint 2, but not at any other time. Changes in TMT following practice were not significantly different between groups. **CONCLUSION:** When used during a typical lacrosse practice, repeated carbohydrate rinse may reduce the effects of fatigue on shot accuracy and perceived exertion, however it does not appear to effect other performance measures.

2216 Board #135 May 28 3:00 PM - 4:30 PM
Glucose Mouth Rinse And Mouth Spray Enhance Prolonged Exercise Performance In Healthy Male College Students

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PURPOSE: Research supports the ergogenic effects of glucose mouth rinse (GMR) during prolonged performance, however, the effects of glucose mouth spray (GMS) is limited. The aim of this study was to investigate the effects of GMR and GMS on prolonged exercise. **METHODS:** Nine male college students (age, 22.2 ± 1.1 years; height, 172.0 ± 4.7 cm; body weight, 66.4 ± 6.1 kg; $\dot{V}O_{2peak}$, 3014.9 ± 251.6 ml/min) performed constant load exercise using an electromagnetic brake-type bicycle ergometer (PowerMax VIII; Combi Wellness, Japan). The participants performed constant load exercise for 60 min (intensity 40% $\dot{V}O_{2max}$) and then, four sets of the Wingate test (three 30-s Wingate tests with 4 min recovery period between each test) while they were performing constant load exercise for 30 min (intensity 40% $\dot{V}O_{2max}$). Each trial lasts for 4.8 hrs. All participants completed a total of four experimental trials: (1) ingesting glucose (G) solution (500 ml) at the beginning, (2) 15 GMR, (3) 15 GMS - 5 times rinse or spray during each 30 min constant load, and (4) water (control) ad libitum during the entire trial. The exercise max power value, blood glucose levels, and rating of perceived exertion, were measured. Repeated two-way analysis of variance (ANOVA) was used for comparison of the data among G, GMR, GMS and water. **RESULTS:** The % value of the average max power at the 3rd and 4th sets for each trial (G, GMR, and GMS) were significantly higher compared to the control (water): 3rd set; $95.0\pm 1.5\%$, $96.9\pm 1.5\%$, $96.5\pm 1.4\%$, and $90.2\pm 1.5\%$ (control), $p < 0.01$, respectively, and 4th set; $89.8\pm 1.5\%$, $92.8\pm 1.5\%$, $92.9\pm 1.5\%$, and $85.1\pm 1.5\%$ (control), $p < 0.01$, respectively. Blood glucose level at the 3rd and 4th sets of G, GMR, GMS were significantly higher compared to the control: 3rd set; 80.7 ± 4.5 mg/dl, 81.4 ± 2.5 mg/dl, and 78.3 ± 2.9 mg/dl, 71.3 ± 3.7 mg/dl (control), $p < 0.05$, respectively, and 4th set; 81.8 ± 5.9 mg/dl, 81.4 ± 2.5 mg/dl, 78.3 ± 2.9 mg/dl, and 71.0 ± 2.8 mg/d (control), $p < 0.01$, respectively. During the 3rd and 4th sets, all G, GMR and GMS showed significantly lower rating of perceived exertion compared to water (control), $p < 0.05$. **CONCLUSION:** GMR and GMS resulted in improved endurance performance. The role of G receptors in the mouth during prolonged exercise warrants further investigation.

2217 Board #136 May 28 3:00 PM - 4:30 PM
A 16% Carbohydrate-hydrogel Beverage Reduces Gastrointestinal Permeability And Enterocyte Damage After Cycling In Hot-humid Conditions

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Background. Carbohydrate ingestion during exertional heat stress can reduce enterocyte damage and preserve gastrointestinal permeability. Athletes have begun to use drinks which encapsulate carbohydrate within a pectin-alginate hydrogel, yet little evidence exists to support their preferential use versus traditional carbohydrate-gels and/or beverages with multiple transportable carbohydrates. **Purpose.** To compare the effects of consuming a 16% carbohydrate-hydrogel drink to a nutrient matched maltodextrin-fructose (MF) drink on enterocyte damage and gastrointestinal permeability after cycling in hot and humid conditions. **Methods.** Fourteen endurance trained cyclists (7 men, age 27 ± 8 yr, 176 ± 10 cm, 74 ± 11 kg, $\dot{V}O_{2max}$: 55.2 ± 9.5 ml·kg⁻¹·min⁻¹) cycled (45% $\dot{V}O_{2max}$) for 90 minutes before completing a 15-minute time trial in hot humid conditions (32°C, 70%) on 3 occasions separated by 7 days. During trials participants consumed either water (W), a traditional MF drink, or an encapsulated carbohydrate hydrogel drink (HYDRO) in a randomised order. Each CHO drink provided 90 g CHO·hr (16% w/v). Twenty minutes into exercise a 50 mL drink containing lactulose (L; 5 g) and rhamnose (R; 2 g) was provided and intestinal permeability determined by the percent ratio of lactulose to rhamnose recovered in post exercise urine samples. Venous blood samples were obtained before and 5 minutes after the time trial for assessment of intestinal fatty acid binding protein (IFABP), and data analysed using mixed linear models with fixed effects for condition (W/MF/HYDRO) and time (before and after exercise). **Results.** L:R was greatest in W, and lower in both HYDRO [by 0.019 (95% CI: 0.010 to 0.027), p = 0.0003], and GF [by 0.014 (95% CI: 0.006 to 0.022), p = 0.0018]. No differences in L:R were found between the H and GF conditions (p = 0.083). Post-exercise IFABP concentrations were greater in W compared to HYDRO [by 349 pg·mL⁻¹ (95% CI: 137 to 561 pg·mL⁻¹), p = 0.007] and GF [by 427 pg·mL⁻¹ (95% CI: 152 to 701 pg·mL⁻¹), p = 0.018]. There was no difference in post exercise IFABP concentrations between H and GF (p = 0.90). **Conclusion.** Both CHO drinks preserved intestinal permeability and reduced the appearance of circulating IFABP compared to W. HYDRO offered no additional benefit beyond those achieved with a traditional MF drink.

2218 Board #137 May 28 3:00 PM - 4:30 PM
Effects Of Weight Regain In Obese Individuals With Nafld Following A Low Carbohydrate Diet

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(No relevant relationships reported)

PURPOSE: We determined the effects of weight regain in individuals with NAFLD following a low carbohydrate diet (LC). **METHODS:** Twelve obese subjects (body-mass index, 36.5 ± 1.0 kg/m²) with NAFLD (10.3 ± 2.8%) followed a LC (<60g/d) energy-deficit diet (1,200kcal/day) for 12 weeks. Participants were followed-up at 9 months after the end of the weight loss (WL) phase. DXA, Magnetic resonance spectroscopy, muscle biopsies, and a euglycemic-hyperinsulinemic clamp were used to determine body composition, intrahepatic triglyceride content (IHTG), and insulin action before, after ~12 weeks of caloric restriction using a LC diet, and 9 months follow-up (post weight loss). **RESULTS:** Participants lost a significant (p<0.05) amount of body weight from baseline (101.9 ± 4.0kg) to 12 weeks WL (93.4 ± 4.0kg) but regained most of the body weight body at 9 months follow-up (97.5 ± 5.5kg, p>0.05 compared to baseline). IHTG significantly (p<0.05) decreased from baseline (12.4 ± 2.9%) to 12-weeks WL (8.9 ± 7.3%) but returned to baseline values at 9 months follow-up (11.5 ± 8.9%, p>0.05 compared to baseline). Basal glucose rate of appearance significantly decreased from baseline (14.2 ± 0.4 μmol/kgFFM/min, p<0.001) to WL (11.7 ± 0.3 μmol/kgFFM/min) but returned to baseline values at 9 months follow up (13.2 ± 1.5 μmol/kgFFM/min, p>0.05 compared to baseline). Homeostasis model assessment (HOMA-IR) significantly (p<0.01) decreased from baseline (4.9 ± 0.7) to WL (2.7 ± 0.5) but returned to baseline values at 9 months follow up (4.6 ± 1.6, p>0.05 compared to baseline). **CONCLUSIONS:** Weight regain results in the metabolic profile of obese individuals with NAFLD to return to pre-weight loss levels; emphasizing the need for effective approaches to prevent weight regain following clinically significant weight loss.

2219 Board #138 May 28 3:00 PM - 4:30 PM
Effects Of Low-carbohydrate And Caloric Restriction Diets On Mental Status And Physical Performance

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Low-carbohydrate diets (LCD) for weight reduction and the management of the metabolic syndrome are increasingly popular, but there is a paucity of research about the negative effects of LCD on mental status and physical fitness. **PURPOSE:** We examined the effects of LCD vs. caloric restriction on mental status and physical performance in untrained subjects with overweight and/or glucose intolerance. **METHODS:** We recruited 24 sedentary young subjects (20 ± 2 yrs) and randomly assigned them to an LCD group (carbohydrate intake <40 g) and a caloric restriction (CR) diet group (ideal weight × kcal). We measured the subjects' body composition, blood metabolic parameters (fasting glucose, insulin, lipids, uric acid, liver enzymes, ketone bodies, C-reactive protein, adiponectin, growth hormone, testosterone and dehydroepiandrosterone), mental status (State-Trait Anxiety Inventory [STAI] and brain-derived neurotrophic factor) and various physical performance aspects (leg extension, handgrip dynamometry, sit-up, and bicycle ergometer) before and after 1 month of the diets. **RESULTS:** The ketone bodies value rose remarkably in the LCD group from before the diet to 1 month on the diet (64.9 ± 33.0 vs. 962.1 ± 1047.0 μmol/L, p=0.017) but was unchanged in the CR group (64.8 ± 10.2 vs. 239.0 ± 336.9 μmol/L, p=0.107). The body mass index decreased significantly in both the LCD (24.9 ± 3.5 vs. 23.5 ± 3.5 kg/m², p<0.001) and CR (24.7 ± 3.8 vs. 24.1 ± 3.8 kg/m², p=0.026) groups. Waist circumference significantly decreased in the LCD group (84.9 ± 3.5 vs. 81.1 ± 10.2 cm, p=0.001) but did not change significantly in the CR group (83.8 ± 12.0 vs. 82.6 ± 11.8 cm, p=0.145). The physical performance aspects were similarly maintained in both groups. Other blood parameters and the mental status did not change significantly in either group. **CONCLUSIONS:** Our results demonstrated that an LCD for a relatively short term can decrease obesity measures more effectively than caloric restriction, without negative effects on mental status or physical performance.

2220 Board #139 May 28 3:00 PM - 4:30 PM
Short-term Caloric Restriction With Low Carbohydrate Intake Augmented Baseline Hepcidin Level In Young Females

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Hepcidin is a liver-derived hormone to attenuate iron metabolism. Recent studies suggest that negative energy balance promotes hepcidin elevation. **PURPOSE:** The purpose of the present study was to examine the effect of caloric restriction (CR) with low carbohydrate intake on hepcidin responses. **METHODS:** Twenty-two young females (age: 21.2 ± 0.2 yrs, body weight: 54.6 ± 1.3 kg) were divided into two different groups, either CR with low carbohydrate intake group (LCHO; 22%PRO, 39%FAT, 39%CHO, 1123kcal) or CR with neutral carbohydrate intake group (NCHO; 18%PRO, 19%FAT, 63%CHO, 1162kcal). During three consecutive days of CR program, subjects consumed only the prescribed diet and maintained their usual physical activity levels. Before and after intervention, body composition, basal hepcidin levels or iron status were evaluated following the overnight fast. Six subjects (LCHO: n = 3, NCHO: n = 3) were excluded from data analysis due to severe iron deficiency (serum ferritin < 10 ng/mL) or infection. **RESULTS:** After intervention, body weight and fat mass were significantly decreased (P < 0.05), with no significant difference between groups. Following the intervention, blood glucose level significantly decreased in LCHO group (P < 0.05). Serum iron and ferritin levels were significantly elevated following the intervention (P < 0.05). Moreover, the magnitude of increased serum iron level tended to be higher in LCHO group than in NCHO group (P = 0.06). In contrast, total iron-binding capacity (TIBC) did not differ following the intervention in either group. Also, plasma IL-6 level did not change following the intervention (LCHO: before 0.84 ± 0.14 pg/mL, after 0.66 ± 0.06 pg/mL, NCHO: before 1.09 ± 0.23 pg/mL, after 0.93 ± 0.19 pg/mL). Serum hepcidin level significantly increased after the intervention in both groups (LCHO: before 13.11 ± 4.16 ng/mL, after 29.9 ± 4.76 ng/mL, NCHO: before 13.03 ± 3.10 ng/mL, after 19.94 ± 4.41 ng/mL, P < 0.05). In addition, the relative change in hepcidin level was significantly higher in LCHO group (264.3 ± 87.2%) than in NCHO (68.9 ± 22.1%, P < 0.05). **CONCLUSIONS:** Three consecutive days of CR with low carbohydrate intake augmented basal hepcidin level compared with CR with neutral carbohydrate intake. Supported by Urakami Foundation for Food and Food Culture Promotion

2221 Board #140 May 28 3:00 PM - 4:30 PM
Long Term Habituation To Carbohydrate-Restricted Diet Preserved Performance And Central Drive After 2 Hours Of Running: A Case Study

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PURPOSE: While the brain is usually wholly dependent on glucose for fuel, prolonged carbohydrate deprivation results in adaptations that allow the brain to access fat via ketone bodies. Given the depletion of carbohydrate that takes place during prolonged exercise, a shift toward ketone bodies may maintain central nervous system function, preventing the central fatigue observed during long-duration exercise. In addition, enhancing peripheral muscle's use of free fatty acids and intra-muscular lipids might prolong contractions. Thus, high fat/low carb diets have been proposed to delay fatigue during endurance exercise. However, studies utilizing periods of 1 to 5 weeks of adaptation to high fat diets have shown equivocal changes in performance at moderate or high intensities. We compare endurance and time trial performance of a keto-adapted male runner (KETO) to 8 subjects (NORM) on whom we have previously reported.

METHODS: We measured peripheral and central fatigue in 8 men runners (38±2 yrs; VO_{2peak} 59±3 ml/kg/min) who habitually ate a carbohydrate-liberal diet (NORM) and in a runner (41 yrs, 70 ml/kg/min) who followed a high fat/low carb diet for >2 years. Water was provided at 1% of body mass/hr, during a 2-hr run at ventilatory threshold (~65% VO_{2peak}), followed by a self-paced 2-km time trial (TT). RPE and respiratory measures were determined every 20 minutes. Strength was tested in a semi-reclined position [75° hip flexion, to facilitate femoral nerve stimulation] pre-exercise, after the 2-hr run and post-time trial as follows: voluntary isometric quad strength was measured on the Biodex with the knee flexed 60°, and with superimposed peripheral magnetic stimulation of the femoral nerve to determine central activation (CAR). **RESULTS:** Respiratory exchange ratio indicated that KETO (0.78) used less carbohydrate than NORM (0.86±0.01) during the 2-hr run. While we measured no fatigue of any kind in KETO, NORM declined in voluntary strength (-16±5%) and experienced loss of central drive to the muscle (CAR decreased from 0.85±0.04 to 0.76±0.05). KETO ran the TT at a mean pace of 16.4 km/hr compared to 14.8±0.7 km/hr in NORM.

CONCLUSIONS: Our KETO runner did not display strength loss and may have had better TT performance after exhausting exercise as compared to our NORM runners who exhibited central fatigue.

2222 Board #141 May 28 3:00 PM - 4:30 PM
Impact Of Cardiorespiratory Fitness On Carbohydrate Utilization In Overweight And Obese Adults

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Obese individuals have impaired metabolic flexibility compared to lean individuals. During exercise, this population relies more heavily on fat oxidation than carbohydrate oxidation for energy even at higher intensities. Although increased fat oxidation during exercise can be beneficial in lean individuals, increased fat oxidation during exercise in obese populations is a paradox. Examining the relationships of fat versus carbohydrate oxidation in obese subjects with different cardiorespiratory fitness levels, may help to explain these differences further. **PURPOSE:** To determine whether overweight and obese (OW/OB) individuals with higher versus lower cardiorespiratory fitness differ in their carbohydrate and fat utilization at 35, 50, 65, and 80% of VO_{2max} during a graded exercise test. **METHODS:** Adults (n=34), 28-55 years old with BMI 27-36 kg·m⁻² were measured for their age-predicted VO_{2max} using a modified Bruce protocol on a treadmill to 85% of age predicted heart rate maximum. Participants were first split into group based on sex and then divided for comparison into upper and lower halves based on age-predicted VO_{2max}. After they were split into within sex low and high groups, their carbohydrate and fat utilizations were compared at 35, 50, 65, and 80% of VO_{2max} and normalized to body mass. **RESULTS:** An intensity by fitness group interaction (p<0.05) was measured for both sexes. For women (n=10 per group), the low and high fitness groups were similar in carbohydrate oxidation at 35 and 50 of VO_{2max} and the high fitness women oxidized more (p=0.05) carbohydrate at 65% (mean +/- SD, 0.08 +/- 0.02 vs 0.06 +/- 0.03 kcal/kg/min) and 80% (0.20 +/- 0.09 vs 0.12 +/- 0.05 kcal/kg/min) VO_{2max}. For men (n=7 per group), both groups had similar carbohydrate oxidation at 35, 50, and 80% of VO_{2max} and the high fitness men oxidized more (p<0.05) carbohydrate (0.16 +/- 0.07 vs. 0.09 +/- 0.02 kcal/kg/min) at 65% VO_{2max}. Fat utilization did not differ between groups for either males or females. **CONCLUSIONS:** OW/OB adults with better cardiorespiratory fitness utilized more carbohydrates for energy during a graded exercise test at moderate or

moderate to high intensity and did not differ in fat utilization. Supported by Montana State University Research Initiative 51040-MUSRI2015-03 and USDA-NIFA 2017-67018-26367.

2223 Board #142 May 28 3:00 PM - 4:30 PM
Effects Of Low-load, High-repetition Exercise And Sex On Metabolic Properties Of Skeletal Muscle

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INTRODUCTION. During exercise women are better able to initiate aerobic metabolism and are less reliant on anaerobic energy stores. Whether this metabolic difference persists during resistance exercise remains unknown. **PURPOSE.** To characterize fuel utilization patterns during a bout of low-load, high-repetition (LL-HR) resistance exercise and determine whether sex influences the fuel utilization pattern. **METHODS.** Twenty young, healthy participants (n=10 men and women) were recruited and matched for VO_{2peak} relative to fat-free mass and habitual resistance training. The LL-HR bout consisted of a circuit of chest press, leg extension, lat pulldown, hamstring curl, shoulder press, and leg press for 25-35 repetitions at 30% of 1RM with 30s rest between each exercise and 2 minutes rest between circuits. Muscle biopsies were taken prior to and following exercise and finger prick assessment of blood lactate was taken during the exercise bout. Western blot analysis was completed for assessment of the high-energy phosphate transfer (CK, phosphorylated CK, AMPD2) and glycolytic (GP, PFK, LDH H and M, PDHE1α, PDHK4, MCT 1 and 4, phosphorylated PDHE1α) pathways. Muscle content of creatine, ATP, lactate, P_i, pyruvate, and glycogen were also determined. Muscle fibre type was determined using myosin heavy chain immunofluorescence staining. **RESULTS.** Women had a higher proportion of type I muscle fibres than men (p=0.007). There were no sex differences in the protein content of any of the enzymes at rest. Men had higher content of muscle glycogen (p=0.001), lactate (p=0.02), ATP (p=0.01), and P_i (p=0.007) than women. Glycogen, ATP, and phosphorylation of CK and PDHE1α decreased in men and women with exercise (p<0.001). Phosphorylation of CK decreased to a greater extent in women (p=0.023) and women tended to use more glycogen (p=0.081) during exercise. Alternatively, creatine increased to a greater extent in men (p=0.026) and men tended to have a greater lactate concentration at the end of the exercise bout (p=0.097). **CONCLUSION.** Sex differences in fuel metabolism during LLHR resistance exercise exist. While women tend to utilize more glycogen during LLHR, men have a higher muscle lactate content, suggestive of a greater reliance on anaerobic metabolism.

2224 Board #143 May 28 3:00 PM - 4:30 PM
POST BREAKFAST RESISTANCE EXERCISE AND REDOX STATUS RESPONSES IN PATIENTS WITH BETA THALASSEMIA MAJOR EXHIBITING INSULIN RESISTANCE

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Beta-thalassemia major is an inherited hemoglobin disorder that manifests within the first few months of life. Especially insulin resistance and diabetes mellitus are common consequences of iron overload in the pancreas. **PURPOSE:** To examine whether a session of resistance exercise can affect the redox status and improve postprandial hyperglycaemia in patients with beta-thalassemia major exhibiting insulin resistance. **METHODS:** Six patients (weight: 66.0 ± 16.6 kg, body fat: 37.6 ± 5.1 %, SBP: 104.5 ± 9.7 mmHg, DBP: 67.5 ± mmHg) underwent two trials (exercise and control) following breakfast meal ingestion, in a counterbalance order, separated by at least three days. In exercise trial, patients performed chest and leg press (3 sets of 10 maximal repetitions), while in control trial they rested. Blood samples were obtained in both trials: pre-meal, 45 min post-meal, immediately post, 1 hour post, 2 hours post and 24 hours post. Blood was analysed for TBARS, catalase, total antioxidant capacity (TAC) and glucose. **RESULTS:** No time or condition interaction was found for TBARS, catalase and TAC (Table 1). Blood glucose levels increased significantly following breakfast meal ingestion and were not differed between trials at the same time points.

Table 1: Redox and glucose responses following a post-breakfast resistance exercise session

CONCLUSIONS: A session of resistance training consisting of two major muscle exercises is not enough to influence changes in redox status or glucose metabolism in patients with beta-thalassemia major exhibiting insulin resistance.

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2225 Board #144 May 28 3:00 PM - 4:30 PM
Effect Of Wearing Lower-body Compression Garments During Prolonged Running On Substrate Oxidation And Running Kinematics

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Lower body compression garments (CG) have been suggested previously to provide favorable effects during running. One of explanation for the benefits of wearing CG might be explained by augmented arterial blood flow by external pressure applied. Enhanced muscle perfusion can increase oxygen delivery to exercising muscle, thereby affecting oxygen uptake and substrate oxidation. Furthermore, wearing CG might assist the propulsive force by optimizing running kinematics as a result of the elastic nature of the garment, leading to less metabolic cost of running at a given speed. These insights may be advantageous in situation with prolonged running, which is required large metabolic demand under development of fatigue. However, little information is available for effect of wearing CG during prolonged running (> 1h) on energy metabolism and running kinematics. **PURPOSE:** To determine influence of wearing CG on energy metabolism and running kinematics during prolonged running. **METHODS:** Eight physical active male (24 ± 2 yrs, 168.4 ± 5.0 cm, 63.9 ± 5.0 kg, VO₂max; 54.8 ± 4.3 mL·kg⁻¹·min⁻¹) completed 2 exercise trial in the different days. The exercise consisted of 120 min of uphill running (7% gradient) at 60 % of VO₂max (6.8 ± 0.6 km·h⁻¹). The exercise trials included 1) wearing CG with exerting 15 mmHg [CG]; and 2) wearing garment with exerting below 5 mmHg [CON] to thigh and calf. Respiratory gas variables (carbohydrate oxidation) and running kinematics (step length and frequency, ground-contact time, flight time, joint angles) were assessed every 30 min of exercise. Blood samples were collected to determine blood glucose and lactate, and plasma IL-6 as indication of carbohydrate metabolism. *P* < 0.05 was considered to be statistically significant. **RESULTS:** Time course of changes in carbohydrate oxidation, running kinematics and blood glucose and lactate did not differ between the two trials (*P* > 0.05). Area under the curve (AUC) of plasma IL-6 concentration for 120 min of exercise tended to be lower in the CG trial (803 ± 452 pg·mL⁻¹) compared with in the CON trial (1,219 ± 842 pg·mL⁻¹, *P* = 0.07). A positive relationship was observed between the AUC of plasma IL-6 concentration and the total carbohydrate oxidation (*r* = 0.5, *P* = 0.049). **CONCLUSION:** Wearing CG did not alter energy metabolism and running kinematics during prolonged running.

2226 Board #145 May 28 3:00 PM - 4:30 PM
Comparing The Effects Of Different Modes Of Exercise On Glucose Handling In Young Recreationally Active Men

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PURPOSE: The prevalence of type 2 diabetes (T2D) is increasing dramatically and is characterized by insulin resistance (IR). Exercise training is an effective modality to improve IR and acutely can increase post-exercise glucose handling for up to 72 hours. However, there is conflicting evidence as to which mode of exercise elicits the greatest positive effect on glucose handling. The purpose of this study was to compare the effectiveness of different modes of exercise on post-exercise glucose handling in young recreationally active men. **METHODS:** Twelve (age: 22±3 years) recreationally active men completed 4 separate oral glucose tolerance tests (OGTT) either at rest, or 1.5 hours after moderate-intensity continuous exercise (MICE; 30 min @ 65% VO₂peak), low-load high-repetition resistance exercise circuit (LLHR; 20-25 reps/set for 3 sets at 30% 1RM) and high-intensity interval training bout (HIIE; 10x1min at 90% HR_{max}). Heart rate and blood lactate were taken throughout the exercise bouts. Blood was analyzed for total plasma glucose concentration (mmol/L), c-peptide concentration (ng/mL) and blood insulin concentration (μIU/mL). **RESULTS:** Average blood glucose concentration during the OGTT was lower following LLHR (6.386 ± 0.261mmol/L, *p* = 0.03) as compared with MICE (6.839 ± 0.256 mmol/L, *p* = 0.03) with no differences between baseline (6.625 ± 0.333 mmol/L) and HIIE (6.737 ± 0.267 mmol/L). Glucose area under the curve (AUC) was lower following LLHR (781.76 ± 36.08) as compared

to MICE (842.81 ± 35.8; *p* = 0.033) with no difference compared to baseline glucose AUC (804.61 ± 46.7, *p* = 0.475). Blood c-peptide concentrations were not significantly different between baseline, MICE, HIIE or LLHR average concentrations. Similar to c-peptide there were no significant differences between blood insulin concentrations post exercise. **CONCLUSION:** In young, healthy men none of the exercise modes improved glucose handling as compared with baseline. However, LLHR resistance exercise did result in greater glucose clearance than MICE, suggesting that it may be a better modality to improve glucose control. Future work should examine the acute and chronic effects of LLHR resistance exercise on glucose handling in individuals with IR to determine the potential effectiveness of this exercise modality to improve insulin sensitivity.

2227 Board #146 May 28 3:00 PM - 4:30 PM
The Effect Of Arm Versus Leg Dominant Physical Activity On Postprandial Blood Glucose Levels

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PURPOSE: The aim of this investigation was to assess the effects of two different exercise trials that used different amounts of muscle mass on postprandial blood glucose levels. **METHODS:** Subjects (*n* = 8) participated in a series of three tests after ingesting a 75g 100% glucose solution: a control, a bout of arm-only exercise, and a bout of leg-only exercise following the standard OGTT protocol. Each exercise bout was thirty minutes in length, the intensity of which was matched at 0.5 watts/ kg of body weight between trials. **RESULTS:** The average postprandial blood glucose was significantly different between conditions (Two Way Repeated Measures ANOVA, *p* < 0.05). At 20 minutes blood glucose was significantly lower in legs conditions versus the arm condition (*p* = 0.003). There was no difference in mean HR or RPE between trials. **CONCLUSION:** The data suggests that when factors such as workload are matched, the amount of muscle mass recruited for light physical activity can impact postprandial blood glucose control. The results of this pilot study help to further define the role exercise could play in the prevention of increasingly prevalent metabolic disorders, helping people to live longer, healthier lives utilizing exercise as medicine.

2228 Board #147 May 28 3:00 PM - 4:30 PM
Does Energy Expenditure Of Activity Interruptions In Prolonged Sitting Impact On Glycemic Responses?

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PURPOSE: To explore the impact of energy expenditure (EE) on glycemic responses when prolonged sitting is interrupted by three regular activity bouts.

METHODS: Fourteen healthy, sedentary, inactive adults (8 women; age 23.7±2.9 y; BMI, 22.2±2.4 kg/m²; VO₂ max, 38.5±5.2 mL·kg⁻¹·min) completed four 26 h interventions in randomized order, including 22.5 h in an EE-testing calorimeter chamber. The four 9 h intervention periods were as follows: uninterrupted sitting (SIT); 30 min sitting/3 min brisk treadmill walk (60% VO₂max, WALK3); 45 min sitting/5 min brisk treadmill walk (WALK5); or 60 min sitting/8 min brisk treadmill walk (WALK8). Meals and meal times were standardized across the trials for all participants. After adjustment for age, sex, percent of body fat, relative VO₂max, treatment order, and corresponding baseline interstitial glucose concentrations, the relationship between EE and the incremental area under the curve (iAUC) for interstitial glucose was examined during the whole 26 h observation period and each segmentation period (intervention period, evening period, and sleep period). The interstitial glucose was obtained via continuous glucose monitoring. Random effects mixed model analyses were performed and data were represented as unstandardized coefficients with 95% confidence intervals.

RESULTS: Model parameter estimates revealed that EE was negatively associated with glucose iAUC during the intervention period ($\beta = -1.87 \text{ mmol} \cdot \text{h} \cdot \text{L}^{-1} \cdot \text{MJ}^{-1}$ [-3.68 - -0.05], *P* = 0.04) and positively associated with glucose iAUC during the 2 h post-dinner period immediately following the intervention period ($\beta = 0.64 \text{ mmol} \cdot \text{h} \cdot \text{L}^{-1} \cdot \text{MJ}^{-1}$ [0.27 - 1.00], *P* = 0.001). There was no significant association between EE and glucose iAUC during the entire 26 h observation or the other segmentation periods. The 2 h post-dinner iAUC was higher in men than in women (mean difference: 0.74 mmol·h·L⁻¹ [0.16 - 1.33], *P* = 0.01).

CONCLUSIONS: Higher EE after the interruption of sitting time was associated with lower interstitial glucose responses during the intervention period in healthy, sedentary adults, but the opposite was true in the 2 h postprandial period immediately following the intervention period.

2229 Board #148 May 28 3:00 PM - 4:30 PM
Males And Females Exhibit Similar Muscle Glycogen Recovery Across Varied Diets

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Research has demonstrated that post exercise glycogen recovery is altered by varied macronutrient intake and timing and in response to ambient or skeletal muscle temperatures. However, research has minimally considered the implications of glycogen recovery in females and has mostly focused on commercial sport nutrition products. **PURPOSE:** To determine the effects of varied mixed macronutrient feedings on glycogen recovery and subsequent exercise performance in both sexes. **METHODS:** Males (n=8) and females (n=8) participated in a counter-balanced crossover study. Subjects completed a 90-minute cycling glycogen depletion trial then rested for 4 hours. Two carbohydrate feedings (1.6 g kg⁻¹body weight each) of either sport supplements or potato-based products were delivered at 0 and 2 hours post exercise. Muscle biopsies and blood samples (glucose, insulin) were collected during the recovery. Following the 4-hour recovery period, subjects completed a 20km cycling time trial. Data were analyzed using 2 and 3 way ANOVA with repeated measures with statistical significance established at p<0.05). **RESULTS:** There was no difference between sexes or dietary sources for glycogen recovery rates (male: 7.9±2.7, female: 8.2±2.7, potato-based: 8.0±2.5, sport supplement: 8.1±3.1 mM · kg wet wt⁻¹ · hr⁻¹, p>0.05). Potato based feedings resulted in higher ratings for taste, satisfaction and acceptability (p<0.05). Time trial performance was not different between diets (38.3±4.4 and 37.8±3.9 minutes for potato and sport supplement, respectively, p>0.05). **CONCLUSION:** These results indicate that food items, such as potato-based products, can be as effective as commercially marketed sports supplements when developing glycogen recovery oriented menus and that carbohydrate dose recommendations (g kg⁻¹body weight) can be universally applied to both males and females. Supported by the Alliance for Potato Research and Education

2230 Board #149 May 28 3:00 PM - 4:30 PM
Interrupting Sitting With Short Walks Or Repeated Chair Stands Improves Glycemic Control In Healthy Adults

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 (No relevant relationships reported)

Uninterrupted sedentary time is an independent risk factor for the development of metabolic diseases. Interrupting prolonged sitting with brief, intermittent walks can improve postprandial glucose metabolism; however, the efficacy of other types of exercise that do not require equipment nor space beyond one's immediate sedentary area remain to be investigated. **PURPOSE:** To determine the impact of interrupting prolonged sitting with practical 'activity snacks' on postprandial glycemia and insulinemia in healthy adults. **METHODS:** Fourteen participants (7 males, 7 females; 23±5yr; 24±5kg/m²; 40±8ml/kg/min; 4587±1231steps/d) completed three 7.5hr trials in a randomized order consisting of uninterrupted sitting (SIT), sitting with intermittent (every 30 min) walking (WLK; 2min at 3.1mph) or sitting with intermittent squats (SQT; 15 'chair stands with calf raise'). Mixed-macronutrient liquid meals (~55:30:15% carbohydrate:fat:protein) provided 20% ('breakfast'; 406±87kcal) and 30% ('lunch'; 609±130kcal) of daily energy needs to mimic traditional Western meal patterns. Blood was obtained every 30min and analyzed for plasma glucose and insulin concentration. Positive incremental area under the curve (iAUC) for glucose, insulin and insulin:glucose ratio were calculated 1 and 3h postprandially using the trapezoidal rule. **RESULTS:** Postprandial glucose and insulin did not differ across conditions following breakfast. After lunch, peak insulin concentration was lower in SQT (51.6±26.7, p<0.001) and WLK (62.2±34.9, p<0.05) compared to SIT (78.9±43.0µIU/ml). The insulin:glucose iAUC 3h following lunch was also reduced by the activity snacks (SQT: 489±300; WLK: 541±401) compared to SIT (700±398, p<0.05). Insulin iAUC 1h following lunch was lower in SQT (1412±902, p<0.01) and WLK (1575±1145, p<0.05) relative to SIT (2231±1540µIU/ml x 1h, p<0.01), however 3h insulin iAUC was only reduced in SQT (SQT: 2992±1735 vs. SIT: 3954±2261µIU/ml x 3h; p<0.05). **CONCLUSION:** Interrupting prolonged sitting with short walks or repeated chair stands reduces postprandial insulinemia following lunch in healthy adults. Our results add to the evidence suggesting that short 'activity snacks' can help mitigate cardiometabolic risk factors associated with prolonged sitting. Supported by ACSM Research Endowment Grant.

2231 Board #150 May 28 3:00 PM - 4:30 PM
Abstract Withdrawn

2232 Board #151 May 28 3:00 PM - 4:30 PM
Passive Stretch Improves Insulin-stimulated Glucose Transport Together With Downregulation Of TXNIP In Rat Soleus Muscle

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 (No relevant relationships reported)

PURPOSE: Although passive stretch is known to stimulate muscle glucose transport independently of insulin action, it is unclear whether stretch increases susceptibility of glucose transport to insulin and improves insulin resistance in skeletal muscles. Therefore, we examined the effect of stretch on insulin-stimulated glucose transport in insulin resistant soleus muscles of immobilized rats. In addition, we examined the possibility that stretch decreases protein expression of TXNIP which is known to be a key negative regulator of insulin signaling. **METHODS:** Rats were divided into non-immobilized control and immobilized groups. Non-immobilized control rats were allowed to move freely in their cages. Immobilized rats were anesthetized and their both hindlimbs were immobilized for 6 h. Unilateral soleus muscles of immobilized rats were shortened by plantarflexing the ankle joint throughout 6 h immobilization. Contralateral muscles were stretched for 1 h by dorsiflexing the ankle joint following 5 h shortening by plantarflexing. We measured basal and insulin (50µU/ml) stimulated 2-deoxyglucose (2DG) uptake rate in isolated soleus muscles. Moreover, TXNIP protein expression was evaluated in these muscles. **RESULTS:** Although insulin (50µU/ml) increased glucose transport by 1.9-fold in soleus muscles of non-immobilized control rats (p<0.05), insulin did not significantly increase glucose transport in shortened muscles of immobilized rats. This result shows that insulin resistance is induced in these shortened muscles. On the other hand, 1 h passive stretch restored insulin resistance of glucose transport in muscles of immobilized rats (insulin-stimulated 2DG uptake in control, 3.12±0.29; shortened, 1.73±0.17; stretched, 3.04±0.31µmol/g muscle/20min). In addition, TXNIP protein was increased in shortened muscles of immobilized rats as compared with muscles of control rats (p<0.05). Moreover, elevated TXNIP expression in these muscles was returned to control level after 1 h passive stretch (TXNIP in control, 100±9; shortened, 166±8; stretched, 107±9 arbitrary units). **CONCLUSIONS:** Passive stretch improves insulin-stimulated glucose transport in insulin-resistant soleus muscles of immobilized rats. This may be due to stretch-induced downregulation in TXNIP protein expression.

2233 Board #152 May 28 3:00 PM - 4:30 PM
Acute Hypoxia Suppresses Exogenous Glucose Rate Of Appearance And Metabolic Clearance Rate During Steady-state Aerobic Exercise

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BACKGROUND: Previously, we observed that exogenous carbohydrate oxidation is reduced when lowlanders perform steady-state aerobic exercise after 5 h exposure to high altitude (HA). However, the underlying glucose kinetics that may contribute to the reduction in exogenous carbohydrate oxidation during steady-state aerobic exercise performed at HA have not been explored. **PURPOSE:** Determine glucose turnover responses to exogenous carbohydrate ingestion during metabolically-matched, steady-state aerobic exercise at HA and sea level (SL). **METHODS:** Using a randomized, crossover design, lowlanders (n = 8 males, mean ± SD, age: 23 ± 2 yr, body mass: 87 ± 10 kg, and VO_{2peak}: SL 4.3 ± 0.2 L/min and HA 2.9 ± 0.2 L/min) consumed 145 g (1.8 g/min) of glucose while performing 80 min of metabolically-matched (SL: 1.66 ± 0.14 L/min $\dot{V}O_2$, 329 ± 28 kcal; HA: 1.59 ± 0.10 L/min $\dot{V}O_2$, 320 ± 19 kcal) treadmill exercise at SL (757 mmHg) and after 5 h of simulated HA (hypobaric hypoxia, 460 mmHg) exposure. Glucose rate of appearance (Ra), disappearance (Rd), and metabolic clearance rate (MCR), were determined during the last 40 min of exercise using primed, constant [6,6-²H₂] glucose infusions and ¹³C glucose-labeled drinks.

RESULTS: Exogenous glucose oxidation rate was lower ($P < 0.05$) at HA (0.35 ± 0.07 g/min) compared to SL (0.44 ± 0.05 g/min). Total glucose R_a was lower ($P < 0.05$) at HA (12.3 ± 1.5 mg/kg/min) compared to SL (13.8 ± 2.0 mg/kg/min). Exogenous glucose R_a was lower ($P < 0.05$) at HA (8.9 ± 1.3 mg/kg/min) compared to SL (10.9 ± 2.2 mg/kg/d), but there was no difference between endogenous glucose R_a at HA compared to SL. Glucose R_a and MCR were lower ($P < 0.05$) at HA (12.7 ± 1.7 mg/kg/min and 9.0 ± 1.8 mg/kg/min) compared to SL (14.3 ± 2.0 mg/kg/min and 12.1 ± 2.3 mg/kg/min).

CONCLUSION: Ingesting carbohydrate during steady-state aerobic exercise performed 5 h after arriving at HA is associated with lower exogenous glucose R_a , glucose R_a , and MCR compared to SL. These data suggest that altered glucose kinetics, indicative of either a reduction in exogenous glucose absorption or release from the gut, may contribute to lower exogenous carbohydrate oxidation during exercise upon initial exposure to HA.

2234 Board #153 May 28 3:00 PM - 4:30 PM
Relationship Of Glucose Kinetics With Exercise Capacity, Body Composition, And Mitochondrial Function With Aging

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 (No relevant relationships reported)

Aging is commonly associated with decreases in aerobic capacity, skeletal muscle mass and function, as well as metabolic dysregulation including insulin resistance. **PURPOSE:** We sought to investigate relationships between these aforementioned hallmark traits of aging. **METHODS:** Young healthy adults (24-34 years; n=16; 7F/9M; BMI: 25 ± 3 kg/m²) and older adults (65-79 years; n=39; 20F/19M; BMI: 27 ± 4 kg/m²) were recruited as a part of this investigation. Subjects completed a graded maximal exercise test (VO_{2peak}) on a treadmill, a dual-energy X-ray absorptiometry scan, measurement of single-leg knee extension power, a mixed meal tolerance test upon which blood glucose was monitored throughout the next 5 hours, and a resting vastus lateralis biopsy to measure ATP production from permeabilized muscle fibers. **RESULTS:** Young had a 38% greater aerobic capacity and 45% greater knee extensor maximal power/lean mass. Fasting plasma glucose was lower ($P < 0.05$) in young (86 ± 7 mg/dL vs. 93 ± 8 mg/dL in young and old, respectively), as well as young had 31% lower plasma glucose area above baseline (AAB) in response to the mixed meal tolerance test compared to old ($P < 0.05$). No differences between young and old were observed in lean body mass, fasting plasma insulin, or maximal mitochondrial ATP production (state III). Interestingly, AAB was not significantly correlated with phenotypic characteristics (BMI or lean body mass), fasting plasma glucose or insulin, or maximal ATP production. However, AAB was significantly ($P < 0.05$) inversely correlated with VO_{2peak} relative to body mass ($r = -0.38$) and knee extensor power/lean mass ($r = -0.47$). **CONCLUSIONS:** These data suggest that glucose tolerance may be a function of skeletal muscle quality rather than total lean mass. However, the inverse relationship with AAB and measurements of whole body functional tests do not appear to be related mitochondrial energy production, suggesting the need for further mechanistic investigations. Supported by NIH grant R01AG054454

2235 Board #154 May 28 3:00 PM - 4:30 PM
Hand Heating Lowers Fasting And Postprandial Blood Glucose

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 Reported Relationships: J. Moore: Industry contracted research; AVACEN Medical.

Purpose: Examine the effect of hand heating with negative pressure on postprandial blood glucose (PBG) and fasting blood glucose (FBG). **Methods:** Design: Double-blind randomized controlled trial. Subjects: PPG experiment: 13 healthy subjects (2 males). FBG experiment: 17 healthy subjects (4 males). Interventions: Devices included one providing heat only, one heat and negative pressure, and one acting as a sham. For the PPG experiment the devices were used for one hour during an oral glucose tolerance test (75 grams dextrose). For the FBG experiment the devices were used for 30 minutes. Outcome Measures: Blood glucose measurements were used to determine peak PBG, area under the curve (AUC), incremental AUC (iAUC), and change in FBG. **Results:** PBG: Compared to the sham device the heat plus vacuum and heat only device lowered peak blood glucose by 16 ± 31 mg/dL, $p = 0.092$ and 18 ± 28 mg/dL, $p = 0.039$, respectively. AUC and iAUC: Compared to the sham device, the heat plus vacuum device and heat only device lowered the AUC by $3.7 \pm 14\%$, $p = 0.234$ and $7.7 \pm 11\%$, $p = 0.024$ respectively and iAUC by $17.2 \pm 53\%$, $p = 0.178$ and $20.5 \pm 34\%$, $p = 0.054$, respectively. FBG: The decrease in fasting blood glucose from 0 min to 30 min for the heat plus vacuum device and heat only device was 1.8 ± 4.8 mg/dL, $p = 0.07$ and 3.2 ± 5.3 mg/dL, $p = 0.01$, respectively. The sham device had no effect on

mean resting blood glucose as it was 92.6 mg/dL both pre and post-treatment ($p = 0.47$).

Conclusions: Local hand heating combined with negative pressure lowers fasting and postprandial blood glucose in healthy subjects.

2236 Board #155 May 28 3:00 PM - 4:30 PM
EFFECTS OF INTERMITTENT LOW DOSE CARBON MONOXIDE INHALATION ON BLOOD GLUCOSE REGULATION IN OVERWEIGHT ADULTS: A RANDOMIZED CONTROLLED CROSSOVER TRIAL

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PURPOSE: Low dose carbon monoxide (CO) inhalation upregulates several proteins important for glucose metabolism. However, it is not known whether CO's ability to upregulate proteins associated with glucose metabolism has consequences for whole body glucose metabolism which could have implications for both research and clinical fields. We hypothesized that low dose CO inhalation would improve the glucose and insulin responses to ingestion of an oral glucose bolus in overweight humans.

METHODS: Eleven young adults (5 male, 6 female; body mass index: $25-35$ kg/m²) were included in this randomized, placebo-controlled, single blinded crossover study. Following screening, subjects completed two 7-day protocols, separated by at least 4 weeks. Prior to (24-hours) and following 5 consecutive days of either once daily CO (males: 1.2 mL kg⁻¹ body mass; females: 1.0 mL kg⁻¹ body mass) or placebo (room air) inhalation, subjects underwent two-hour oral glucose tolerance tests (OGTT).

RESULTS: Although blood glucose was on average 5 mg/dl lower post-intervention compared to pre-intervention ($p < 0.001$), there were no significant main effects or interactions across experimental conditions for any OGTT parameters (presented as overall average and [95% CI]), including fasting glucose (84.0 [78.8-89.2] mg/dL; intervention x pre/post interaction $p = 0.53$), two hour post glucose (96.9 [87.2-107.0] mg/dL; $p = 0.71$), fasting insulin (4.82 [2.63-7.00] μ U/mL; $p = 0.33$), the homeostatic model of insulin resistance (1.04 [0.53-1.55]; $p = 0.45$) or the Matsuda Index (17.3 [6.24-28.3]; $p = 0.60$). **CONCLUSION:** 5 days of low dose CO administration did not influence the glucose and insulin responses to an OGTT in overweight adults. Since low dose CO inhalation is used in the assessment of hemoglobin mass and other physiological parameters, these findings allow researchers to utilize these procedures without concern of altering glucose metabolism.

2237 Board #156 May 28 3:00 PM - 4:30 PM
Effects Of 12-weeks Of Post-meal Walking On Glycemic Control And Body Composition In Older Adults

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There is strong evidence that short bouts of light-intensity post-meal exercise are effective at lowering post-prandial and 24-h glucose concentrations in older people with impaired glucose tolerance (IGT). It is unknown, however, whether these transient benefits result in more enduring improvements in glycemic control after training.

Purpose: To determine the effects of a home-based, 12-week post-meal walking program on improvements in glucose metabolism, as well as on changes in body composition in overweight (BMI = 30 ± 1.8 kg/m²) older adults (N=6; 72 ± 5.3 years) with IGT. **Methods:** Participants performed three 15-minute bouts of low-intensity (3 METs) walking beginning 30 minutes after each meal on five days per week for 12 weeks. Glucose and insulin responses to an oral glucose tolerance test were determined 48 h after the last exercise bout before and after training. Changes in body composition were determined using iDXA. **Results:** Overall adherence to the total training program (180 post-meal walking bouts) was 65%; however, participants reported completing an average of 82% of the post-dinner walks across the 12 weeks. Total areas under the curve for both glucose [29.5 ± 9.3 vs. 29.5 ± 8.9 (mg·dL⁻¹)·3h·10³] and insulin [9.2 ± 5.4 vs. 9.0 ± 4.4 (mg·dL⁻¹)·3h·10³] responses did not change between baseline and follow-up; however, HbA1c levels (6.45% vs. 5.86%) and the Whole Body Insulin Sensitivity Index (4.5 ± 3.6 vs. 5.8 ± 8.7) showed promising improvements following training. There were no changes to body weight, body fat, or lean mass; however, visceral fat volume decreased (688.7 ± 311.4 vs. 584.3 ± 306.0 cm³), and four of the six participants reduced their visceral fat mass by over 37g. **Conclusions:** Data from this pilot study suggest that the benefits of regular, low-intensity post-meal walking on glycemic control may not last beyond 24h in older adults with IGT. On the other hand, if

performed consistently over time, the transient benefits may result in more enduring improvements in HbA1c and particularly in visceral fat mass. Supported by NIH/NIA R56 AG050661

D-66 Free Communication/Poster - Energy Availability in Athletes

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
Room: CC-Exhibit Hall

2238 Board #157 May 28 3:00 PM - 4:30 PM Examination Of Energy Needs Across 2-week High-Intense Functional Exercise Program In Recreational Athletes

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Increases in physical activity without proper nutritional knowledge may expose recreational athletes to compromised energy needs and macronutrient profiles. **Purpose:** To examine the energy needs across a 2-week high intense functional exercise program in female and male recreational athletes. **Methods:** Thirty adults (age: 31.2 ± 8.1; females: 164.7 ± 7.1 cm, 69.9 ± 11.1 kg; body fat%: 29.2 ± 5.5%; males: n=12, 176.9 ± 6.2 cm, 89.5 ± 15.1 kg, body fat%: 22.3 ± 8.8%) participated in a larger cross-sectional study. Participants completed a demographic survey, a 7 day online dietary and exercise log across 2 weeks. Measurements included; height, weight, and DXA scan (body fat%) at the beginning of the study. Exercise energy expenditure (EEE) was calculated using Ainsworth/Heyward equations, energy availability (EA) was calculated by EA = ((EI - EEE)/FFMkg¹) and energy balance (EB) was calculated by EB = (EI - TDEE = 0). Macronutrients (CHO, PRO, and fats) were assessed using ACSM recommendations (recs.). Low EA (LEA) was defined at >30 kcal/FFMkg¹ and EB was defined as negative, balanced, or positive, and Macros were defined as low, within or above recs. **Results:** Results yielded LEA (week 1: 73.3%, n = 22, week 2: 80% n=24) and negative EB (week 1: 94.4%, n=17; 75.0%, n=9) across the two weeks. No significant differences were found between gender or training weeks for energy needs and Macros. Over the 2 weeks, participants demonstrated similar energy needs including: EI (week 1: 1752.3 ± 599.8 kcals, week 2: 1831.2 ± 634.4 kcals), EEE (week 1: 310.7 ± 63.7 kcals, week 2: 302.7 ± 62.1 kcals), EA: (week 1: 25 ± 10.1 kcal/FFMkg¹, week 2: 25.1 ± 9.8 kcal/FFMkg¹), TDEE (week 1: 2518.5 ± 266.1 kcals, week 2: 2543.1 ± 286.1 kcals), and EB (week 1: -766.2 ± 627.4 kcals, week 2: -712 ± 652.3 kcals). Macronutrients were also similar between weeks; with PRO intake within recommendations (week 1: 50%, n=15; week 2: 63%, n=17, n=6), CHO intake was extremely low (week 1: 96.7%, n=29; week 2: 93.3%, n=28), and fats were within recs. (week 1: 62.1%, n=18; week 2: 46.7%, n=9). **Conclusion:** Participants demonstrated consistent EI and EEE habits over the 2 weeks, however, the recreational athletes under consumed CHO and presented at risk for LEA and negative EB. This leads to compromised fueling for the EEE utilized during training. Funded by Avadim Technology

2239 Board #158 May 28 3:00 PM - 4:30 PM BODY COMPOSITION AND ENERGY BALANCE CHANGES IN FEMALE RUGBY ATHLETES ACROSS ONE COMPETITIVE SEASON

Johnathan L. Boring, Jessica M. Moon, Anthony M. Hagele, Travis Russo, Kayla M. Ratliff, Blumkaitis C. Julia, Richard A. Stecker, Petey W. Mumford, Richmond Scott, Kyle L. Sunderland, Chad M. Kerksick, FACSM. Lindenwood University, Saint Charles, MO. (No relevant relationships reported)

Achieving and maintaining energy balance (EB) is a key nutritional goal for competing athletes. Recently published formulas have allowed for the estimation of EB using measured body composition values, but limited data is available in team sport athletes, particularly female rugby athletes. **PURPOSE:** To determine the changes in EB in female rugby athletes across an entire competitive season by assessing body composition using DEXA at three time points: pre-season, post-season and off-season. **METHODS:** Female rugby athletes (Mean ± SD; 18.5 ± 0.8 yrs, 166.8 ± 4.0 cm, 73.7 ± 9.73 kg, 28.9 ± 4.3 % fat, n=8) had three DEXA scans completed during pre-season (day 0-30), post-season (day 100 - 120), and off-season (day 300-365) for determination of fat mass (FM), fat-free mass (FFM), and percent body fat. Changes in FFM and FM between scans were assessed for changes across the season in addition to estimating EB (EB (kcal•d⁻¹) = 1.0 + 9.5). Data was analyzed using factorial ANOVA

with repeated measures on time with paired samples t-test being used for post-hoc comparisons. A p-value of 0.05 was used for statistical determinations. **RESULTS:** No statistically significant changes were noted for fat mass (p = 0.83), fat-free mass (p = 0.76), or percent body fat (p = 0.53) were observed across the competitive season (see Table 1). In addition, EB did not exhibit any changes (p = 0.77) across the season (EB = -9.96 ± 69.3 kcals/day). **CONCLUSIONS:** Over the measured time period, female rugby athletes were found to largely be in energy balance as no statistically significant changes were observed for body composition or EB. These data help to inform coaches and athletes about the anticipated energy needs within the sport of rugby.

Table 1: Body composition and energy balance in female rugby athletes.

	PRE	POST	OFF
DXA Fat Mass (kg)	20.6 ± 5.7	20.7 ± 4.7	20.2 ± 6.2
DXA Fat-Free Mass (kg)	47.5 ± 4.5	47.2 ± 4.1	47.5 ± 4.7
DXA % Fat	28.9 ± 4.3	29.3 ± 3.8	28.5 ± 4.4
	PRE vs. POST	POST vs. OFF	PRE vs. OFF
EB (kcal/day)	2.42 ± 153.1	-17.9 ± 83.8	-9.96 ± 69.3
Days between DXA scans	136 ± 4	242 ± 84	378 ± 6

2240 Board #159 May 28 3:00 PM - 4:30 PM Comparison Of Energy Expenditure Observed Between Scheduled Activities In Female Collegiate Basketball And Lacrosse Athletes

Jessica M. Moon¹, Hannah Zabriskie², Bre R. Zanders¹, Patrick S. Harty³, Brad S. Currier⁴, Richard A. Stecker¹, Petey W. Mumford¹, Andrew Jagim⁵, Chad M. Kerksick, FACSM¹. ¹Lindenwood University, St. Charles, MO. ²Towson University, Towson, MD. ³Texas Tech University, Lubbock, TX. ⁴McMaster University, Hamilton, ON, Canada. ⁵Mayo Clinic Health System, Onalaska, WI. (Sponsor: Chad Kerksick, FACSM) (No relevant relationships reported)

Specific energy needs of team-sport female athletes have been understudied, particularly with regard to scheduled daily activities. **PURPOSE:** To examine the difference between energy expenditure changes in NCAA Div II female basketball (BBALL) and lacrosse (LAX) athletes depending on scheduled team activities. **METHODS:** All athletes (BBALL: n=10; 19.8±1.3 yrs, 173.9±13.6 cm, 74.6±9.1 kg, 27.1±3.2 % fat; LAX: n=20; 20.4±1.8 yrs, 168.4±6.6 cm, 68.8±8.9 kg, 27.9±3% fat) were outfitted with heart rate and activity monitors during four consecutive days on five different occasions (20 days total) across their competitive seasons to assess differences in activity energy expenditure (AEE), total daily energy expenditure (TDEE) and physical activity level (PAL). Data collected was categorized by type of scheduled daily activities: Practice, Game, Conditioning or Off. All dependent variables were analyzed using a mixed factorial ANOVA with paired sample T-Tests as post-hocs when necessary. **RESULTS:** All results are outlined below in Table 1. Independent of day type, TDEE, AEE, and PAL levels were greater (p<0.05) in LAX athletes. Changes between day types for each sport were significantly different (p<0.05) for TDEE, AEE, and PAL. **CONCLUSION:** Calculated levels for TDEE, AEE, and PAL in female collegiate BBALL and LAX athletes were determined to all be different, irrespective of the scheduled daily activity. LAX athletes, regardless of scheduled activities, had greater TDEE, AEE, and PAL compared to BBALL athletes. Caloric expenditure in female collegiate athletes varies significantly depending on scheduled team activities with energy needs progressively increasing between Off, Conditioning, Practice, and Games. Table 1: TDEE, AEE, and PAL, in practice, game, conditioning, off, and combined days, in female collegiate BBALL and LAX athletes.

THURSDAY, MAY 28, 2020

Variable	Sport	Type of Day
Total Daily Energy Expenditure (kcal/day)	Basketball (n=10)	Practice: 3094 ± 250 ^{B,D}
		Game: 3564 ± 609 ^{A,D}
		Conditioning: 3079 ± 684 ^D
		Off: 2497 ± 281 ^{C,D}
		All Days: 3020 ± 620
	Lacrosse (n=20) [†]	Practice: 3717 ± 625 ^B
		Game: 4018 ± 591 ^A
		Conditioning: 3359 ± 652 ^{C,B}
		Off: 3140 ± 747 ^{A,D}
		All Days: 3559 ± 727
Activity Energy Expenditure (kcal/day)	Basketball (n=10)	Practice: 1179 ± 211 ^{B,D}
		Game: 1611 ± 489 ^{A,D}
		Conditioning: 1169 ± 549 ^D
		Off: 644 ± 270 ^{C,D}
		All Days: 1126 ± 525
	Lacrosse (n=20) [†]	Practice: 1824 ± 501 ^B
		Game: 2099 ± 553 ^A
		Conditioning: 1505 ± 522 ^C
		Off: 1298 ± 621 ^B
		All Days: 1681 ± 622
Physical Activity Levels (PAL)	Basketball (n=10)	Practice: 1.94 ± 0.18 ^{B,D}
		Game: 2.22 ± 0.32 ^{A,D}
		Conditioning: 1.92 ± 0.34 ^D
		Off: 1.56 ± 0.22 ^{C,D}
		All Days: 1.89 ± 0.36
	Lacrosse (n=20) [†]	Practice: 2.44 ± 0.35 ^B
		Game: 2.67 ± 0.44 ^A
		Conditioning: 2.21 ± 0.36 ^C
		Off: 2.14 ± 0.47 ^C
		All Days: 2.37 ± 0.45

[†]Significantly different between sports (p<0.05); Different letters denote statistical differences between days.

2241 Board #160 May 28 3:00 PM - 4:30 PM
Examination Of Low Energy Availability And Sleep In High-intensity Functional Exercise Program Athletes
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Low energy availability (LEA) affects the body's physiological systems, which can negatively affect an athlete's performance and recovery. Athletes that participate in high-intensity functional exercise may not have adequate dietary intake to match energy needs or obtain optimal amount of sleep to recover fully.

PURPOSE: To examine the low energy availability (LEA) and sleep among male and female recreational athletes who engage in high-intensity functional exercise programs. **METHODS:** Thirty adults (age: 31.2 ± 8.1; males: n = 12, 176.9 ± 6.2 cm, 89.5 ± 15.1 kg; females: 164.7 ± 7.1 cm, 69.9 ± 11.1 kg) participated in a larger cross-sectional study. Participants completed a demographic survey, Pittsburgh Sleep Quality Scale, a 7-day online dietary and exercise log. Participants were measured for height, weight,

DXA scan (BMD), and RMR through indirect calorimetry (MedGem). ANOVAs examined differences between gender and energy needs, and Chi-squared analysis examined differences between gender and risk for LEA and Poor Sleep. **RESULTS:** Significant differences were found between gender and RMR (males: 2296.7±400.3 kg; females: 1761.7±341.6 kg; P=0.001), EI (males: 2027.5±694.5 kg; females: 1568.9±461.1 kg; P=0.038) and EEE (males: 357.8±60.3 kg; females: 279.3±44.4 kg; P≤0.01). No significant differences were found between gender and LEA (males: 24.8.7±12.2 kg; females: 25.0±8.9 kg). Overall risk for LEA was 66.7% (n = 20); however independently LEA was 50% (n=6) for males and 77.8% (n=14) for females. Overall, 63.3% (n=19) recreational athletes report poor sleep. No significant differences were found across gender and poor sleep, independently poor sleep for males was 50% (n=6) and females 72.2% (n=13). No significant differences were found between gender, poor sleep, and LEA. Of those at risk for LEA (n=20), 60% (n=12) also had reported poor sleep. **CONCLUSIONS:** Recreational athletes were at risk for both LEA and poor sleep, with a majority at risk for both. A combination of LEA and poor sleep can lead to poor performance and recovery from high-intensity exercises. Therefore, education to recreational athletes on the importance of dietary intake to match energy needs and encouragement for positive sleeping habits is imperative to optimize physiological recovery.

2242 Board #161 May 28 3:00 PM - 4:30 PM
Effects Of Relative Energy Deficiency On Metabolism And Biomarkers In Korean Male Athletes

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2014 International Olympic Committee (IOC) consensus statement suggested the concept of 'Relative Energy Deficiency in Sport' (RED-S) presenting impaired physiological function caused by inadequate energy availability (EA) and it has been studying in many athletes. However, there are limited studies on Asian and male athletes.

PURPOSE: To investigate EA and its relationship with metabolic status, bone health, and endocrine changes which have been studied for RED-S consequences in Korean male collegiate soccer players during regular training season. **METHODS:** Twelve male athletes from the University soccer team in Korea participated in this study. The subjects completed subjective condition check form for one month and dietary record for energy intake (EI) with heart-rate monitoring for exercise energy expenditure (EEE) during one week. Body composition was measured using dual-energy x-ray absorptiometry (DXA) and physiological biomarkers were analyzed using blood and urine samples. Resting energy expenditure (REE) was measured using the Douglas bag method and predicted REE was calculated for REE_{ratio} (measured REE/predicted REE) to evaluate metabolic status. The subjects were categorized into two groups by EA level as having relative energy deficiency (RED; EA <30 kcal/kg FFM/d, n=5) or moderate energy status (MES; EA ≥30 kcal/kg FFM/d, n=7).

RESULT: Total mean EA was 31.9 ± 9.8 kcal/kg FFM/d and the RED group showed significantly lower EA (22.4 ± 2.9 vs 38.7 ± 6.6 kcal/kg FFM/d, p<0.05) with lower REE_{ratio} (0.96 ± 0.07 vs 1.09 ± 0.06, p<0.05) and REE/FFM (26.0 ± 1.7 vs 28.8 ± 1.4 kcal/kg/d, p<0.05) than the MES group. There was no difference in bone turnover markers. FSH was higher in the RED group (5.50 ± 1.01 vs 3.64 ± 1.41 mIU/mL, p<0.05) and IGF-1 was higher in the MES group (248.6 ± 51.2 vs 318.9 ± 43.4 ng/mL, p<0.05). The regression analysis showed that the athletes with lower EA were more likely to have the lower REE_{ratio} and IGF-1 levels.

CONCLUSION: Relative energy deficiency can result in lower metabolic status and IGF-1 levels, but there are no relations with bone health status and other endocrine status in Korean male collegiate soccer players.

2243 Board #162 May 28 3:00 PM - 4:30 PM
Energy Requirements And Intake Of Collegiate Athletes

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Nutrition is an important aspect of sport performance, yet many athletes are unaware of how many calories they should, or do, consume on a daily basis. Limited literature exists comparing perceived energy requirements with actual energy requirements based on body composition. **PURPOSE:** To determine student athletes' awareness of energy requirements based on their body composition and physical activity level. **METHODS:** Athletes (N=41; 20 male and 21 female) were recruited from 7 of the 11 existing sports at a NCAA Division II institution. Knowledge of daily energy

requirements, estimated caloric intake, and a subjective indicator of physical activity level were assessed. Body composition, resting metabolic rate (RMR), and energy requirements were assessed via displacement plethysmography (ADP) (Bod Pod). Comparisons of in-season and out of season perceived caloric needs, estimated caloric intake, and actual energy requirements were made using paired sample T-tests. **RESULTS:** For males, significant difference were found between estimated caloric intake during in-season and energy requirements, if very active (2745 ± 973 vs. 4339 ± 564), $t(20) = -6.21$, $p < .001$, and if active (2745 ± 973 vs. 3672 ± 395), $t(20) = -3.70$, $p = .002$, and estimated intake out of season and energy requirements if very active (2627 ± 917 vs. 4339 ± 564), $t(20) = -7.21$, $p < .001$, and if active (2627 ± 917 vs. 3672 ± 394), $t(20) = -4.51$, $p < .001$. Significant differences were also found between in-season perceived and estimated intake (3085 ± 698 vs. 2745 ± 973), $t(20) = 2.89$, $p = .009$. For females, significant differences were also found between estimated intake during in-season and energy requirements if very active (2376 ± 653 vs. 3184 ± 378), $t(21) = -4.32$, $p < .001$, and estimated intake out of season and energy requirements if very active (1971 ± 880 vs. 3184 ± 378), $t(21) = -5.42$, $p < .001$, and if active (1971 ± 880 vs. 2676 ± 318) $t(21) = -3.30$, $p = .004$. **CONCLUSIONS:** Student athletes have limited knowledge of caloric needs as they relate to energy requirements as active or very active athletes. If estimated caloric intake represents actual daily intake, student athletes are not consuming adequate calories to meet energy needs. A follow-up study, using a three-day diet record, is being conducted and will be added to present study for further analysis.

2244 Board #163 May 28 3:00 PM - 4:30 PM
Risk Factors For Relative Energy Deficiency In Sport In Costa Rican Female Runners

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Competing in weight sensitive sports increases the risk for low energy availability (EA) which is associated with health impairments. Most of the available evidence on syndromes that result from low energy availability is in female athletes. **PURPOSE:** To identify body composition, caloric intake, physical activity, and other risk factors for developing the syndrome of Relative Energy Deficiency in Sport (RED-S) in female runners. **METHODS:** 31 female recreational runners completed a sociodemographic and an adaptation to the RED-S CAT tool to evaluate 12 risks factors for RED-S, a 7-day weekly exercise record based on calories spent on training sessions using their heart rate monitor, a 3-day dietary record (two work days and one weekend day) completed with the app "My Fitness Pal" and a body composition evaluation by bioimpedance. Energy availability was calculated and classified as: No risk (≥ 45 kcal/kg LBM/day); Moderate risk ($30-45$ kcal/kg LBM/day); and At risk (≤ 30 kcal/kg LBM/day). **RESULTS:** Age of 33 ± 6.0 years with experience of 7 to 9 years. The average personal record in 10 kilometers was $40:24:48 \pm 2.0$ minutes. The average body mass was 53 ± 5.3 kg, $BMI = 20.9 \pm 1.6$ kg/m², a percentage of body fat = $26.4 \pm 3.7\%$ and lean body mass = 38.9 ± 3.1 kg. The average reported daily exercise caloric expenditure was 529.5 ± 176.4 kcal and daily caloric intake was 1679.5 ± 327.7 kcal. Results showed an EA of 1147.7 ± 343.3 kcal/day, or 29.6 ± 9.1 kcal/kg of LBM/day. Only 6% of the runners were classified as no risk, 42% as moderate risk and 52% as at risk. Other risk factors were history of interrupted menstrual cycles (42%), birth control pills (29%), non-nutritional technique to lose weight (22%), history of eating disorder (16%), stress fracture (10%), hormonal disorder (7%). There was a weak and non-significant correlation between EA and personal best ($r = -0.45$, $p = 0.811$). **CONCLUSION:** This group of Costa Rican runners demonstrate energy availability that is far below from the optimal and various risk factors to develop the syndrome of Relative Energy Deficiency in Sport.

2245 Board #164 May 28 3:00 PM - 4:30 PM
A Nutritional Intervention In Exercising Women With Oligo/Amenorrhea Improved Energy Availability

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Reduced energy availability (EA) suppresses reproduction and induces oligo/amenorrhea (O/A) in exercising women. Treatment goals are to increase energy intake (EI) to improve EA and restore menstrual function. **Purpose** Determine if a nutritional intervention that increased EI in exercising women with O/A improved EA and energetic status. **Methods** A 12 month randomized controlled trial designed to increase energy intake 20-30% above baseline energy needs in exercising women with O/A randomized participants into O/A+CAL (n=13) and Control (n=10) groups. EI and exercise energy expenditure (EEE) were assessed throughout the intervention. EA was calculated as EI-EEE/fat free mass (FFM). Fasting blood samples were collected to

assess TT₃ and leptin. Independent t-tests/Mann-Whitney U tests compared differences between groups and correlations were run between changes in energy and hormones. Data are mean \pm SE. **Results** Subjects were 22 ± 1 yr, BMI 20.0 ± 0.4 kg/m². Menstrual recovery was observed and previously reported. There were no pre intervention differences in EI (1837 ± 95 kcal/d), EEE (390 ± 40 kcal/d), FFM (41.5 ± 0.8 kg) or EA (37.2 ± 2.7 kcal/kg FFM/d) between groups. During the intervention there were greater absolute and percent increases in EI in O/A+CAL vs Control (448 ± 170 vs -117 ± 147 kcal/d, $p = 0.02$; 23.6 ± 8.6 vs $-4.6 \pm 8.4\%$, $p = 0.03$). There were no differences between groups in absolute or percent change for EEE (133 ± 46 kcal/d, $p = 0.07$; $38.8 \pm 11.3\%$, $p = 0.10$) or FFM (0.6 ± 0.3 kg, $p = 0.60$; $1.6 \pm 0.7\%$, $p = 0.51$). Absolute increase in EA was greater in O/A+CAL vs Control (10.8 ± 5.5 vs -6.0 ± 3.9 kcal/kg FFM/d, $p = 0.03$), but no difference in percent change (29.2 ± 13.4 vs $-6.7 \pm 12.5\%$; $p = 0.07$). Absolute and percent increase in fat mass (2.3 ± 0.3 vs 0.7 ± 0.5 , $p < 0.01$; 20.6 ± 3.1 vs $5.4 \pm 3.2\%$, $p < 0.01$) and body mass (3.2 ± 0.3 vs 0.8 ± 0.8 , $p < 0.01$; 6.1 ± 0.7 vs $1.5 \pm 1.3\%$, $p < 0.01$) were greater in O/A+CAL vs Control. O/A+CAL had larger absolute and percent increases in TT₃ (10.3 ± 5.0 vs -6.7 ± 5.3 ng/dL, $p = 0.03$; 17.2 ± 7.4 vs $-8.3 \pm 5.5\%$, $p = 0.02$) and percent increase in leptin (85.1 ± 24.0 vs $-13.3 \pm 18.0\%$) vs Control. Changes in EI and EA were not associated with changes in hormonal markers. **Conclusion** An intervention designed to improve EI can be considered an effective nutritional intervention for managing oligo/amenorrhea in exercising women.

2246 Board #165 May 28 3:00 PM - 4:30 PM
Body Composition And Energy Balance Changes In Collegiate Female Swimmers

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 (No relevant relationships reported)

Maintaining energy balance (EB) throughout training and competition should be a primary goal for competing athletes. Female athletes, in particular, may be prone to low energy availability which can reduce performance and negatively impact training adaptations observed. Regular determination of EB is challenging due to the need for accurate dietary intake and energy expenditure. However, recently published formulas have allowed for the estimation of energy balance using body composition derived computation, but comparisons across competitive seasons in various sports are limited. **PURPOSE:** To examine the changes in body composition and EB in collegiate female swimmers across an entire competitive season. **METHODS:** Thirteen female NCAA Division II swimmers (mean \pm SD: 19.5 ± 1.2 years; 68.9 ± 8.6 kg; 169.9 ± 8.8 cm) were evaluated annually at the beginning of two competitive seasons. Fat mass (FM), fat-free mass (FFM), and body fat percentage (BF%) were evaluated with dual-energy x-ray absorptiometry (DEXA) and changes in energy balance (EB) were calculated as $1.0(\Delta FFM/\Delta \text{time}) + 9.5(\Delta FM/\Delta \text{time})$. Data was analyzed using paired samples t-tests. A p-value of 0.05 was used for statistical determinations. **RESULTS:** Approximately 406 days separated each DEXA scan. Although body mass was not significantly affected (Year 1: 68.9 ± 8.9 kg vs. Year 2: 69.4 ± 8.2 kg, $p > 0.05$), a negative EB was observed (-67.0 ± 51.3 kcal·day⁻¹) across the season. Significant changes ($p < 0.001$) in FM (Year 1: 18.6 ± 5.0 kg vs. Year 2: 15.4 ± 5.1 kg), BF% (Year 1: $28.0 \pm 4.9\%$; Year 2: $23.4 \pm 5.7\%$), and FFM were observed across time (Year 1: 47.0 ± 5.3 kg vs. Year 2: 50.2 ± 4.8 kg). **CONCLUSION:** Assessments of changes in body composition and energy balance are important considerations for athletes and coaches regarding the health and performance of athletes. From Year 1 to Year 2, female swimmers were largely successful at maintaining their energy balance while significantly improving FM, FFM, and %BF. Body composition derived assessment of energy balance can be used to provide general indications of energy balance status in athletes across large periods of time.

2247 Board #166 May 28 3:00 PM - 4:30 PM
Examination Of Low Energy Availability (LEA) And Macronutrient Intake Among Beach Volleyball Players

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 (No relevant relationships reported)

Low energy availability (LEA) may be prevalent in female collegiate beach volleyball players, which can be a catalyst for negative health consequences. Athletes can present in a state of LEA as a result of inadequate intake of the recommended macronutrients; those being proteins (PRO), carbohydrates (CHO), and fats.

Purpose: Examine the prevalence of LEA and macronutrient intakes (PRO, CHO, and fats) among NCAA Division I female collegiate beach volleyball players.

Methods: Data from a larger cross-sectional study was used to examine recreational athletes (n=18; age: 19.8±1.4 years; height: 174.4±5.5 cm; weight: 63.2±5.1 kg). Athletes were moderately trained (exercised a minimum of 3-4 days/week). Data collection consisted of anthropometric data, surveys (e.g., demographics, age, gender, etc.), resting metabolic rate (RMR), a 7-day online dietary log to measure energy intake (EI), and exercise logs to measure exercise energy expenditure (EEE). Basic descriptive statistics, Chi-squares, and cross-tabulations were used to examine the proportion of participants classified as "at risk" for LEA (<30 kcal/kg/FFM) and the proportion that met the macronutrient recommendations.

Results: Overall, beach volleyball players demonstrated the following, with 94.4% (n=17) being identified as at risk for LEA: Average energy availability (EA): 12.4±9.6 kcal/kg FFM and average EEE: 1108.7±157.6 kcals. RMR recommendations for average minimal caloric intake for the sample was 1477.7±272.3 kcals; however, 55.6% (n=10) did not meet the recommendations. Recommended CHO and PRO macronutrient intake were not met by 100% and 61.1% of the sample, respectively. Overconsumption of fat compared to the recommendation was found in 33.3%.

Conclusions: Beach volleyball athletes in this sample were severely and alarmingly at risk for LEA. Most of the athletes demonstrated low CHO and PRO intake while overconsuming fat compared to the recommendations. These athletes would benefit from nutrition education focused on properly fueling and macronutrient intake, which are both essential for elite performance in the athletic arena.

2248 Board #167 May 28 3:00 PM - 4:30 PM
Body-composition Derived Energy Balance Changes Across An Entire Female Division II Basketball Season

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Limited data is available using body composition-derived metrics to establish energy balance (EB) in team-sport athletes, especially female athletes. Tracking EB is important for coaches and athletes to understand how well the energetic demands of training and competing are being met by the diet. **PURPOSE:** The purpose of this study was to determine and track changes in energy balance across an entire competitive season in female Division II basketball athletes. **METHODS:** Eight female NCAA Division II basketball athletes (mean ± SD: 19.3 ± 0.9 yrs.; 72.8 ± 7.7 kg; 176.0 ± 7.4 cm; 24.8 ± 3.2 % body fat) underwent three dual-energy x-ray absorptiometry (DXA) scans over approximately 12 months, separating the season into two phases (in-season, [IS, Week 1-24], offseason [OS, Week 24-49]) and combined to form a full season (FS, Week 1-49). Body composition derived energy balance (kcal·d⁻¹) was estimated from changes in fat free mass (FFM) and fat mass (FM) between scans using the formula: EB (kcal·d⁻¹) = 1.0 + 9.5 · Data was analyzed using factorial ANOVA with repeated measures on time. A p-value of 0.05 was used for statistical determinations. **RESULTS:** Across the FS, a positive EB of 87.4 ± 36.4 kcal·d⁻¹ was observed (P > 0.05), which tended to decrease across the entire season (p = 0.06). A net decrease in FFM (-0.52 ± 0.10 kg) and increase in FM (3.2 ± 0.5 kg) was observed. During IS, EB was greater (137.6 ± 29.1 kcal·d⁻¹) due to significant changes (p<0.05) in FM (2.7 ± 0.5) and FFM (-2.6 ± 0.4). During the OS, EB was 39.6 ± 81.0 kcal·d⁻¹, with an increase in mean FFM (2.0 ± 0.38 kg, P < 0.05) and FM (0.5 ± 0.5 kg, P > 0.05). **CONCLUSIONS:** Results from this study suggest that female collegiate basketball athletes were largely able to maintain energy balance across an entire season. A mean positive EB observed over the season which overlapped with negligible changes in FM and FFM suggest a suitable matching of energy intake and energy demands across the FS. This information is useful for athletic performance staff, who should be aware of EB when providing athletes with proper nutrition and fueling strategies, particularly during the IS period to maintain appropriate energy balance when travel, classes, and food access may complicate energy intake and also during OS when training goals should be achieved.

2249 Board #168 May 28 3:00 PM - 4:30 PM
Changes In Body Composition And Energy Balance In Collegiate Female Gymnasts Over Multiple Competitive Seasons

Travis Joseph William Russo, Anthony M. Hagele, Johnathan L. Boring, Petey Mumford, Julia Blumkaitis, Kayla M. Ratliff, Jessica M. Moon, Richard A. Stecker, Scott Richmond, Kyle Sunderland, Chad M. Kerksick, FACSM, *Lindenwood University, St. Charles, MO.* (Sponsor: Chad Kerksick, FACSM)
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The maintenance of energy status is an important dietary goal for competing athletes to properly fuel efforts, promote recovery, and prevent onset of illness or decrements in performance. Recent work in competing male athletes has reported on energy balance using body-composition derived parameters, but limited data is available highlighting changes in female athletes, and in particular female athletes who participate in physique sports. **PURPOSE:** To assess the changes in body composition and energy balance in female collegiate gymnasts over multiple competitive seasons. **METHODS:** 19 NCAA Division II collegiate female gymnasts (Mean ± SD; 18.4 ± 0.68 yr, 59.4 ± 4.5 kg, 160.9 ± 5.4 cm, 22.6 ± 2.2 % fat, 18.0±1.2 kg/m² fat free mass index) underwent dual-energy x-ray absorptiometry (DEXA) scans at the start of each season. Data was collected on all 19 subjects over three years with nine subjects being extended to a fourth year. Energy balance (EB) was calculated using a previously validated equation (EB= 1.0(Δ FFM/Δ Time) + 9.5(Δ FM/Δ Time) using fat free mass (FFM), time (days between scans) and fat mass (FM). A factorial ANOVA with repeated measures on time was conducted for changes in FFMI and Δ EB. Individual paired samples T-Tests were conducted when significance was found. **RESULTS:** Significant differences (p<0.05) between EB at year 1 (26.1 ± 46.7 kcals/day) and year 2 (-20.3 ± 57.9 kcals/day). Differences were also found (p<0.05) between years 2 (-20.3 ± 57.9 kcals/day) and year 3 (48.9±59.7) among the 9 subjects whose data extended to a fourth scan. No statistical significance was found (p > 0.05) between FFMI levels between year 1 (18.0 ± 1.2 kg/m²), year 2 (18.1 ± 0.8 kg/m²), and year 3 (18.3 ± 1.3 kg/m²). **CONCLUSION:** Changes in energy balance were largely stable in competitive female gymnasts across three years periods of time. Additionally and in concert, FFMI levels were also found to be stable across the measurement period. While statistically significant differences were present, the practical significance of these differences is not deemed to be relevant. Additional research is needed in all female athlete population to help identify and understand what dietary changes may be needed to best promote health, performance, and recovery.

2250 Board #169 May 28 3:00 PM - 4:30 PM
Examination Of Energy Availability And Hydration Status Among University Marching Band Artists

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Marching band (MB) members rehearse for pre-game and half-time performances outdoors for several hours a day starting at the end of July or beginning of August. There is lack of research on energy needs (e.g., energy availability) and proper hydration in MB during these hot months. **PURPOSE:** To examine energy availability and hydration status among MB members. A secondary purpose was to examine differences between sex. **METHODS:** We utilized data from a larger cross-sectional study. MB artists (n=37, Males: n=12, age: 19.8±1.4 years, height: 177.1±7.8 cm, weight: 74.6±23.8 kg; Females: n=25, age: 20.0±1.1 years, weight: 68.4±16.4 kg; height: 163.3±4.6 cm) from an NCAA Division I institution completed a survey (eg, basic demographics, band background, etc.) and were measured for height, weight, body composition, and resting metabolic rate (RMR). For 7-days, participants completed an online dietary log to measure energy intake (EI), wore a Polar m200 watch to estimate exercise energy expenditure (EEE) during rehearsals and gameday performances, and provided a morning urine sample to measure urine specific gravity (Usg). Low energy availability (LEA) was defined as <30 kcal/kg FFM/day and hypohydration was Usg >1.025. Basic descriptive statistics examined all energy needs and Usg. Chi square were used to identify proportions of members "at risk" for LEA and hypohydration and compared the differences across sex. **RESULTS:** Significant differences were found for EI for males and females respectively (2090.2±676.7 kcal, 1531.0± 460.8 kcals, P=.002). No significant differences were found for EEE and EA for males and females (335.5±66.0 kcal, 333.8± 66.9 kcals and 23.6±11.0 kcal/kg FFM, 22.9± 10.1 kcal/kg FFM). Overall, 73.7% (n=28) were at risk for LEA. No significant differences were found for Usg and sex (Males: 1.022±.006, Females: 1.022±.005), however 36.8% (n=14) reported chronically hypohydrated (≥ 4/7 days >1.025). Of those with LEA (n=28), 31.6% (n=12) also reported to be chronically

hypohydrated. **CONCLUSION:** The majority of MB members had LEA and over a third were also chronically hypohydrated. Due to performances in hot and humid environments, as well as the physical demands associated with MB, healthcare professionals should provide resources and education on hydration and proper fueling for MB artists.

2251 Board #170 May 28 3:00 PM - 4:30 PM
Abstract Withdrawn

2252 Board #171 May 28 3:00 PM - 4:30 PM
Evaluation Of The Assessment Of Energy Availability In The Field

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PURPOSE: The current study aimed to evaluate Sports Dietitian's methods of assessing energy availability (EA) in the field.

METHODS: Eligible participants were provided with a detailed web-based survey evaluating relevant elements of the assessment of EA among other related indicators. **RESULTS:** A total of 112 Sports Dietitians (n= 105, 93.8% female) participated. Over half (n= 62, 55.4%) were Board Certified Specialists in Sports Dietetics (CSSD), with a majority practicing in a collegiate (n= 41, 36.6%), private practice (n= 31, 27.7%), or professional team (n= 31, 27.7%) setting. While 67% (n= 75) reported measuring energy balance while assessing athletes, only 41% noted evaluating energy availability. A higher proportion of Sports RDs practicing ≥ 7 years compared to < 7 years acknowledged assessing EA (59.5% vs. 27.6%, $p = 0.001$, $X^2 = 10.3$). Sports RDs used a variety of methods to evaluate energy intake, including evaluation of "typical intake" during one-on-one session (n= 54, 48.2%), food log(s) (n= 30, 26.8%), 24-hour recall (n= 15, 13.4%), a combination (n= 5, 4.5%), or "other" method (n= 8, 7.1%), exercise energy expenditure, including activity factor estimates (n= 58, 51.8%), exercise logs (n= 32, 28.6%), a combination (n= 11, 9.8%), heart rate monitor (n= 6, 5.4%), or "other" methods, and body composition, including bioelectrical impedance analysis (n= 15, 13.4%), air displacement plethysmography (n= 15, 13.4%), dual energy x-ray absorptiometry (n= 14, 12.5%), and skinfold thickness (n= 11, 9.8%)

CONCLUSIONS: A majority of Sports Dietitians did not report regularly evaluating energy availability in their assessments of athletes. The variables used to calculate EA (i.e. EL, EEE, fat free mass) were evaluated using a variety of methods ranging in their level of potential error. Due to the potential difficulty and limitations of evaluating EA, development of a protocol for assessing EA may aid in increasing frequency and accuracy EA assessments in the field.

D-67 Exercise is Medicine®/Poster - EIM: Exercise and Cognitive Function, Psychological Conditions and Sleep

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
Room: CC-Exhibit Hall

2253 Board #172 May 28 2:00 PM - 3:30 PM
Number Of Inactive Adults With Arthritis Who Can Improve Their Anxiety And Depression By Exercising

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State-level estimates of the number of physically inactive adults with arthritis and other rheumatic and musculoskeletal diseases (RMDs) who can improve their anxiety and depression is currently unknown but important given that national data may not be appropriate for the conditions observed in each state. **PURPOSE:** Provide state-level estimates of the number of physically inactive adults in the United States with RMDs who could improve their anxiety and depression by exercising. **METHODS:** Utilizing (1) number-needed-to treat (NNT) data from two prior meta-analyses of randomized controlled trials addressing the effects of exercise on anxiety and depression in adults with RMDs, (2) recent age-adjusted, state-level prevalence estimates on arthritis and physical inactivity in adults with arthritis and other RMDs, and (3) state-level 2000 US Census population data, the number of physically inactive adults with RMDs who could improve their anxiety and depression by exercising was estimated. **RESULTS:** Across all states, the number of adults with RMDs who could improve their anxiety and depression by starting an exercise program was estimated at 2,622,907 for anxiety

and 2,245,962 for depression. For anxiety, numbers ranged from 3,583 (95% CI = 2,592 - 4,863) in the District of Columbia to 201,173 (95% CI = 156,923- 254,135) in Texas. For depression, numbers ranged from 3,068 (95% CI = 2,219 - 4,164) in the District of Columbia to 172,262 (95% CI = 134,37 - 217,613) in Texas. **CONCLUSIONS:** These findings provide important state-level information regarding the number of physically inactive adults in the United States with RMDs who could improve their anxiety and depression by exercising. This information should be useful to both interventionists and decision-makers.

2254 Board #173 May 28 2:00 PM - 3:30 PM
12 Weeks Of Maximal Strength Training Restores Muscle Force-generating Capacity In Patients With Schizophrenia

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Patients with schizophrenia spectrum disorders (ICD-10) suffer from impaired muscle force-generating capacity (MFGC) and functional performance of the lower extremities. **PURPOSE.** To investigate if 12 weeks of maximal strength training (MST) would restore MFGC and functional performance. **METHODS.** Forty-eight outpatients (28 men, 35±10 yrs; 20 women, 35±12 yrs) were randomized to a training group (TG) or control group (CG). Forty-eight age and gender matched healthy controls (28 men/20 women, 35±11 yrs) were tested to establish reference values. TG performed leg press MST (4x4 repetitions) 2d/week for 12 weeks at ~90% one repetition maximum (1RM). CG received two sessions of MST and encouragement to follow traditional physical activity guidelines. **RESULTS.** 17/24 patients in the TG (12 men/5 women, 34±11 years) completed 79% of training sessions and 19/22 patients in the CG (9 men/10 women, 37±12 years) completed the study. TG improved 1RM (28%, 12.6±4.1 to 16.2±5.0 Kg·m^{-0.67}, $p < 0.01$) and rapid force development (20%, 18.6±8.6 to 22.4±10.8 N·m·s⁻¹·m^{-0.67}, $p < 0.01$), reaching 106% and 85% of healthy reference values, respectively. TG improvements differed from CG ($p < 0.01$) where no changes occurred (1RM; 11.4±3.0 to 12.0±2.7 Kg·m^{-0.67}, rapid force development 16.4±6.9 to 17.3±6.5 N·m·s⁻¹·m^{-0.67}). Both TG and CG improved 30-second sit-to-stand test (30sSTS) performance (15±3 to 17±4 stands and 13±3 to 14±3 stands, respectively, $p < 0.05$). Changes were not apparent as between group difference nor close the gap to reference levels (27±5 stands). **CONCLUSION.** MST restored the patients' lower extremity MFGC and improved 30sSTS performance. Supported by grants from the Norwegian ExtraFoundation for Health and Rehabilitation, The Liaison Committee between the Central Norway Regional Health Authority and the Norwegian University of Science and Technology, and The Norwegian Directorate of Health.

2255 Board #174 May 28 2:00 PM - 3:30 PM
Exercise Is Medicine For Mental Illness: Insights From Mental Health Professionals

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PURPOSE: Serious mental illness (SMI) is a major public health concern linked with adverse outcomes (premature mortality, cardiovascular disease, obesity).^{1,2} Physical activity (PA) has effectively reduced health risks,^{3,6} yet challenges exist for effective PA treatment delivery and sustainability in SMI populations.^{7,8} Certified peer specialists (CPSs), trained persons with lived recovery experience working in mental health settings, offer a potentially sustainable and reimbursable delivery mechanism for Exercise Is Medicine (EIM) PA interventions.⁹ This study examined CPSs' insights on the feasibility and acceptability of an EIM intervention in adults with SMI delivered in peer group settings. **METHODS:** Qualitative data were collected Spring/Summer 2018 through 4 focus groups of 3-6 people per group. CPSs were recruited through two behavioral health facilities in Kansas (n=11) and Georgia (n= 8). Semi-structured focus group guides elicited information regarding knowledge of PA, current PA with SMI peers, role of the CPS to promote PA, and feasibility of administering a PA intervention. Audio files were transcribed verbatim and analyzed with NVivo11 using qualitative content analysis with an inductive approach.^{10,11} **RESULTS:** Focus groups averaged 49±8 minutes. Data were coded into four themes: knowledge of PA, current PA with SMI peers, role of the CPS to promote PA, and PA intervention administration. CPSs stated their knowledge of PA is general and mostly comes from personal experience or internet searches. CPSs agreed their role covers Whole Health Action Management principles including promoting and participating in PA with SMI peers. CPSs were eager to participate in a PA intervention and willing to complete PA

training or certification. PA intervention administration included input on PA duration, frequency location, time of day, resources needed, motivators (e.g., buddy systems, competitions, rewards) and overcoming common SMI barriers (e.g., transportation). **CONCLUSIONS:** CPSS were willing to facilitate EIM interventions and offered valuable insights on current practices, program feasibility and administration. Findings will aid development of a PA intervention delivered through mental health services to address low rates of PA and reduce health disparities in adults with SMI.

2256 Board #175 May 28 2:00 PM - 3:30 PM
Effects Of Taichi-qigong Exercise On Mental Health Of Nasopharyngeal Carcinoma Survivors

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The incidence of nasopharyngeal carcinoma (NPC) is high in endemic areas. The long-term chemotherapy and radiotherapy cause bodily dysfunction and extended psychological stress in NPC cancer survivors. The meditative exercise, especially Taichi-Qigong exercise (TQE), are getting more common and continues to grow among cancer survivors. Empirical evidence found positive effects in improving side effects induced by cancer therapy from practicing TQE, however, scientific evidence is still lacking. **PURPOSE:** to evaluate the effects of a 10-weeks TQE, as a non-pharmacological treatment, on mental health of NPC survivors. **METHODS:** 43 NPC survivors (age 32-79 yrs-old; men 45.5%) recruited from the Cancer Patient Resource Centers of a local hospital, were randomly assigned into either a TQE (n=23) or a control group (n=20). The TQE group practiced TQE for at least 3 times a week (one 60-min instructor-led session and two 30-min self-practice sessions) for 10 weeks, whereas control group maintained usual care. Both TQE and control groups received health & diet education once a month. The pre- and post-outcome measures included: questionnaires on cancer-related quality of life (FACT-G), cancer-related fatigue (Brief Fatigue Inventory; BFI), depression (Center for Epidemiologic Studies Depression Scale; CES-D) and sleep quality (Pittsburgh Sleep Quality Index; PSQ). Same measures were obtained 3-months after the intervention (maintenance tests). **RESULTS:** Two-way (group x pre-post) repeated measure ANCOVA with age, gender, and body mass index (BMI) as covariates, found TQE exhibited significant better overall quality of life (FACT-G) ($p \leq .05$), and emotional sub-scale of FACT ($p < .10$). The benefits did not change at maintenance ($p > .05$). The TQE group also demonstrated improved PSQ after intervention ($p < .10$). There were no group difference in BFI and CES-D. ($p > .05$) **CONCLUSIONS:** The present study provides preliminary findings to suggest that, Taichi-Qigong exercise, as a typical mind-body exercise, may contribute to better quality of life, emotion, and sleep quality during the course of NPC rehabilitation. Further study with longer intervention is needed to examine the effects of TQE on other mental health outcomes of cancer survivors such as fatigue and depression, as well as physical health outcomes.

2257 Board #176 May 28 2:00 PM - 3:30 PM
Common Experiences And Beliefs Among Highly Active, Older Adults: Implications For Psychological Satisfaction And Frustration

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PURPOSE: The prevalence of physical inactivity (PA) has remained largely unchanged in the USA, despite extensive informational campaigns calling for individuals to participate in more PA. Self Determination Theory (SDT) provides a well-researched framework for understanding motivation, and proposes that the satisfaction of three primary psychological needs (autonomy, competence, and relatedness) fuels motivation for physical activity and promotes wellness. This mixed-methods study used SDT to identify experiences and beliefs that affect individual motivation for physical activity in older adults. **METHODS:** The International Physical Activity Questionnaire was used to establish a moderate-high level of PA for all participants (3 males, 2 females; age range: 58-78). The Basic Psychological Needs Satisfaction and Frustration Scale (BPNSFS), and Motives for Physical Activities Measure Revised (MPAM-R) were used along with semi-structured interviews to elucidate the experiences and beliefs of the participants A Wilcoxon signed rank test was used to evaluate BPNSFS data for psychological satisfaction/frustration with the alpha-value set at 0.05. Researchers independently coded interview responses for motivational type (Competence, Social, Interest/Enjoyment, Fitness, Appearance) as well as statements of satisfaction and frustration. MPAM-R data identified motivational priorities and were compared with coding results to establish consistency.

RESULTS: Participants' scores indicated greater life satisfaction than frustration ($p = 0.042$) for each of the three basic psychological needs. Qualitative analysis confirmed predominance of psychological satisfaction, as well as motivation driven by a need for competence, interest, and relatedness. Fitness was the highest scoring motivational construct on the MPAM-R, but was not frequently cited as motivational during the interviews. **CONCLUSIONS:** Active older adults showed greater satisfaction than frustration with the basic psychological needs, suggesting a potential association with moderate-high levels of PA. Motivational factors influencing PA varied among participants, but they shared many common beliefs (e.g., high value of PA and fitness) and experiences (e.g., free play as children).

2258 Board #177 May 28 2:00 PM - 3:30 PM
Trainuvimab: Impact Of High-intensity Exercise On Cognition In Multiple Sclerosis - Interim And Subgroup Analysis

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Cognitive impairment is a common symptom of Multiple Sclerosis that directly impacts patients' quality of life. Yet, evidence of treatments is mixed. Exercise reveals high potential as a supportive non-pharmacological therapy.

PURPOSE: To investigate the effects of a three-week high-intensity interval training (HIIT) on processing speed, verbal and visual-spatial memory in cognitive impaired persons with MS (pwMS).

METHODS: 66 persons with relapsing-remitting (RR) or secondary-progressive (SP) MS were randomly assigned to an intervention (HIIT: 5x 1.5min intervals at 95-100% HF_{max}, 3x/week) or an active control group (CG: 24min continuous exercise at 65% HF_{max}, 3x/week). For subgroup analysis participants with cognitive impairment were identified (deviation of ≤ 1.5 SD from normative test data from at least one test). Cognitive performance was assessed pre and post to the intervention period with the Brief International Cognitive Assessment for Multiple Sclerosis (BICAMS). Potential within (pre vs. post) - and between -subject (group, MS-type) effects and their interactions were investigated by analysis of variance (ANOVA) with repeated measures. Post-hoc tests (Bonferroni) were conducted for significant main effects of within or between-subjects.

RESULTS: 28 pwMS were identified as cognitively impaired. ANOVA revealed no significant interactions for any outcome and showed no significant main effects for visual-spatial memory. Significant main effects (factor time) were observed for processing speed ($F(1, 24)=15.65, p=.001$) and verbal memory ($F(1, 24)=4.85, p=.037$). In the HIIT-group participants with RRMS significantly improved processing speed over time (MD: -4.67, 95%-CI [34.41, 43.81], $p=.023$), whereas no changes ($p=.051$) were shown for participants with SPMS. No improvements were observed for the CG. Pairwise comparisons revealed no significant changes for verbal memory.

CONCLUSION: Compared to the CG, HIIT shows stronger impact on processing speed for RRMS. SPMS-type showed no changes. However, results should be interpreted cautiously, as the data set reveals no significant main effects for group and MS-phenotypes.

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2259 Board #178 May 28 2:00 PM - 3:30 PM
Effect Of A Multicomponent Exercise Program On Functional Capacity And Cognitive Function In Frail Community Elders With Cognitive Decline

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PURPOSE: Both frailty and mild cognitive impairment are prevalent issues among the geriatric population but have traditionally been evaluated on separate terms. Given the growing evidence that these two conditions might share a biological substrate, interventions aiming to improve physical function might as well induce benefits on cognitive function. The main objective was to test the effect of a multicomponent

exercise program (VIVIFRIL) on both domains in frail and pre-frail patients (according to Fried criteria) with evidence of mild cognitive impairment or mild dementia (Reisberg GDS 3 and 4).

METHODS: We performed a preliminary analysis of 96 recruited patients (mean age 83±5) from three Spanish hospitals (San Sebastian, Pamplona and Getafe). Subjects were randomized to a control or an intervention group, the last one undergoing a 12-week multicomponent exercise program (VIVIFRIL). Changes in functional capacity were evaluated through Short Physical Performance Battery (SPPB), one leg press repetition maximum strength (1-RM) and Barthel index, and those in cognitive function with the Montreal Cognitive Assessment test (MOCA), verbal fluency and the Mini Mental State Examination (MMSE).

RESULTS: Significant improvement was found in the following variables: SPPB improved in 1.14 points (p=0.002), 1-RM improved in 12 points (p=0.035), MOCA test improved in 3.32 points (p=0.033) and verbal fluency improved in 2 points (p=0.028) in the intervention group versus the control group.

CONCLUSIONS: A multicomponent exercise intervention program using the VIVIFRIL methodology improves both functional capacity and cognitive function in frail and prefrail elderly patients who exhibit mild cognitive impairment and mild dementia.

2260 Board #179 May 28 2:00 PM - 3:30 PM
Exercise Is Associated With Decreased Fracture Odds In Young Adults With Attention Deficit Hyperactivity Disorder

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Young adults with Attention Deficit Hyperactivity Disorder (ADHD) have higher fracture rates than healthy adults. While exercise is recommended for people with ADHD to alleviate hyperactivity-impulsivity, little is known about the relationship between exercise and fracture in this population. **PURPOSE:** To explore the association between exercise and fractures in young adults with ADHD, not using medication. **METHODS:** We performed a retrospective analysis of data of young adults with ADHD treated at the University of Alabama at Birmingham Health Systems. We selected a case if an individual was previously diagnosed with ADHD using ICD-10 code F90 and ages between 21 and 35 years. The comparison group were individuals with ADHD and have not had a fracture within the same age limits. The outcome variable was whether a patient with ADHD diagnosed with a fracture or not during this period. Exercise files included data about exercise status (i.e., yes or no), frequency (i.e., low, moderate, or high), and type (i.e., aerobics or non-aerobics). Exercise assessment was within the year before the fracture date for fracture group and within the year before data acquisition for the non-fracture group. We ran a multivariable logistic regression analysis to test the association between fractures and 1) exercise status, 2) exercise frequency, and 3) exercise type, controlling for sex. We analyzed the data using STATA SE 15.1. **RESULTS:** Our analyses included 296 persons with a mean age of 27.29 ± 4.17 years for the comparison group and 28.0 ± 3.58 years for the fracture group. The mean age of fracture in the fracture group was 25.09 ± 3.45. Also, the logistic regression that was controlled for sex, showed that individuals who exercised had significantly lower odds of having a fracture compare to those that reported no exercise [OR: 0.14, 95% CI: 0.08, 0.27]. Of those, females compared to males, were also significantly associated with sustaining fewer fractures, controlling for exercise status [OR: 2.86, 95% CI: 1.53, 5.35]. Finally, exercise frequency and exercise type were not significantly associated with fracture risk. **CONCLUSIONS:** Engaging in exercise might decrease the odds of sustaining a fracture in young adults with ADHD. Exercise needs to be studied more in young adults with ADHD to determine how exercise may protect against fractures.

2261 Board #180 May 28 2:00 PM - 3:30 PM
Physical Activity Is Critical To Preserve Cognitive Function In Nephrology Patients

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Chronic kidney disease (CKD) associates with earlier onset of cognitive impairment. Physical activity (PA) improves neuronal plasticity and cognitive function among older adults. However, limited data exist exploring the effect of PA on cognitive function in CKD patients. **PURPOSE:** To investigate the effect of regular physical activity on cognitive function in CKD patients. **METHODS:** We analyzed 68 patients with CKD admitted to a Midwestern hospital between January 2017 and

July 2018. All subjects provided a health history, had a comprehensive metabolic panel with estimated glomerular filtration rate (eGFR), and reported whether they engaged in regular physical activity (PA). Cognitive impairments, including dementia, Alzheimer's, and Parkinson's disease were documented. Independent-samples t-tests and chi-squared tests compared patient profiles between sedentary and active patients. Logistic regression analyses tested the effect of PA on cognitive impairments holding constant other significant predictors. **RESULTS:** Patients were 64.7 ± 17.4 years old, had an eGFR of 24.7 ± 13.8 mL/min, 66.2% were sedentary, and 25.0% had a cognitive impairment. Older subjects were more likely to have a diagnosis of cognitive impairment (p=0.051) and the prevalence was higher in sedentary patients (33.3%) than in those who were physically active (8.7%; p=0.026). Holding constant the age of the patient and the stage of CKD, engagement in PA shared a trending association with mental impairment (p=0.056), predicting a 79.8% reduction in the likelihood of diagnosis (Pseudo R² = 0.187; 95% CI of OR: 0.039 to 1.040). Similarly, controlling for eGFR rather than CKD stage, the significance of PA as a predictor remained stable (p=0.057; 95% CI of OR: 0.039 to 1.052). **CONCLUSIONS:** Patients with CKD experience a higher risk of cognitive impairment than age-matched controls. In our sample, engagement in regular physical activity demonstrated a protective effect, and sedentary behavior influenced diagnosis more than age.

2262 Board #181 May 28 2:00 PM - 3:30 PM
Exercise And Geriatric Depression: A Scoping Review Of The Research Evidence

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Geriatric depression is a common late-life mental health disorder that increases morbidity and mortality. It has been shown that exercise is effective in alleviating symptoms of geriatric depression. However, inconsistencies across studies and lack of optimal dose-response of exercise for improving geriatric depression have made it challenging to draw solid conclusions on the effectiveness of exercise in late-life depression. **Purpose:** To further investigate the moderators of the effectiveness of exercise on geriatric depression across the current body of evidence. **Methods:** Based on the Arksey and O'Malley framework, an extensive search strategy was performed by exploring PubMed, Scopus, Sport Discus, PsycInfo, ERIC, and IBSS without limitations in the time frame. Eight systematic reviews with empirical results and evaluated the effect of exercise on depression among people aged 60 years and older were identified, and their individual studies were screened for inclusion. One additional study was found through the hand searching of reference lists. After full-text screening and applying inclusion and exclusion criteria, 21 studies were retained. **Results:** The review revealed high variability in characteristics of the exercise interventions and outcome measures. Sample characteristics, nature of comparators, main outcome assessment, and baseline severity of depression also varied notably. Mind-body and aerobic exercises were found to significantly reduce geriatric depression. However, results on the relationship between resistance training and improvements in geriatric depression were inconsistent, and results of the intensity-related antidepressant effects of exercise interventions were mixed. Extensive use of self-reported questionnaires for the main outcome assessment and lack of evidence on the relationship between depression severity and observed effect were of the other important highlights of the review. **Conclusion:** Several literature gaps were found regarding the potential effect modifiers of exercise and geriatric depression. While acknowledging the complexity of establishing recommendations on the exercise variables and geriatric depression, future studies are required to understand the threshold effect of exercise for treating geriatric depression.

2263 Board #182 May 28 2:00 PM - 3:30 PM
Effect Of 1 Year Of Qigong Exercise On Cognitive Function Among Older Chinese Adults

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Objectives. To compare the effectiveness of a tailored qigong exercise versus stretching and toning exercises in the maintenance of cognitive abilities in Chinese elders at risk of cognitive decline. **Design.** A 1-year, single-blind, cluster randomized controlled trial. **Method.** Seventy-four older Chinese adults with risk of cognitive decline were enrolled in the study. They were cluster randomized to the qigong group and to the stretching and toning control exercise group. Cognitive and functional performance were assessed at baseline and at 1 year as measured using the Chinese version of Montreal Cognitive Assessment-Basic (MoCA) test and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). **Results.** At 1 year, 25 of 33 participants (75.8%) in the qigong group and 26 of 33 participants (78.8%) in the control group completed the exercise intervention. A bivariate correlation test indicated a good correlation between the MoCA test score and the

RBANS total score after the intervention ($r = 0.517, p < 0.01$). Generalized estimating equations revealed that those in the qigong group had lower risk of progression of cognitive decline at 1 year (odds ratio, 0.314; 95% confidence interval, 0.103-0.961; $p = 0.04$). Two-way repeated-measures analyses of variance followed by post hoc t -tests with Bonferroni corrections indicated that performances on the MoCA test and the RBANS were significantly better in the qigong group than in the control group for the MoCA score ($p < 0.01$) and the RBANS cognitive domains of global cognition ($p < 0.01$), memory ($p < 0.01$), visuospatial/construction ($p < 0.01$), and language ($p < 0.01$) abilities, but not for attention ($p > 0.05$). **Conclusions.** Performance of qigong for 1 year was significantly superior to stretching and toning exercises not only for preventing progression of cognitive decline but also for improving several cognitive functions among older Chinese adults at risk of cognitive decline.

2264 Board #183 May 28 2:00 PM - 3:30 PM
A 6-week Aquatic Exercise Improve Accelerometer-measured Sleep Efficiency Among Adults With Chronic Musculoskeletal Pain

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To investigate the effect of a 6-week moderate-intensity aquatic exercise program on sleep efficiency, sleep quality, pain, stress and physical activity among adults. **METHODS:** A quasi-experimental trial was conducted with a sample of 30 adults with chronic musculoskeletal pain, assigned to two groups (Intervention Group and Control Group). Subjects were recruited by convenience sampling through a community physiotherapy Centre in Hong Kong. Subjects allocated to the intervention group followed a structured, 6-week, bi-weekly, 60-minute aquatic exercise program. The 12 sessions were supervised by a qualified aquatic fitness instructor in a 20x10m pool with water temperature controlled. Six exercises were performed in each session with one old exercise replaced by a new one in each session. During the session, heart rate and RPE were monitored. Control Group was reminded to not change their exercise habits or medication regimen. Data regarding sleep efficiency by ActiGraph, sleep quality by Chinese version of the Pittsburgh Sleep Quality Index (CPSQI), pain by numeric pain rating scale were collected before and after the 6-week aquatic exercise program. Data were analyzed with SPSS 25 and a p -value less than 0.05 indicated statistical significance of results. **RESULTS:** No statistically significant differences on all demographic data and outcome measures between intervention and control group in the baseline measurement, except there was significantly higher average BMI ($p \leq 0.05$) and fewer total true sleep hours ($p \leq 0.001$) in intervention group. Significantly longer total true sleep time (27 minutes, $p \leq 0.01$), greater sleep efficiency (3% improvement, $p \leq 0.01$), less pain ($p \leq 0.05$) and better sleep quality ($p \leq 0.05$) were found in intervention group. Significant group-time interaction found only in total true sleep time ($p \leq 0.001$). **CONCLUSION:** Aquatic exercise has been proven effective in improving sleep. From the within-group pre-post result, it shows that there is a statistically significant improvement in term of sleep efficiency and reduction of pain. This study helps to extend the work by studying the effect of aquatic-based exercise on adults with chronic musculoskeletal pain.

2265 Board #184 May 28 2:00 PM - 3:30 PM
Meta-analysis Of Ba Duanjin In The Treatment Of Insomnia

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Meta-analysis of Ba Duanjin in the treatment of insomnia
 Abstract:

Objective: Insomnia is the most common diseases. Long-term insomnia can seriously affect normal life , even lead to a serious accident. Ba Duan Jin is a traditional Chinese exercise, which can regulate meridians qi -blood-body fluid, and improve the quality of sleep. This article comprehensively evaluates the effect of Ba Duan Jin on insomnia by meta-analysis.

Methods: Searching Wanfang platform, VIP consulting platform , CNKI, Pubmed and Springer on Ba Duanjin in the treatment of insomnia Randomized controlled trial (RCT) . Meta-analysis was performed using revman5.3 software. The main indicators were the number of recovered patients ,effective patients and invalid patients, the Pittsburgh sleep quality score (PSQI).

Results: A total of 98 articles were retrieved by searching in computer . Excluding the literature which is repeated or with incomplete date , the final including was 9 RCT.A total of 789 patients were included in the analysis. Meta-analysis showed that the number of patients with recovery was higher in the experimental group than in the control group. [OR=3.14, 95% CI (2.18, 4.52), $p < 0.00001$], and the number of invalid

patients was lower. [OR=0.19 , 95% CI (0, 12, 0.31), $p < 0.00001$], the difference was statistically significant. There was no statistical difference between the effective groups. PSQI were not statistically different due to excessive heterogeneity. **Conclusion:** This meta-analysis showed that in the treatment of insomnia, the clinical efficacy of the group with Ba Duan Jin intervened was better than the group with the conventional drug, and the difference was statistically significant.

D-68 Free Communication/Poster - Cognition and Emotions

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
 Room: CC-Exhibit Hall

2266 Board #185 May 28 2:00 PM - 3:30 PM
The Effect Of Brief Mindfulness Intervention As Adjuvant Of Fluid Intake On Athletes' Cognitive Function

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PURPOSE: The present study investigated the effect of combined fluid intake and brief mindfulness intervention (MBI) in a simulative half-time break of soccer competition on athletes' cognitive function.

METHODS: In a 3 (treatments) \times 2 (times) double-blinded cross-over design, fourteen male athletes (age: 24.3 \pm 3.7 yr, height: 173.8 \pm 4.5 cm, weight: 68.3 \pm 5.1 kg, VO_{2max} : 47.0 \pm 4.4 ml/kg/min) received three treatments (Control: non-carbohydrate (CHO) electrolyte solution + traveling introduction audio; CHO: CHO-electrolyte solution + travelling introduction audio; and CHO_M: CHO-electrolyte solution + MBI) in a simulative half-time break. Cognitive function performance (assessed by Stroop Test, Corsi Block Test, Rapid Visual Information processing task (RVIP)), mindfulness level, blood glucose and lactic, rating of perceived exertion was tested at different time points during the trial.

RESULTS: Major findings include: (1) CHO_M trial obtained a better score in post Stroop colour test when compared with Control trial (CHO_M vs. Control: 17813.87 \pm 3706.98 vs. 22990.43 \pm 6665.36; $p = .04$); (2) a significant interactive effect was observed on the performance of Corsi block test ($p = .03$). Specifically, the reaction time decreased from pre-trial to post-trial in CHO_M and Control trials (pre vs. post: 826.88 \pm 384.67 vs. 667.49 \pm 331.56 ms, $p < .01$ for CHO_M; pre vs. post: 1085.43 \pm 388.51 vs. 798.36 \pm 253.28 ms; $p < .01$ for Control), but not in CHO trial (pre vs. post: 832.68 \pm 296.37 vs. 810.11 \pm 347.70 ms, $p = .66$); (3) CHO trial spent less time on missing numbers in post RVIP test than the other two trials (Control vs. CHO vs. CHO_M: 5939.57 \pm 2100.27 vs. 3316.79 \pm 2716.73 vs. 6201.43 \pm 4013.58 ms; $p = .03$), given that their performance in pre-test were statistically the same ($p = .13$).

CONCLUSIONS: In conclusion, a positive effect of the combined fluid intake and brief MBI on athlete's cognitive function was revealed, while both positive and negative effect was revealed for fluid intake only.

2267 Board #186 May 28 2:00 PM - 3:30 PM
Preschoolers Demonstrate Similar Learning And Enhanced On-task Behavior Following Physically-active Lessons On Emerging Numeracy Skills

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Previous studies demonstrate variable effects of physically-active instruction on academic achievement and classroom behavior. The utility of such approaches to train the approximate number system—a foundational construct underlying later mathematics achievement—in preschoolers remains unclear.

PURPOSE: To determine the acute effects of physically-active lessons on acuity of the approximate number system and on-task behavior in preschoolers.

METHODS: Using a randomized within-participants repeated-measures crossover design, children ($N = 51$; 3-5 y) completed a computerized approximate number system task before and after engaging in either 20-min of either physically-active or conventional sedentary instruction during two separate, counterbalanced sessions. The conventional sedentary lessons consisted of activities previously shown to strengthen approximate number representations (i.e., number line estimation, counting, and magnitude estimation) at an intensity of approximately 12% heart rate reserve whereas the physically-active lessons consisted of comparable activities integrated with

movement corresponding to 30% heart rate reserve. Separate univariate multi-level models were constructed. Difference in pedometer step count between conditions was analyzed using independent t-test.

RESULTS: Although no significant differences were observed in behavioral task performance at posttest between conditions, $F_s(2,49) \leq 1.0, p_s \geq 0.434, f^2_s < 0.02$ [95% CI: 0 to 0.08], fewer experimenter redirections were required following the physically-active lessons (2.5 ± 2.8) relative to following the conventional sedentary lessons (5.0 ± 3.6), $F(1, 49) = 20.7, p < 0.001, f^2 = 0.61$ [95% CI: 0.24 to 1.29]. On average, children accrued 931.3 ± 8.2 more steps during the physically-active lessons relative to the sedentary lessons, $t(95) = 19.1, p < .001, d_s = 3.91$ [95% CI: 3.19 to 4.55].

CONCLUSION: Physically-active lessons on emerging numeracy skills do not impede training of the approximate number system and result in greater on-task behavior relative to conventional sedentary lessons in preschoolers. Future studies should explore the integration of such approaches into early childhood education.

Funding: Supported by funds from the Department of Kinesiology at Michigan State University.

2268 Board #187 May 28 2:00 PM - 3:30 PM
History Of Heading In Soccer Impairs Cognition But Not Cerebral Perfusion In Young Amateur Players

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Heading the ball in soccer has been linked to impaired cognition and may increase the risk of neurodegenerative disease. This may be explained by an accelerated decline in cerebral perfusion, a major risk factor for cognitive impairment, stroke and dementia, for reasons that remain unclear.

Purpose To determine if a history of recurrent heading of a football predisposes to cerebral hypoperfusion and cognitive impairment.

Methods Twenty-nine amateur male soccer players (age: 28 ± 6 yrs) with a playing history of 15 ± 6 yrs and a self-reported heading frequency of 9 ± 4 balls per game were recruited for the study. They were compared to 32 age and fitness-matched controls who had not participated in contact sports with no history of concussion. All participants completed a battery of psychometric tests that assessed learning and memory (Rey-Auditory Verbal Learning Test), working memory (Repetition of Digits Backwards; Trail Making Test B) and attention and information processing (Repetition of Digits Forwards; Trail Making Test A; Digit Symbol Substitution Test). A sample of the soccer players ($n = 13$) and controls ($n = 22$) also completed a cerebrovascular screening whereby middle cerebral artery velocity (MCAv) and mean arterial blood pressure (MAP) were assessed using transcranial Doppler ultrasound and finger photoplethysmography, respectively. Cerebrovascular conductance/resistance were calculated as MCAv/MAP and MAP/MCAv.

Results Soccer players were characterized by impaired learning and memory, and attention and information processing compared to controls ($P < 0.05$; Table 1). However, no between group differences were observed in MCAv, CVC or CVR between groups ($P > 0.05$; Table 1).

Conclusion Heading the ball in soccer is associated with impaired cognition that appears to be independent of cerebral hypoperfusion.

Table 1. Cognitive function and cerebral perfusion

	Controls	Soccer Players	P Values
MCAv (cm.s ⁻¹)	59 ± 12	61 ± 10	0.587
MAP (mmHg)	88 ± 20	90 ± 11	0.620
CVC (cm.s ⁻¹ .mmHg)	0.71 ± 0.20	0.69 ± 0.15	0.959
CVR (mmHg.cm.s ⁻¹)	1.49 ± 0.32	1.51 ± 0.33	0.922
Rey Auditory Verbal Learning Test A1-A5 (n)	53 ± 8	46 ± 9*	0.002
Rey Auditory Verbal Learning Test B1 (n)	7 ± 2	5 ± 2*	0.001
Rey Auditory Verbal Learning Test A6 (n)	12 ± 3	10 ± 2*	0.002
Rey Auditory Verbal Learning Test A6-A5 (n)	-1 ± 2	-1 ± 1	0.450
Repetition of Digits Backwards (n)	6 ± 2	5 ± 2	0.429
Trail Making Test B (s)	57 ± 14	62 ± 13	0.186
Repetition of Digits Forwards (n)	8 ± 2	6 ± 2*	0.001
Trail Making Test A (s)	26 ± 6	30 ± 9	0.066
Digit Symbol Substitution Test (n)	61 ± 10	57 ± 10	0.134

2269 Board #188 May 28 2:00 PM - 3:30 PM

Exercise Affect And Cardiac Vagal Tone: A Psychophysiological Connection

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(No relevant relationships reported)

INTRODUCTION: Evidence suggests vagal tone may be a viable physiological marker of exercise readiness and recovery. However, whether vagal tone is associated with feeling states (i.e., affect) prior-to, during, and following exercise is poorly understood. Consistent with psychological hedonism, individuals will pursue exercise that elicits pleasure while avoiding displeasure. Thus, it is of interest whether an index of physiological readiness is associated with dis/pleasure while engaging in high-intensity interval exercise. **PURPOSE:** Explore the psychophysiological relationship between reactivity and recovery of phasic vagal tone and affect occurring during high-intensity interval exercise (HIIE). **METHODS:** Participants (N= 25, 13 females, 23.3±4.0 yrs) completed a 20-minute session of HIIE (5-blocks of 3-min exercise to 1-min rest) where vagal tone (i.e., High Frequency Power) and affect (via Feeling Scale) was recorded prior to, during (vagal tone recorded during rest-intervals), and up to 15-min post-exercise. **RESULTS:** Prior to exercise, vagal tone (6.5 ± 1.6) and affect (2.4 ± 1.4) were positively related ($r = 0.58$). Upon HIIE initiation, both vagal tone and affect significantly declined during Block 1 ($1.6 \pm 1.7, P < 0.001; 1.7 \pm 2.0, P < 0.001$, respectively). Vagal tone remained withdrawn (Rest-2: $1.2 \pm 1.5; R3: 0.8 \pm 1.5; R4: 1.3 \pm 1.5; P_s > 0.05$) until post-15 (4.1 ± 2.9). Affect significantly declined during each exercise block (Block 1Δ: $-0.6; B2Δ: -0.7; B3Δ: -1.1; B4Δ: -1.6; B5Δ: -1.0; P_s < 0.05$), but also significantly increased following each rest-interval (Rest-1Δ: $+0.4; R2Δ: +0.5; R3Δ: +0.7; R4Δ: +1.3; P_s < 0.05$), with post-15 affect (3.0 ± 1.9) significantly exceeding pre-affect ($P < 0.01$). Time-lagged correlations suggested small-to-moderate relationships between vagal tone and affect during the HIIE ($r_s = 0.22-0.47$), with a disconnection at post-15 ($r = -0.03$). **CONCLUSIONS:** As expected, participants experienced vagal tone withdrawal at HIIE initiation and a decline in pleasure during high-intensity exercise blocks, with affective rebounds during recovery. This suggests vagal tone can be a psychophysiological marker of affective readiness and displeasure experienced during exercise, but not as an index of affective recovery.

2270 Board #189 May 28 2:00 PM - 3:30 PM

The Effect Of Mind-body Exercise On Working Memory: Differences Between Experts And Novices

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BACKGROUND: Working memory is one of the sub-abilities of executive function and plays an important role in the entire cognitive process. However, working memory decline in aging seriously impairs the living ability of older people. Therefore, how to mitigate the decline of working memory function in older adults has become a focal point of current research. Mind-body exercise (MBE) is considered an effective

way to delay cognitive decline in older adults, but the effects of MBE on working memory function and mechanisms by which MBE may improve cognition in older adults remain unknown. **PURPOSE:** This study explores whether long-term MBE will influence working memory function by comparing MBE experts with novices. These findings will provide theoretical and empirical basis for maintaining the cognitive function of older people. **METHODS:** A total of 39 healthy older people (all female, mean age = 65.23 ± 2.43 years) from a community in Beijing participated in this experiment. 13 subjects in the Tai Chi group (TC) experienced more than 5 years of TC exercise. 13 subjects in the Baduanjin group (BD) experienced more than 5 years of BD exercise, and 13 subjects without systematic MBE were assigned to the control group. Each participant was administered the N-back task to evaluate working memory function. The primary outcome was reaction time (RT) and accuracy rate (AR) for the N-back task. **RESULTS:** the TC group and BD group had faster RT for N-back task compared with the novice group ($p < 0.05$). The RT of the BD group was faster than the TC group, but the difference was not significant ($p > 0.05$). The TC group and BD group had higher AR for the N-back task compared with the novice group ($p < 0.05$). The AR of TC group was higher than BD group, but the difference was not significant ($p > 0.05$). **CONCLUSION:** Different BMEs are beneficial to the working memory function of the elderly. Compared with the novices, long-term BME can significantly improve the working memory function of older adults, which is an effective exercise to maintain the cognitive function of the elderly.

2271 Board #190 May 28 2:00 PM - 3:30 PM
Influence Of Single Bouts Of Different Exercise Intensities On Dual-tasking Efficiency In Healthy Individuals

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PURPOSE: Dual-tasking refers to concurrent performance of two physical or mental tasks. Considering the critical role of dual-tasking in daily life, it is important to develop interventions to improve its efficiency or slow down its decline with age or disease. The specific purpose of this research was to study the effects of single bouts of a moderate-intensity (MI) or high-intensity interval training (HIIT) exercise on the efficiency of the extended cognitive Timed Up and Go (ETUGcog) test, which involves concurrent performance of physical and mental tasks.

METHODS: 17 males and females aged 23-35 years underwent two different single bouts of exercise sessions, a HIIT and a MI, on separate occasions, based on established protocols. Each session began with ETUGcog prior to exercise as pre-test. ETUGcog involves simultaneous performance of an extended version of Timed Up & Go test (the physical task), while counting backwards by sevens starting from a given number (the mental task). The post-tests were administered immediately after the exercise when the subject cooled down to 10% above resting HR (10%aHR), and 24 hours later. The test parameters that were recorded are the number of correct responses while counting backwards until test completion, and time to complete test.

RESULTS: Correct responses after a HIIT session were significantly higher than pre-test responses when tested at 10%aHR (5.18 ± 1.43 vs 4.24 ± 1.82 , $p = 0.02$), and 24 hours later (5.82 ± 2.24 vs 4.24 ± 1.82 , $p = 0.002$). No such improvements were seen after a MI session, as correct post-test responses at 10%aHR (5.18 ± 2.98) and 24 hours later (5.06 ± 2.75) were similar to pre-test responses (4.79 ± 2.47), with $p > 0.05$ in both paired comparisons. Also, the times to complete ETUGcog tests were not significantly different when comparing the pre-test to both post-test times, with $p > 0.05$, in both types of exercise sessions.

CONCLUSIONS: A single bout of high-intensity, but not moderate intensity exercise, might improve dual-tasking efficiency by increasing cognitive processing speeds, without delaying activity completion times, and improvements can last a full day. This could be due to neuroplastic improvements in brain's cognitive areas in the prefrontal cortex, caused by blood flow increases sufficient with high intensity, but not with lower intensity exercise.

2272 Board #191 May 28 2:00 PM - 3:30 PM
Effects Of Acute Caffeine Ingestion Following A Period Of Sleep Loss On Cognitive And Physical Performance: A Systematic Review And Meta-analysis

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PURPOSE: This systematic review and meta-analysis examined the impact of acute caffeine consumption on cognitive and physical performance in sleep deprived/

restricted individuals. **METHODS:** Electronic databases were searched for studies measuring cognitive and/or physical performance following *sleep restriction* (≤ 6 h sleep within 24h) or *deprivation* (≥ 24 h wakefulness) under control (placebo) and intervention (caffeine) conditions. Studies were included if performance was assessed within 6h of caffeine consumption. Individual effect estimates (EEs) were calculated as Hedges' g for independent groups. Random effects meta-analyses were performed to determine intervention efficacy. Statistical significance was attained if the 95% CI did not include zero. Multiple meta-regression analysis was conducted to determine effects of caffeine dose and period of wakefulness on the magnitude of the effect. **RESULTS:** 36 publications providing 250 EEs were included. Caffeine improved performance on reaction time tasks (12 EEs; $g = 1.11$; 95% CI: 0.75-1.47) and both response time (44 EEs; $g = 0.86$; 95% CI: 0.53-0.83) and accuracy (27 EEs; $g = 0.68$; 95% CI: 0.48-0.88) on attention tasks. The magnitude of the effect increased as caffeine dose increased, but was not influenced by the period of wakefulness for either task. Caffeine improved executive function (38 EEs; $g = 0.35$; 95% CI: 0.15-0.55) and the magnitude of the effect increased as caffeine dose increased ($p = 0.007$) and period of wakefulness decreased ($p = 0.021$). Caffeine also improved response time (20 EEs; $g = 1.95$; 95% CI: 1.39-2.52) and accuracy (34 EEs; $g = 0.43$; 95% CI: 0.30-0.55) on information processing tasks, but neither caffeine dose ($p = 0.785$) nor period of wakefulness ($p = 0.373$) influenced the magnitude of the effect. No other performance outcomes were appropriate for meta-analysis. However, studies typically indicated a benefit of caffeine on memory (25 EEs), crystallized intelligence (11 EEs) and physical (39 EEs) performance. **CONCLUSION:** Caffeine is an effective counter-measure to the cognitive and physical impairments associated with sleep loss.

2273 Board #192 May 28 2:00 PM - 3:30 PM
Impact Of 45 Minutes Of Daily Pe On Fitness And Processing Speed Overtime

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Research has demonstrated higher cognitive abilities are often linked to physical activity participation. **PURPOSE:** To examine the impact that 45 minutes of daily physical education on the aerobic capacity and perceptual speed of elementary school children. **METHODS:** An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education on fitness and perceptual speed among youth in grades 6th-8th attending Legacy Early College, a Title I school in the southeastern US. Gain scores (final post-test assessment in May 2019 - original pre-test assessment in September 2017) were calculated and analyzed for significance. The interaction between school and time was estimated for each outcome. Each analysis was stratified by gender and adjusted by age to control for baseline differences by school. A Title I control school that provided physical education once per week was utilized as a comparison. **Summary of RESULTS:** Legacy Early College children significantly improved on perceptual speed compared to controls. A significant gain increase at post-test for sections 1, 2, 3 and the Total score ($p = .002$ $F = 9.27$, $p = .020$ $F = 5.45$, $p = .019$ $F = 5.54$, $p = .003$ $F = 9.17$) respectively, was found. Legacy females had significant gains for sections 1 and 2 compared to controls ($p = .041$ $F = 4.25$, $p = .010$ $F = 6.68$). Legacy males had a similar trend with significantly higher gains for sections 1, 3, and Total ($p = .041$ $F = 4.26$, $p = .030$ $F = 4.80$, $p = .038$ $F = 4.38$) compared to controls. Additionally, Legacy children improved significantly on PACER laps compared to controls (8.64 vs. 2.08; $p = 0.000$, $F = 23.77$) over time. Legacy females had significantly higher gains in PACER laps compared to controls ($p = 0.000$, $F = 34.30$). Legacy males also had significant gains in PACER laps over time compared to controls ($p = .010$ $F = 6.86$). **CONCLUSIONS:** 45 minutes of daily physical education led to increases in fitness and processing speed over time. Supported by Campbell Young Leaders

2274 Board #193 May 28 2:00 PM - 3:30 PM
Baseline Cognitive Performance Moderates The Benefits Of Regular Exercise On Cognition In Children

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Although a growing number of studies have examined the effects of regular exercise on cognition and academic performance in children, the findings have remained controversial due to divergent experimental approaches. **PURPOSE:** The present study investigated baseline cognitive performance as a moderating factor underlying the effects of regular exercise intervention on cognition, with the goal of determining whether baseline variance may account for the lack of consensus in the literature.

METHODS: We reanalyzed data from three randomized controlled trials in which the effects of regular exercise intervention on cognition were examined using executive function tasks (e.g., flanker task), with a cumulative total of 292 participants (9-13 years). To test the moderation effects of baseline performance on the relationship between exercise intervention and changes in cognitive performance, we used hierarchical generalized multiple regression analysis predicting pre-post changes in cognitive performance. **RESULTS:** Results indicated that the beneficial effects of regular exercise intervention on cognitive performance were greater in lower baseline performers. Additionally, the pre-post changes in cognitive performance did not differ between the control and intervention groups, even for high baseline performers. **CONCLUSIONS:** These findings suggest that baseline cognitive performance is an individual difference variable that moderates the effects of regular exercise intervention on changes in cognition. Thus, future studies should account for baseline cognitive performance when examining the exercise - cognition relationship. The present study also supports recent views that increased time spent in physical exercise does not detract from cognitive performance and academic achievement in children. Supported by NICHD Grant R01 HD055352 and the Gottfried and Julia Bangerter-Rhyner-Foundation (8472/HEG-DSV).

2275 Board #194 May 28 2:00 PM - 3:30 PM
The Effects Of High-altitude Mountaineering On Cognitive Function In Mountaineers: A Meta-analysis
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PURPOSE: Nowadays, high altitude mountaineering is increasingly popular among different populations with a dream to challenge high-altitude exercises facilitated by the convenience of global traveling. In view of this, the authors performed a meta-analysis in the hope of finding the effects of high-altitude mountaineering on cognitive function in mountaineers prior to and after the climbing.

METHODS: After a thorough electronic literature search and selection, eight studies were included in this meta-analysis, and test cycle ranged from 8 to 140 days. The eight variables included in this meta-analysis were: trail-making test part B (TMB), finger tapping test-left (FTL), finger tapping test-right (FTR), digit span test forward (DSF), digit span test backward (DSB), wechsler memory scale visual (WMSV), aphasia screening test-visual motor errors (AST-vis), aphasia screening test-verbal items (AST-ver). The effect sizes and Forest Plots of these eight variables were generated. **RESULTS:** Five variables (trail-making test part B (TMB), ES = 0.39; digit span test forward (DSF), ES = 0.57; finger tapping test-right (FTR), ES = 0.50; finger tapping test-left (FTL), ES = 0.16; wechsler memory scale visual (WMSV), ES = 0.63;) out of eight were significantly improved after high-altitude mountaineering, while ES values of digit span test backward (DSB), aphasia screening test-verbal items (AST-ver) and aphasia screening test-visual motor errors (AST-vis) did not show significant improvement after the mountaineering.

CONCLUSIONS: Our findings have some limitations arising from methodological issues inherent in the meta-analysis and we could not explain the high heterogeneity between studies. Despite such limitations, the current study has the strength of being the first meta-analysis trying to specify cognitive function of mountaineers compared with before and after high-altitude mountaineering. High-altitude mountaineering, as a short-term plateau exercise, has no significant negative impact on the cognitive function of climbers. Future research is needed for a long period of high-altitude mountaineering.

2276 Board #195 May 28 2:00 PM - 3:30 PM
Excess Body Mass Attenuates The Effects Of Acute Exercise On Preadolescent Brain Function And Cognition
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Purpose

This study investigated the transient effects of an acute bout of aerobic exercise and excess body mass on cognitive and brain function in preadolescent children.

Methods

Thirty-nine children (8-10yrs; 16 females) completed baseline and demographic questionnaires, and dual-energy X-ray absorptiometry and VO2max tests. Children were randomly allocated into a within-subjects crossover intervention design including 20-minutes of restful reading and 20-minutes of treadmill walking. Children completed post-intervention cognitive tasks that tap inhibition (Go-NoGo, flanker) with EEG (P3-ERP), and standardized tests of academic achievement in reading and math.

Summary of Results

Following the treadmill walking intervention, children of normal weight (NW) demonstrated improved response accuracy ($p \leq 0.05$), shorter reaction times ($p \leq 0.05$), and larger P3-ERP amplitudes ($p \leq 0.05$) during the Go task, relative to children with obesity (OB). Additionally, after the walking intervention, NW children demonstrated a trend for larger P3 amplitude ($p = 0.068$) during the NoGo task. NW children also demonstrated shorter reaction times ($p = .041$), and reduced perceptual interference ($p = 0.039$) compared to OB children during the flanker task. Lastly, NW children demonstrated improved performance on academic achievement tests of reading and math after the walking intervention, compared to OB children ($p \leq 0.05$).

Conclusion

These findings indicate that the beneficial effects following an acute bout of aerobic exercise on cognitive and brain function may be attenuated in children with obesity. These results provide evidence indicating that neuroelectric and behavioural indices of attention, inhibition, and academic achievement are influenced by aerobic exercise and body mass in children. Given that childhood obesity is a public health concern with an array of health complications, these results have important implications for the physical and cognitive health of children.

Grant Funding

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2277 Board #196 May 28 2:00 PM - 3:30 PM
Effect Of Mental Fatigue Induced By A Cognitive Task On A Subsequent Handgrip Endurance Exercise
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Mental fatigue is commonly observed when using the sequential task protocol. In this protocol, participants perform a first task that requires effortful control or that does not. Then, they have to perform a second task that systematically requires effortful control. Participants generally give up earlier the second task when they have exerted effortful control in the first task. Despite an extensive literature on this phenomenon, researchers still debate about its real existence and failed to define its conditions of occurrence.

PURPOSE: To replicate the mental fatigue effect with a long cognitive task tapping executive functions on a subsequent effortful physical task. **METHODS:** Fifty-five young adults completed 4 sessions separated by a minimum of 48h. The first session was a learning session in which participants familiarize with the Stroop task and the handgrip task. During the second session, participants only performed the endurance handgrip task at 13% voluntary maximal contraction until exhaustion. During the third and fourth sessions, participants performed a 30-min cognitive task (modified Stroop task vs. Video task) followed by the same handgrip task than in the 2nd session. The order of sessions 2 and 3 were counterbalanced across participants. **RESULTS:** As expected, participants squeezed the handgrip during a shorter time (5.36 min) after the Stroop task than after watching an emotionally neutral movie (5.82 min). In addition, there was a significant difference between the performance of the second session (5.80 min) and the performance after the Stroop task. **CONCLUSION:** This study clearly shows that a long task overloading execution functions leads to an early disengagement of mental effort in a subsequent effortful physical task. The cause of this earlier dropout is explained in different ways: (1) a quicker depletion of brain resources, (2) energetic and computational costs higher than the benefits associated with the achievement of the task goal, or (3) a reorientation of attention and intention to more pleasant tasks. Further studies are needed to confront these different explanations and manipulate the difficulty of the first task (duration and effortful control load) to determine the conditions of occurrence necessary to induce mental fatigue.

2278 Board #197 May 28 2:00 PM - 3:30 PM
Abstract Withdrawn

2279 Board #198 May 28 2:00 PM - 3:30 PM
Effect Of Intermittent Isometric Handgrip Exercise On Cognitive Function
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Previous study reported that an isometric handgrip (IHG) exercise improves cognitive function. However, an isometric exercise may increase the risk for cardiovascular disease because of a larger increase in arterial blood pressure (ABP) compare with dynamic exercise, especially in elderly patients. **PURPOSE:** The purpose of the present study was to examine the effect of acute intermittent IHG exercise without a large

increase ABP on cognitive function. **METHODS:** Five healthy subjects performed a cognitive task (Go/No-go task) before and immediately after IHG exercise protocols; 16 sets of 30-s IHG at 30% of maximum voluntary contraction and 45-s recovery. ABP was measured continuously throughout the experiment. Cognitive function was evaluated by the Go/No-go task. **RESULTS:** Mean arterial pressure at the end of IHG exercise protocol (92 ± 12 mmHg) was not significantly different from the baseline (86 ± 4 mmHg, $P > 0.05$). Also, the number of error trials in the Go/No-go task was unchanged; however, the reaction time was decreased in four out of five subjects after IHG exercise. **CONCLUSION:** These results provided the possibility that intermittent isometric exercise may improve cognitive function without an elevation in ABP. However, further investigation with large sample size is needed to identify our questions.

2280 Board #199 May 28 2:00 PM - 3:30 PM
Relationship Between Aging-related Declines In Leg Muscle Volume And Quality And Cognitive Functions

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PURPOSE: Aging is associated with declining in not only skeletal muscular function but also cognitive function including speed of processing, working memory, and long-term memory. However, it remains unclear whether aging-related decline in muscular function is related to impaired cognitive function. In addition to decreased muscle volume, aging-related decline in muscular function can be attributed to impaired muscle quality such as increased intramuscular fat and connective tissue (Akima et al, 2018; Goodpaster et al, 2006). The aim of the present study was to examine whether the aging-related declines in lower body muscle volume and quality are associated with cognitive function in Japanese adults. **METHODS:** The participants in this study were 86 adults (43 males, 43 females; age range 30 to 77 years old). The participants' thigh muscle volume was assessed by bioelectrical impedance analysis. Muscle quality (i.e., levels of intra- and extra-myocellular lipid and connective tissue) of the vastus lateralis was determined using 1H-magnetic resonance spectroscopy at 3T MR system and echo intensity measured with ultrasound. Cognitive functions (inhibitory control, short memory, working memory) were determined with the color-word Stroop task, Face-name matching task and Reading Span Test, respectively. **RESULTS:** Aging was associated with a decline in muscle volume and an increase in echo intensity ($p < 0.05$). The aging-related decline in muscle volume was correlated to impaired inhibitory control score in both male and female ($p < 0.05$). In addition, aging-related increase in echo intensity was correlated to impaired inhibitory control score ($p < 0.05$). There were no relationships between those muscle properties and short memory score or working memory score.

CONCLUSIONS: These findings suggest a link between aging-related impairment in inhibitory control and reduction in muscle volume and quality. Further studies are needed to determine whether ameliorating muscular function can be a therapeutic target against the aging-related decline in cognitive function.

2281 Board #200 May 28 2:00 PM - 3:30 PM
Effectiveness Of Modeling Videos On Psychological States Of Patients Undergoing Rehabilitation Following ACL Reconstruction

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To date, much of the rehabilitation following anterior cruciate ligament reconstruction (ACLR) has centered on physical components. However, return to sports depends on not only physical recovery but also psychological readiness. According to a systematic review published in 2017, there is limited evidence on the efficacy of psychological interventions. **PURPOSE:** To examine the effectiveness of modeling videos to reduce preoperative kinesiophobia and fear of reinjury as well as to increase postoperative self-efficacy after ACLR. **METHODS:** Following baseline assessment of psychological states through ACL-Return to Sport after Injury (ACL-RSI), Knee Self Efficacy Scale (K-SES), and Tampa Scale of Kinesiophobia (TSK) and knee function (International Knee Documentation Committee [IKDC] system), patients scheduled for ACLR were randomly assigned to intervention, placebo, or control group. Six modeling intervention videos were developed by the investigators to represent six different periods: pre-operation, during hospitalization, 2 weeks, 6 weeks, 3 months, and 6 months post operations. Another six videos were developed to serve as placebo. Intervention and placebo groups watched their respective videos during

their follow-up visits while control group did not. All groups completed psychological and functional assessments during their follow-up visits. **RESULTS:** Ten patients were assigned to intervention group, 11 to placebo group, and 11 to control group. No significant changes in ACL-RSI, K-SES, and TSK scores over six-month period were found among groups ($p=0.574$, $p=0.808$, $p=0.888$, respectively). Although three groups all showed improvement in ACL-RSI, K-SES, and TSK at six months, their improvements were not linear ($p=0.467$, 0.364 , 0.274 , respectively). All groups demonstrated temporary decrease in ACL-RSI and TSK scores at three months. **CONCLUSIONS:** Watching modeling videos compared to placebo and control did not reduce kinesiophobia or fear of reinjury as well as improve self-efficacy after ACLR. However, there may be potential room for psychological intervention at three months, and it is important to recognize psychological readiness for successful return to sports.

2282 Board #201 May 28 2:00 PM - 3:30 PM
Abstract Withdrawn

2283 Board #202 May 28 2:00 PM - 3:30 PM
Semantic Memory Activation After Training Cessation In Master Athletes

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PURPOSE: Despite a robust body of literature demonstrating the salutary effects of exercise on memory, we have yet to learn the link between exercise training cessation and memory in the aging brain. The aim of this study was to examine the effects of 10-day training cessation on semantic memory-related functional activation using task-activated functional magnetic resonance imaging (fMRI) in master athletes.

METHODS: Twelve master athletes (62.6±7.0 years) with long-term endurance training histories (≥15 years), were recruited from Washington DC area running clubs. Participants were instructed to remain sedentary and perform only activities of daily living for 10 days. Before and immediately after the training cessation period, fMRI semantic memory activation was measured during performance of a Famous and Non-Famous name discrimination task.

RESULTS: There were no significant differences in behavioral performance including response time and accuracy between pre- and post-training cessation. The 10-day training cessation was associated with greater semantic memory activation (Famous > Non-Famous) in five out of ten semantic memory-related regions (voxel-wise $p < 0.001$, FWE $p < 0.05$).

CONCLUSIONS: The present results provide evidence that even a relatively short period of exercise training cessation results in changes in semantic memory network function and suggests reduced neural efficiency during memory retrieval. This study also indirectly indicates potentially detrimental effects of sedentary behavior in older adults and highlights the importance of sustained participation in exercise.

2284 Board #203 May 28 2:00 PM - 3:30 PM
Transient Effects Of Acute Aerobic Physical Activity On The Pupillary Response And Inhibitory Control

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Purpose: Acute bouts of aerobic exercise have been found to transiently improve executive function and its neural underpinnings. Moderate activation of the locus coeruleus-norepinephrine (LC-NE) system increases attention toward goal-directed behaviors, yet non-optimal activation may promote distractibility. Pupillary responses are believed to be a marker of the LC-NE system, and tasks requiring greater amounts of inhibitory control modulate baseline (tonic) and task-evoked (phasic) pupil dilation. The purpose of this study was to examine the pupillary response as a LC-NE biomarker to understand the mechanisms underlying the effect of acute exercise on inhibitory control.

Methods: Twenty-six participants (19.7 ± 1.8 yr, 17 female) performed 20 min interventions (seated rest/moderate intensity exercise) followed by Simon and modified flanker tasks. Participants' eyes were tracked during the tasks using a tabletop eye imaging camera at a 500hz sampling rate.

Results: RM-ANOVAs assessed intervention and inhibitory control (congruency/compatibility) effects on behavior and pupillary outcomes. Incongruent flanker trials resulted in longer reaction times and lower response accuracy, p 's ≤ 0.001. While incompatible Simon trials also resulted in longer reaction times, $p = 0.01$, there was no difference in response accuracy across compatibility conditions, $p = 0.11$. Peak phasic pupil dilation was also greater in incongruent flanker trials as well as incompatible Simon trials, $p=0.003$. While behavior and phasic pupil dilation in both tasks did not

differ across the exercise vs. rest interventions, p 's ≥ 0.18 . Tonic pupil diameter was larger for the exercise intervention in the flanker task, $p = 0.04$, and at trend level in the Simon task, $p = 0.09$.

Conclusion: The tonic pupillary response may be a sensitive biomarker for examining transient changes in LC-NE activity as a function of acute exercise bouts. Moderate intensity exercise did not significantly affect phasic pupillary response. These findings indicate that the pupillary response can be manipulated by aspects of inhibitory control and physical activity, which suggests it may be a sensitive biomarker for examining changes in LC-NE activity.

2285 Board #204 May 28 2:00 PM - 3:30 PM
Perception Of Trust In Physicians Based On Somatotype: A Student And Non-student Comparison
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 (No relevant relationships reported)

Appearance is the first piece of information available that can powerfully influence perception. Credibility, which includes trust, has been shown to be impacted by a person's somatotype. **PURPOSE:** The purpose of this study was to determine students and non-students perception of trust of a physician based on the physician's somatotype. **METHODS:** A survey was administered to 1,631 students, faculty, and staff at a small Midwestern university using Formstack. Images of an endomorph, mesomorph, and ectomorph somatotype were displayed along with a 5-point Likert scale with 1 meaning "would not trust this physician" to 5 meaning "would completely trust this physician". Participants were asked to select the answer that best correlated with the perceived trust they would have in a physician who had the somatotype shown. **RESULTS:** There were 1,631 emails sent with 333 (20%) responses collected. Of the 333 respondents, 189 (57%) were students and 144 (43%) were non-students (faculty and staff). Perceptions of trust were analyzed using a repeated measure ANOVA which determined there is a significant difference in rank order of the three somatotypes (p -value $< .0001$). A Tukey post-hoc test was then conducted to compare the three somatotypes. When comparing the means for endomorph ($M = 2.7$, $SD = 1.1$) and mesomorph ($M = 3.8$, $SD = .7$), the endomorph somatotype was ranked lower than the mesomorph somatotype ($t = -19.756$, p -value $< .0001$). When comparing the means for the endomorph and ectomorph ($M = 3.6$, $SD = .9$) somatotypes, the endomorph somatotype was ranked lower than the ectomorph somatotype ($t = -15.583$, p -value $< .0001$). Lastly, when comparing the mesomorph and ectomorph somatotypes, the mesomorph somatotype ranked higher than ectomorph somatotype ($t = 4.173$, p -value $< .0001$). **CONCLUSION:** This study indicated that both status groups (students and non-students) ranked the mesomorph somatotype as most trustworthy for a physician, the ectomorph somatotype as second most trust worthy for a physician, and the endomorph somatotype as least trustworthy for a physician. Further research is needed to determine the influencing factors of somatotype perceptions.

2286 Board #205 May 28 2:00 PM - 3:30 PM
Primes For The Mind: Additive Effects Of Verbal Priming And Acute Exercise On Convergent Creativity
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 (No relevant relationships reported)

PURPOSE: The Remote Associates Test (RAT), assesses creative convergence on a single solution. The effects of physical exercise on convergent creativity are equivocal; although, priming has been shown to improve convergent thinking. To this end, we hypothesized that acute, moderate-intensity treadmill-walking while solving anagram primes would stimulate additive effects capable of facilitating convergent creativity, relative to priming alone.

METHODS: Participants ($n=45$) completed two laboratory visits in this within-subject experiment. Six anagram lists were presented during each visit (twelve total lists), with the order of the twelve lists counterbalanced across conditions. Participants randomly assigned to the anagram priming + exercise visit first, performed fifteen minutes of moderate-intensity treadmill-walking (moderate-intensity; 40-45% of heart-rate reserve while solving anagrams). Participants, randomized into the anagram only visit first, sat on a stool placed on the treadmill for fifteen minutes while solving anagrams. Following fifteen minutes of exercise + anagram-solving or seated rest + anagram-solving, participants were escorted to a quiet room, free of distraction, where they solved RAT problems. After a minimum 24-hour interval, participants returned for the second visit. Paired t-tests were used to test differences between both conditions. Post-hoc Bayesian analysis was also performed to quantify evidence for or against the null hypothesis.

RESULTS: A significant difference was evident between exercise + anagram-solving ($= 10.51$, $SD = 3.25$) and seated rest + anagram-solving ($= 9.29$, $SD = 4.12$), $t(44) = 2.385$, $p = .021$, $d = 0.36$, 95% confidence interval for the effect size = 0.052 - 0.655).

Post-hoc Bayesian analysis indicated that the data were 2.05 times more likely under the alternative hypothesis (median $\delta = 0.46$, 95% credible interval for the effect size = 0.053 - 0.86).

CONCLUSION: This experiment offers a novel contribution to the exercise and creativity domains, suggesting a potential additive effect of exercise plus verbal priming on convergent creativity. Continued empirical research is warranted to identify precise mechanisms underlying these additive effects, and to establish novel exercise and priming strategies that may benefit creative thinking.

2287 Board #206 May 28 2:00 PM - 3:30 PM
Parent-report Of Children's Motor Skills Are Selectively Related To Interference Control Among School-aged Children

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 (No relevant relationships reported)

PURPOSE: Previous research has demonstrated that aerobic fitness and adiposity impact children's cognitive function. However, whether children's motor skills independently impact childhood cognition remains unclear. This study examined relationships between children's motor skills and executive function, relational memory, and academic achievement among school-aged children without diagnosed coordination disorder. **METHODS:** Participants were children ages 7-12 years old ($N=90$ [46 females]). Intellectual abilities and academic achievement were measured using the Woodcock-Johnson IV Test (WCJ). Selective attention was assessed using a Flanker task, and relational memory was assessed using a spatial reconstruction task. Aerobic fitness and whole-body adiposity (%Fat) were assessed using a VO2max test and DXA, respectively. Parents completed the Developmental Coordination Disorder Questionnaire (DCDQ) as an assessment of the child's current motor skill abilities. Spearman and partial spearman correlation tests were conducted to explore potential relationships. **RESULTS:** 14% of participants indicated a possible developmental coordination disorder and 50% had a score of 67 and above on the DCDQ. Covariates adjusted for included sex, IQ, socioeconomic status (SES), fitness, and %Fat. Following adjustment, higher scores on the control during movement subscale of the DCDQ were related to greater performance in story recall ($Rho = 0.29$; $P = 0.039$), a subscale of the WCJ. There was no significant relationship between relational memory and any of the DCDQ outcomes. However, higher scores on the control during movement subscale were related to lower accuracy interference during the Flanker task ($Rho = -0.25$; $P = 0.03$), indicating that children who had higher motor control while moving exhibited greater selective attention, compared to those who had poorer control abilities during movement. **CONCLUSION:** Motor control abilities were associated with recall memory and attentional abilities in school-aged children, independent of aerobic fitness and adiposity.

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2288 Board #207 May 28 2:00 PM - 3:30 PM
Influence Of Acute Resistance Training On Memory, Executive Function, And Mood

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Acute exercise has been shown to improve performance on several domains of cognitive function. The majority of research has focused on the benefits of aerobic exercise, but research on the cognitive and mood effects of acute heavy resistance training (RT) is limited. **PURPOSE:** To determine how an acute bout of RT affects cognitive function and mood. **METHODS:** This was a within subjects design. College-aged males ($n=21$) visited the laboratory on 3 days, separated by at least 1 week. During session 1, subjects were tested for their 5 repetition maximum (5RM) on the box squat, bench press, and lat pulldown. During sessions 2 and 3, participants completed a rest or RT condition in a counterbalanced order. Prior to both sessions, participants completed trials 1-6 of the Rey Auditory Verbal Learning Task (RAVLT). During the RT session, participants completed 3 sets of 8-12 repetitions at 70% of estimated 1RM on the box squat, bench press, and lat pulldown. Training took ~40 minutes (including warm-up and cool-down). After the RT or 40 min seated rest, participants completed the recall and recognition trials of the RAVLT and a cognitive test battery in the Automated Neuropsychological Assessment Metrics (ANAM) Test System. The test battery included 10 tests that assessed memory, processing speed, executive function, and mood. Comparisons in cognitive performance and mood were made using a paired t-test. **RESULTS:** Higher scores on the color subtest of the Stroop Task, a test of processing speed, were found after RT compared to rest

(training=69.57±2.03; rest=65.43±2.01; p=0.01). Better performance was observed in the Matching-to-Sample task, a spatial working memory task, after rest compared to RT (training=41.33±2.77; rest=45.33±2.53; p=0.03). There were no other differences in cognitive performance between conditions (p>0.05). After RT, participants had higher anger (training=11.05±3.34; rest=5.62±1.81; p=0.04), depression (training=6.43±2.22; rest=2.57±1.08; p=0.02), restlessness (training=32.33±4.15; rest=14.58±3.18; p=0.0001), and vigor (training=55.62±3.63; rest=48.24±3.90; p=0.04). **CONCLUSION:** Acute RT has limited effects on cognitive function in college-aged males, but increases anger, depression, restlessness, and vigor when assessed after cognitive tasks.

2289 Board #208 May 28 2:00 PM - 3:30 PM

Psychological State Of A World-Class Ultramarathon Runner: A Case Study

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PURPOSE: While previous studies have revealed various physiological effects of ultramarathon running, the psychological profile and well-being of ultramarathon runners is less often examined and therefore inadequately understood. According to Self-Determination Theory (Ryan & Deci, 2000; 2002), an individual's well-being can be enhanced by participating in activities that support, not thwart, their basic needs of competence, autonomy, and relatedness. Psychological constructs of basic needs satisfaction, well-being, and mental toughness can be considered relatively stable. Yet, it is unknown whether these constructs vary before and after a highly intense exercise bout such as an ultramarathon. In previous studies, the timing of assessing endurance athletes varied from 5 minutes to 4 weeks post-event (Holt, Lee Kim, & Klein, 2014; Micklewright et al., 2009). This case study examined the pre- and post-race psychological profile of a male top-ten finisher of the Western States Endurance Run (WSER), a 100-mile (161 km) foot race over mountainous trails of Northern California in the United States. **METHODS:** The 32-year old participant was a highly-trained ultramarathon runner. At 20 hours prior to the race, the participant completed a quantitative survey about basic needs satisfaction, basic needs thwarting, self-esteem, mental toughness, and affect. When asked to complete the same survey 100 minutes post-race, the participant said he could not focus and asked to complete the survey later at 34 hours post-race. **RESULTS:** Results revealed an adaptive psychological profile that was stable from pre- to post-race; very high scores on basic needs satisfaction ($M_{pre} = 6.9$, $M_{post} = 6.85$ on a 7-point scale), self-esteem ($M_{pre} = 4.0$, $M_{post} = 4.0$ on a 4-point scale), mental toughness ($M_{pre} = 6.5$, $M_{post} = 6.63$ on a 7-point scale), and positive affect ($M_{pre} = 4.9$, $M_{post} = 5.0$ on a 5-point scale), combined with very low scores on basic needs thwarting ($M_{pre} = 1.0$, $M_{post} = 1.0$ on a 7-point scale) and negative affect ($M_{pre} = 1.2$, $M_{post} = 1.2$ on a 5-point scale). **CONCLUSIONS:** While survey results indicated stability in the athlete's psychological state, future research should explore the optimal post-event window to assess psychological constructs of ultra-marathon runners as well as other endurance athletes.

2290 Board #209 May 28 2:00 PM - 3:30 PM

Long-term Exercise Training Prevents Anxious-depressive-like Behavior In Transgenic Alzheimer Rats

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(No relevant relationships reported)

PURPOSE: This study examined the effects of long-term treadmill exercise training on the anxious-depressive-like behavioral phenotype of transgenic Alzheimer rats in the early stage of Alzheimer's disease (AD) development and provided evidence that exercise alleviated fear-avoidance behavior deficits. **METHODS:** 2-month-old Male TgF344-AD and wild-type (WT) rats were separated into WT (n = 9), AD (n = 8), and AD + treadmill exercise (Exe) groups (n = 12). Following 8 months of exercise, the passive avoidance test, Barnes maze task, novel object recognition test, and object location test were used to measure learning and memory function. The open field test, elevated plus maze, sucrose preference test, and forced swim test were conducted to measure anxious-depressive-like behavior of AD rats. Immunofluorescence staining, Western blot analysis, enzyme-linked immunosorbent assay (ELISA) analysis, and related assay kits were used to measure levels of inflammatory cytokines, oxidative stress, amyloid-beta production, and tau hyperphosphorylation. **RESULTS:** Behavioral tests indicated that AD rats aged 12-months did not exhibit spatial learning and memory deficits, but did display anxious-depressive-like behaviors (open field, Center time: $P = 0.008$; Center entries: $P = 0.009$; Line crossings: $P = 0.001$). Long-term exercise significantly prevented anxious-depressive-like behaviors in AD rats (Center

time: $P = 0.016$; Center entries: $P = 0.004$; Line crossings: $P = 0.033$). In addition, AD animals displayed enhanced A β deposition ($P < 0.001$), Tau hyperphosphorylation ($P < 0.001$), microglial activation ($P < 0.001$), inflammatory cytokine release ($P < 0.05$), and oxidative damage ($P < 0.05$) that was attenuated significantly after long-term exercise training ($P < 0.05$). **CONCLUSIONS:** Long-term exercise training ameliorated anxious-depressive-like behaviors and improved fear-avoidance behavior in transgenic AD rats, supporting exercise training as an effective strategy to prevent or reduce anxiety, depression and fear-avoidance behavior deficits in the early stages of AD pathogenesis.

2291 Board #210 May 28 2:00 PM - 3:30 PM

The Effect Of Treadmill Desk Walking On Creative Thinking

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(No relevant relationships reported)

PURPOSE: Most research on treadmill desks in the workplace report no significant change in productivity. However, most of these studies focused on cognitive performance measured by tests in attention, memory or reasoning. While aerobic exercise has been linked to producing a positive effect on creative potential, few studies have tested workplace creativity thinking. The purpose of this study was to examine the effect of treadmill desk walking on convergent and divergent creative thinking.

METHODS: Twelve (n=12) male and female college-age students were recruited and completed three tests of creative function: the verbal Guilford's Alternate Uses Task (VGAT) of divergent thinking, written Guilford's Alternative Uses Task (WGAT), and the Remote Associations Task (RAT) of convergent thinking. Participants completed all tests while seated at a traditional desk and while walking on a treadmill desk at 1.5 mph. Step length, stride length, and gait cycle were assessed by the OptoGait gait analysis system. A paired sample t-test was used to compare creative test scores and gait variables.

RESULTS: There were no significant differences between any test scores while seated and walking (p>0.05). There was no significant difference between baseline gait and divergent thinking (VGAT, WGAT) task gait in any variable (p>0.05). There was a significant increase in step length (p=0.049), stride length (p=0.046), and gait cycle (p=0.039) between the walking only condition and the treadmill desk walking during the RAT. **CONCLUSIONS:** Results of this study suggest neither convergent nor divergent creative thinking are improved when walking on a treadmill desk. While gait patterns are not changed during divergent thinking, this study suggests gait during convergent thinking may be altered.

2292 Board #211 May 28 2:00 PM - 3:30 PM

Acute But Not Chronic Aerobic Exercise Enhances Attention And The Neuroelectric Mismatch Negativity Among Fatigued Individuals

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PURPOSE: Symptoms of fatigue are a public health burden, comorbid with both cardiovascular disease and cancer. While exercise requires considerable energy expenditure, both acute and chronic aerobic exercise reduce feelings of fatigue. However, the brain mechanisms underlying this effect are not well-understood. To explore the neural mechanisms of this effect, we examined EEG correlates of attention before and after acute and chronic aerobic exercise. We hypothesized that the lo-intensity acute and chronic effects of exercise would produce increased attentiveness. **METHODS:** In this pilot study, 13 students, ages 18-36, with elevated levels of fatigue, were randomly assigned to: lo-intensity, hi-intensity, and a no exercise control. Each participant was evaluated pre- and post-exercise three times (e.g., baseline, week 3, and post-intervention) during the 6-week study. At each session participants were outfitted with hi-density EEG and completed an auditory odd-ball task that resulted in a mismatch negativity (MMN). The MMN is an index of pre-attentive change detection, and its amplitude decreases with fatigue. EEG was analyzed via established guidelines including ICA algorithms for artifact-removal. To extract the MMN, the N1 was located in each recording and a difference wave was calculated by subtracting the electrocortical activity to the standards minus targets, in the 100ms after the N1 (120-220ms). **RESULTS:** A repeated-measures, mixed model ANOVA (3 Group (lo-intensity, hi-intensity, control) x 2 Time (pre/post intervention) x 3 Week (baseline, week 3, post-intervention)) revealed a marginally significant interaction between Group, Time, and Week [$F(4,16)=2.79$, $p=0.06$, $\eta^2=0.41$] such that the MMN was reduced after hi-intensity exercise at the final session. In addition, the 2-way interaction between Group and Time [$F(2,8)=4.05$, $p=0.06$, $\eta^2=0.50$]

revealed a marginally significant interaction such that the lo-intensity group showed an increased MMN amplitude post exercise, the hi-intensity group showed a decrease, and the control group showed no change. No other effects were significant (all $p > 0.24$, $\eta^2 < 0.29$). **DISCUSSION:** Our data suggest that automatic pre-attentive change detection is only altered after lo-intensity acute aerobic exercise among our sample of fatigued individuals.

2293 Board #212 May 28 2:00 PM - 3:30 PM
Fitness Related Differences And Neuroelectric Indices Of Arithmetic Approximation In College-aged Adults
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(No relevant relationships reported)

As a growing body of literature supports a positive association between aerobic fitness and mathematics achievement, it has been suggested that individuals higher in aerobic fitness may use strategies, such as arithmetic approximation, that are more efficient during mathematical reasoning. **Purpose:** To understand how individuals at extremes of the aerobic fitness spectrum differ on numerical approximation. **Methods:** A sample of higher- and lower-fit college-aged adults was recruited to participate in the study based on maximal oxygen consumption ($\dot{V}O_{2max}$). Participants performed a complex arithmetic approximation task presenting operands $a + b$ and were instructed to indicate whether the sums were greater than or less than 100. Problems were equally distributed across conditions that varied in the extent to which the operands required arithmetic approximation: extra small split (i.e., $\pm 2\%$ or 3% ; $63+39$, medium split (i.e., $\pm 5\%$ or 8% ; $69+26$), large split (i.e., $\pm 10\%$ or 15% ; $48+62$), and massive split (i.e., $\pm 50\%$ or 55% ; $64+86$). To determine the extent to which arithmetic strategy differed between fitness groups, behavioral and neural indices of cognitive processing were assessed. **Results:** Numerical conditions requiring relatively lower levels of arithmetic approximation were not observed to differ between higher-and lower-fit participants whereas the numerical conditions requiring arithmetic approximation exhibited fitness-related differences. **Conclusion:** These findings suggest that high-fit individuals may engage in more efficient mathematical reasoning strategies relative to their low-fit counterparts. Therefore, fitness-related differences in mathematics achievement may result from differences in strategy execution. Future research should examine the degree to which physical activity interventions designed to enhance aerobic fitness also result in shifts in arithmetic approximation strategy.

2294 Board #213 May 28 2:00 PM - 3:30 PM
Pre-Competition Emotions In Cheerleading Sport: Differences Across Gender And Association With Final Results
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(No relevant relationships reported)

Although cheerleading's history is long until relatively recently it was not considered a sport. The evaluation is based on an assessment of strength, flexibility, and perfection of routine. Despite positive energy, charisma, and joy, during a competition, athletes can experience positive and negative emotions that could influence performance. **PURPOSE:** to analyze pre-competition emotions in a final cheerleading university games participation, assessing differences between male and female cheerleaders and associating positive and negative emotions with the score obtained in the competition. **METHODS:** From six universities 40 cheerleaders (n=22 male; n=18 female), mean age was 21.03 yr (SD 1.51), participated in the study, they competing at the National University Games in Bahia, Brazil. The teams were finalists in the first time of cheerleading participation in 67 editions of this competition. The twenty-two items of the Pre-Competitive Emotion Scale in the Portuguese language were selected from the original scale developed earlier (Jones et al., 2005). This scale has positive (e.g., happy, excited, enthusiastic) and negative (e.g., angry, sad, tense) emotions. Athletes were asked to rate how intense they were experiencing the emotions through self-evaluation 30min before the competition, on a scale in Likert format anchored by 1 (not at all) to 5 (very much so). **RESULTS:** Cheerleaders athletes experienced positive emotions (3.82 ± 0.69) more intensely than negative emotions (1.94 ± 0.44). In gender comparison, the independent sample t-test showed a significant difference in negative emotions (m. 1.78 ± 0.36 vs f. 2.14 ± 0.46 ; $p=0.009$) and a non-significant difference in positive emotions (m. 3.91 ± 0.64 vs f. 3.72 ± 0.76 ; $p=0.42$). Pearson correlation also indicated a significant, weak, positive correlation ($r=0.35$; $p=0.02$) between positive emotions and final score, while the negative emotions demonstrated a non-significant correlation ($r=-0.03$; $p=0.81$). **CONCLUSIONS:** Cheerleaders experienced both, positive and negative pre-competitive emotions. As well, female athletes experienced

more intense negative emotions than male athletes, and the intensity of positive emotions was related to the final score. This information may be useful for training psychological aspects and emotional control.

2295 Board #214 May 28 2:00 PM - 3:30 PM
The Mechanism Of Dance Training Regulating Emotion Of College Students: A FMRI Study
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(No relevant relationships reported)

PURPOSE: The purpose of the study is to evaluate the effect of dance training on emotion regulation of college students and explore the possible mechanism by using a magnetic resonance imaging (MRI) technique.

METHODS: 30 healthy college students were selected, 15 majored in classical Chinese dance (Dance Training group, DTG) and 15 (Control Group, CG) have no previously experience of regular training. MRI technique was used to observe the effect of dance training on the structure and function of emotion related brain areas. Siemens MAGNETOM Trio 3.0t MRI was selected and data analyzed by ALFF/FC with GREYNA.

RESULTS: Compared with CG, whole brain (1366 ± 88 ml), gray matter (674 ± 49 ml), white matter (488 ± 39 ml) was no significant difference with DTG ($P > 0.05$). The structural of left BA20 of DTG was increased significantly (voxels=142, $t=5.91$). The structural of left anterior cingulate gyrus, right central cingulate gyrus and insula gray matter decreased significantly in DTG ($P < 0.05$). With the increase of training years, the structural volume of BA20 gray matter increased significantly (voxels=420, $r=0.80$). In DTG the ALFF value and ReHo value in BA48 and BA23 were significantly increased ($P < 0.05$). The functional connections between the left insula and the right transverse temporal gyrus and the left superior temporal gyrus were enhanced ($P < 0.05$). Also right insula and the left amygdala, transverse temporal gyrus, superior temporal gyrus, middle temporal gyrus, inferior temporal gyrus and transverse temporal gyrus were significantly enhanced ($P < 0.05$).

CONCLUSIONS: The possible mechanism of dance training regulating emotion of college students may be relevant to the changes of structure, function and functional connections of emotion related brain areas. The effect of dance training on emotion regulation is highly related to the years of dance training (Supported by The Innovation ability promotion Plan Foundation of Beijing Municipal Education Commission No.TJSH20161005101).

2296 Board #215 May 28 2:00 PM - 3:30 PM
Cognitive Response And Motor Speed Before And After A Sustained Endurance Run
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(No relevant relationships reported)

There has been some controversy regarding the effects of physically exhausting the human body through endurance exercise. When it comes to the fatigue of the muscular system and being "physically tired", there is a question of the mental fatigue that such sustained physical exercise can take on the body.

PURPOSE: To test the differences in quick thinking tasks and reaction time before and after a 3-hour treadmill run, in trained endurance males.

METHODS: 10 male endurance runners (32 ± 6.0 yr; 161.3 ± 20.7 lb, 68 ± 1.6 in; $14.7 \pm 6.6\%$ body fat) ran for 3-hours on the treadmill (6.1 ± 0.2 mph, $57 \pm 0.9\%$ $\dot{V}O_{2max}$) for 18.3 ± 0.6 miles, on 3 separate occasions and performed a STROOP interference test, Reaction time test, and a 30 second finger-tapping test pre-run (PRE) and immediately after the treadmill run (POST).

RESULTS: There was a significant improvement in the cumulative time it took for successful responses in the STROOP test POST vs. PRE (24.36 ± 0.68 ; 28.44 ± 1.09 sec; $p < 0.05$). There was a significantly slower average response time when responding to different word colors, vs. the same color for the word ($p < 0.05$). There was a significant improvement in reaction time POST vs. PRE (0.44 ± 0.004 ; 0.48 ± 0.006 sec; $p < 0.05$). There was no significant difference between PRE and POST 3-hr run finger tapping score (209.1 ± 4.6 ; 211.1 ± 4.7 taps; $p=0.45$).

CONCLUSIONS: These results provide support to indicate that even after a fatiguing 3-hr treadmill run, at a moderate intensity, mental response time to cognitive tasks and the reaction time of trained, male endurance runners is not diminished, and is even significantly improved.

2297 Board #216 May 28 2:00 PM - 3:30 PM
The Effect Of Behavioral Automaticity On Behavior Is Moderated By Cognitive Self-control Abilities
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 (No relevant relationships reported)

PURPOSE: Dual-process theories assume that physical activity (PA) behavior is regulated by two different processes: *implicit* (i.e., automatic, unconscious) and *explicit* (i.e., effortful, conscious) processes. In this study we examined the interaction of implicit (i.e., behavioral *automaticity*) and explicit (i.e., cognitive self-control abilities) processes on PA behavior. We expected significant interaction effects between behavioral automaticity and cognitive self-control abilities (i.e., inhibition): highly automatized behaviors will prevail when inhibition abilities are poor, while high inhibition abilities might help to inhibit unwanted automatic behavioral tendencies (e.g., highly automatized sedentary behaviors [SB]).

METHODS: A prospective study with two points of measurement ($N = 114$ undergraduate and graduate students) was conducted. At t1 age, sex, past PA behavior (control variables) and *automaticity* of a) PA and b) SB were assessed with standardized questionnaires. Inhibition was assessed with a computerized Stop-Signal and a Go/No-Go task. At t2 (4 weeks later), PA behavior was measured as dependent variable with a standardized questionnaire. Hierarchical multiple linear regression analyses with interactions *Automaticity* x *Inhibition* on PA behavior and subsequent moderation analyses were calculated for *automaticity* of a) PA and b) SB respectively. **RESULTS:** The expected interaction effects *Automaticity* x *Inhibition* on PA behavior were significant for *automaticity* of a) PA ($b = 55.23, p < .01$) as well as b) SB ($b = -27.40, p < .05$). Moderation analyses revealed that *PA automaticity* was a significant positive predictor of PA behavior when inhibition abilities were poor ($b = 105.75, SE = 23.13, t = 4.57, p < .001$), but not when they were high ($b = -11.10, SE = 24.71, t = -0.45, p = .65$). Furthermore, *automaticity* of SB was a significant negative predictor of PA behavior when inhibition abilities were poor ($b = -42.83, SE = 20.87, t = -2.05, p < .05$), but not when they were high ($b = 13.67, SE = 17.61, t = 0.77, p = .44$).

CONCLUSIONS: In line with theoretical assumptions, automatic behaviors prevailed when the ability to inhibit prepotent responses was poor. However, higher inhibition abilities erase the significant associations between automaticity and behavior for both, PA and SB automaticity.

2298 Board #217 May 28 2:00 PM - 3:30 PM
Preschoolers' Self-regulation, Fine Motor Skills, And Performance On A Standardized Literacy Assessment
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In early childhood, both self-regulation and fine motor skill proficiency are positively related to academic achievement – and recent research suggests that these two factors are interrelated and co-develop such that skill in one may make up for deficiencies in another. **PURPOSE:** The aim of the present investigation was to determine the extent to which fine motor skill moderates the relationship between self-regulation and performance on a standardized literacy assessment in a sample of preschoolers. **METHODS:** Three hundred forty children from Head Start programs in Michigan and Georgia ($M_{age} = 3.76$ years; 172 females; 64% African-American) completed assessments of self-regulation (the Head-Toes-Knees-Shoulders task; McClelland et al., 2014), fine motor skills (the Early Skills Inventory – Revised; Meisels et al., 1997), and emergent literacy skills (the Test of Preschool Early Literacy; Lonigan et al., 2007). Hierarchical regression analyses were conducted to examine the potential moderating association between fine motor skill and self-regulation on emergent literacy skills. **RESULTS:** Replicating extant literature, self-regulation was a statistically significant predictor of emergent literacy skills, $\beta = 0.51, R^2_{adj} = 0.26, p < 0.001$. Novel to the current investigation, fine motor skills were found to moderate this relationship ($\beta_{self-regulation} = 0.53, \beta_{fine\ motor\ skills} = 0.42, \beta_{interaction} = -0.22; R^2_{change} = 0.10; p \leq 0.03$) such that higher fine motor skills were associated with enhanced emergent literacy skills in children with lower levels of self-regulation, but the impact of fine motor skills was attenuated for children with higher levels of self-regulation. **CONCLUSION:** These findings suggest that physical activity interventions designed to enhance fine motor skills could be beneficial in populations with low self-regulatory abilities, given the compensatory relationship between self-regulation and fine motor skills.

2299 Board #218 May 28 2:00 PM - 3:30 PM
Association Of Physical Health And Exercise Intervention With Stress, Depression And Life Satisfaction Among Chinese College Students
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 (No relevant relationships reported)

PURPOSE: This study explores the relationship between Chinese college Students' different levels of physical health and their perceived stress, depression and life satisfaction, then to analyze the impact of university exercise intervention courses on the above-mentioned mental health. **METHODS:** The sample consisted of 991 college students (Males: $N=371$, Age: $M=19.07$ years old) who were voluntarily enrolled in a 10-week weekly exercise intervention course in a famous university of china fitness courses, personal net-separating courses, collective antagonism courses. Before exercise intervention, they uniformly scored physique tests according to the requirements of the National Standards for Physical Health of Students. Perceived Stress Scale (Sheldon Cohen, 1994), Center for Epidemiological Studies Depression (Hann, Winter & Jacobsen, 1999) and Life Satisfaction Scale (Dew & Huebner, 1994) were filled in before and after exercise intervention. **RESULTS:** The better the physical health of College students, the higher their life satisfaction ($R=-0.121, P<.01$), and the lower their perceived stress ($R=-0.085, P<.01$) and depression level ($R=-0.052, P<.05$). Significant decreases were observed for depression in genders, grades and sports courses ($T=12.056, P<.01$). The students whose physical health level are "excellent" ($F=-3.421, P<.05$), "good" ($F=-1.728, P<.01$) and "pass" ($F=-1.003, P<.05$) have lower perceived stress level than the students whose physical health level is "failed". And whose physical health level are "excellent" ($F=4.598, P<.01$), "good" ($F=2.592, P<.01$) and "pass" ($F=1.859, P<.01$) have better life satisfaction than those whose physical health level is "failed". **CONCLUSIONS:** Students with better physical health have significantly higher life satisfaction, lower perceived stress and depression. Physical education course plays an active role in regulating the perceived depression of College students.

2300 Board #219 May 28 2:00 PM - 3:30 PM
Coping Skills Of Wildland Firefighters
 L. Donovan Robinson, Michael C. Meyers, FACSM, Shad K. Robinson. *Idaho State University, Pocatello, ID.*
 (No relevant relationships reported)

Nearly 14,000 firefighters are employed to combat wildland fires resulting in 13 fatalities and 270 injuries per year. Their ability to cope during stressful situations is critical for optimal performance to prevent morbidity and mortality. **PURPOSE:** To quantify the coping skills of wildland firefighters. **METHODS:** Following written informed consent, a modified Athletic Coping Skills Inventory (ACSI): coping with adversity (COPE), peaking under pressure (PEAK), goal setting/mental preparation (GOAL), concentration (CONC), freedom from worry (FREE), confidence and achievement motivation (CONF), coachability (COACH), and personal coping resources (PCR) and a modified Sports Inventory for Pain (SIP): direct coping (COP), cognitive (COG), catastrophizing (CAT), avoidance (AVD), body awareness (BOD), and total coping response (TCR) were completed by 140 wildland firefighters (mean age = 28.5 ± 13.9 yrs). Data were grouped by occupation (hotshot, smokejumper), job description (supervisor, manager, worker), and years of experience (1-9, 10-19, 20+). Raw ACSI and SIP scores were converted to normalized standard scores (T-scores; mean = 50, SD = 10). **RESULTS:** MANOVAs (Wilks' λ criterion) had a significant main effect by job description ($F_{8,139} = 1.919, p = .019$) and years of experience, ($F_{8,139} = 1.835, p = .027$) but not occupation ($F_{8,139} = 1.53$). Post hoc analysis indicated that supervisors scored significantly higher on PEAK ($p = .028$) than managers and workers, respectively. Post hoc analysis indicated 20+ yrs of experience scored significantly higher on FREE ($p = .031$), while 10-19 yrs scored significantly higher on PEAK ($p = .045$). In terms of pain coping, MANOVA indicated a significant main effect by occupation ($F_{6,139} = 3.104, p = .011$). Post hoc analysis indicated that hotshots scored significantly higher on CAT ($p = .014$) AVD, ($p = .002$) but lower BOD ($p = .008$) than smokejumpers, respectively. No other significant main effects were observed. T-scores indicated average to lower than average (39-56) responses from wildland firefighters. **CONCLUSIONS:** It is recommended that occupational psychologists be employed to enhance the coping skills training involving wildland firefighters.

2301 Board #220 May 28 2:00 PM - 3:30 PM
Sentiment Analysis Of Journal Articles, Press Releases, And News Articles Pertaining To Chronic Traumatic Encephalopathy

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(No relevant relationships reported)

PURPOSE: Previous research has called for media balance when reporting on chronic traumatic encephalopathy (CTE) in order to avoid harmful bias towards readers. This call is raised from concerns that the media's representation of CTE has moved beyond what science has proven. The purpose of this study was to use word sentiments to directly compare journal articles with corresponding news articles to evaluate these concerns. The news articles were split into three groups: press releases reporting the articles' findings, news articles about CTE from upper tier news outlets, and articles from lower tier news outlets.

METHODS: Research articles (n=10) directly associated with CTE that were heavily covered in the media were selected for this sample. An equivalent number of press releases (n=10), upper tier articles (n=10), and lower tier articles (n=10) were collected in order to compare semantics. The "AFINN" sentiment analysis dictionary rates the emotional valence of each word with an integer between minus three (negative connotation) and plus three (positive connotation). Words not recognized by the dictionary or with a zero weight were omitted from the analyses. Mean sentiment score was adjusted for total word count.

RESULTS: The mean sentiment scores, adjusted were words count, were as follows: 0.086 for journal articles, -0.096 for press releases, -0.122 for upper tier sources, and 0.026 for lower tier sources. An analysis of variance calculation yielded no significant differences between the groups (F = 1.058, p = 0.379).

CONCLUSIONS: Despite recent calls for a less biased reporting of CTE in mainstream media, our analysis indicates essentially equal sentimental weighting between peer-reviewed journal articles and news reports on CTE, whether the report was a press release, an article from an upper tier source, or from a lower tier source. Additionally, these sentiment weights each approached a value of zero (true neutrality). Future research should take into account the context in which the words appears in the articles in addition to using sentiment averages.

2302 Board #221 May 28 2:00 PM - 3:30 PM
Abstract Withdrawn

2303 Board #222 May 28 2:00 PM - 3:30 PM
Does ACL-reconstruction Lead To Higher Use Of Neural Resources To Prepare & Initiate Challenging Jump-landings?

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(No relevant relationships reported)

Increased cortical motor planning has been suggested to compensate the loss of mechanoreceptors after anterior cruciate ligament (ACL) injury in simple motor tasks. **PURPOSE:** To investigate the cortical processes associated with more sports- and injury-related movements. **METHODS:** Ten males with ACL-reconstructed knee (28±4 yrs., 25±3 kg/m², 63±35 months since surgery; ACLR) and 17 knee-injury free controls (28±4 yrs., 26±3 kg/m²; all males) completed 70 counter-movement jumps with single-leg landings on a pressure plate. Pre-planned (landing leg shown before take-off; PP) and non-pre-planned (visual cue during flight, 360 ms prior ground contact; NPP) landings (35 each) were performed in random order. Movement-related cortical potentials (MRCPs) were analysed to quantify the neural involvement needed to initiate the jump (higher negative potentials indicate more motor planning) using electroencephalography. The mean activity was calculated for fronto-central (FC1, FC2) and central electrodes (C3, C4, CZ) in three successive epochs prior to movement onset (acceleration sensor): Early (-1.500 to -1.000 ms; RP1), late readiness potential (-1.000 to -500 ms; RP2) and negative slope (-500 to 0 ms/movement onset; NS). **RESULTS:** In both groups, MRCPs occurred at CZ only. A 3 x 2 ANOVA revealed a main effect for a significant increase of negativity (ACLR: F(16)=36, p<0.001, eta=0.8; controls: F(9)=22, p<0.001, eta=0.6) across the three epochs (ACLR_{pp}: RP1:-0.8, RP2:-1.8, NS:-5.8 μV, p<0.01; ACLR_{npp}: RP1:-0.9, RP2:-3.2, NS:-8 μV, p<0.01; controls_{pp}: RP1:-0.2, RP2:-1.8, NS:-5.9 μV, p<0.01; controls_{npp}: RP1:-0.2, RP2:-1.1, NS:-4.3 μV, p<0.01). Between groups, no significant effects were found for time (F(26)=0.2, p=0.9), landing condition (F(26)=1.3, p=0.3) nor the interaction of both factors (F(26)=2.0, p=0.2). However, the ACLR-group showed a moderate effect for a higher negativity at all epochs in the NPP condition (d≥0.5). **CONCLUSION:** Our

jump-landing task evoked MRCPs irrespective from group and condition. The trends in our data suggest that ACLR-individuals may use more motor planning resources to initiate a challenging motor task. Research is warranted to elucidate the possible implications of such potential central compensations for injury risk. No funding.

2304 Board #223 May 28 2:00 PM - 3:30 PM
Study On Correlation Between Cognitive Function And Exercise Intensity, Frequency And Types Of People At Advanced Age

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(No relevant relationships reported)

PURPOSE: To explore the correlation between cognitive function and exercise intensity, frequency and type of people at advanced age.

METHODS: 418 elderly people aging from 80 to 85 were recruited from Shangdi community, Haidian District, Beijing, China from April to August 2019. Based on scores of Mini-Mental State Exam (MMSE) of the elderly, the elderly were divided into normal group (≥ 27 points), cognitive impairment group (< 27 points), dementia group (Reference MMSE). To investigate sports in the past five years by surveying the elderly and their family members. Exercise intensity (refer to the "metabolic equivalent table of common daily life, entertainment and work activities") classification: 1-1.9met (eating, dressing, washing hands), 2-2.9met (walking less than 3km / h, simple housework), 3.0-4.4met (cooking, housekeeping, medium speed walking, Tai Chi), 4.5-5.9met (fast walking, jogging), > 6met (running); exercise type: housework exercise, leisure sports, sports; sports frequency: 1-2 times / week, 3-4 times / week, ≥ 5 times / week. **RESULTS:** A total of 401 effective questionnaires (96%) were collected. Except 91 of them who had interrupted their normal exercise habits due to emergencies such as diseases in the past five years, the rest 310 were investigated, including 95 cases in the normal group, 168 cases in the cognitive impairment group and 47 cases in the dementia group (mild, moderate and severe); The rate of exercise in MMSE score normal group with metabolic equivalent between 2-4.5MET was high, compared with that of cognitive impairment group and dementia group (P<0.05). Frequency of exercise in MMSE score normal group and cognitive impairment group was high, compared with that of dementia group (P<0.05). There was no correlation between the MMSE score and the type of exercise.

CONCLUSIONS: Long-term participation in the exercise with metabolic equivalent between 2-4.5met/people at advanced age can slow down the occurrence of cognitive dysfunction, so does the high exercise frequency (≥ 5 times / week). There is no evident correlation between exercise type and cognitive function of people at advanced age.

2305 Board #224 May 28 2:00 PM - 3:30 PM
Exercise's Effect On Reaction Time And Answer Accuracy During Memory Recall

Lucas Van Horn. West Chester University of Pennsylvania, West Chester, PA. (Sponsor: Dr. William A. Braun, FACSM)

(No relevant relationships reported)

Short and long-term memory recall can be improved by regular exercise, based on rat and human brain studies. Regular exercise, by promoting brain blood flow, has been shown to decrease the rate of decline of memory consolidation and recall in adults. Acute exercise can cause an immediate increase of blood flow to the brain thus potentially increasing oxidative supply for memory encoding. Conversely, a hyperglycemic state may interfere with memory encoding. **PURPOSE:** To determine the effects of light exercise (LEC), heavy exercise (HEC), and exogenous glucose (GLU) on reaction time and response accuracy during a computer-based memory recall test. **METHODS:** 15 subjects (20.80±1.26 yr) completed four trials: resting control (CON), low-intensity cycling (LEC), heavy cycling (HEC), and resting glucose (GLU): a 25% glucose solution supplied at 1g/kg of body mass followed by a 25 min rest. For each trial, subjects observed 75 images prior to the assigned treatment and were then asked to recall the images after the treatment. During the post-test, 25 images were replaced with new images; subjects were then asked to recall whether the images had been viewed during the pre-test. Accuracy and reaction time (RT) were assessed. Exercise trials (20 min) were conducted using 20% (LEC) and 40% (HEC) of Wingate anaerobic test work rate. Blood lactate, glucose, and heart rate were collected at specific time points throughout. **RESULTS:** Mean HR was significantly increased during LEC and HEC (117 ± 14.4 bpm and 161 ± 16.5 bpm, respectively) (p < 0.05) vs. CON (68.0±9.4 bpm) and GLU (67.8±7.7 bpm). Blood glucose was significantly increased during GLU (p < .001) and blood lactate significantly increased during HEC (p < .001) vs. all conditions. Despite these physiologic alterations, no main treatment effects were observed for reaction time (RT), or accuracy. However, RT was significantly faster for correct responses (1005.10 ± 22.0 ms) compared to incorrect responses (1328.2±46.5 ms) across all treatments vs. CON (p < .001).

CONCLUSION: Based on the study results, different physiologic stressors resulting from acute exercise or hyperglycemia elicited no positive or adverse effects on short-term memory recall. Though, treatments were associated with a greater RT in selecting correct responses.

2306 Board #225 May 28 2:00 PM - 3:30 PM
A Single Bout Of Aerobic Exercise Improves Cognitive Function In Older Adults
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 (No relevant relationships reported)

A Single Bout of Aerobic Exercise Improves Cognitive Function in Older Adults
 Changes in cognitive function commonly occur in older adults. These changes can range from mild cognitive impairment to dementia. With the number of older adults projected to double in the next 30 to 40 years, it is important to determine interventions capable of improving cognitive function in this sector of the population. **PURPOSE:** To determine if a single bout of moderate intensity aerobic exercise improves cognitive function in older adults. **METHODS:** Older adults were recruited from an independent living community to participate in a single 20-minute bout of moderate intensity exercise performed on a recumbent stepper. Immediately before and 10 minutes after the bout of exercise, participants completed the pattern comparison cognitive assessment to determine the impact of a single bout of aerobic exercise on cognitive function. This instrument includes 30 problems with two patterns side by side per problem where participants denote whether the patterns are the same "s" or different "d" during the 30 second time limit given. Results were scored as correct or incorrect and a higher overall score reflects better cognitive functioning. A paired-samples t-test was used to compare pre- to post-exercise cognitive function scores. Results were considered significant at $p < 0.05$. **RESULTS:** Participants included 23 adults between the ages of 69 and 94, with an average age of 81.91. Of those, 5 were males and 18 were females. There was a significant improvement from pre to post aerobic exercise in the number of correct responses on the cognitive assessment ($pre = 11.95 \pm 3.60$, $post = 13.13 \pm 2.80$, $p < 0.01$). **CONCLUSION:** A single 20-minute bout of moderate intensity aerobic exercise can improve cognitive function in older adults. With a dramatic increase in the number of older adults in the United States, research on mitigating the decline in cognitive function, such as through exercise, is imperative to meet the needs of this growing segment of the US population.

D-69 Free Communication/Poster - Neuroscience

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
 Room: CC-Exhibit Hall

2307 Board #226 May 28 2:00 PM - 3:30 PM
Assessment Of Neurologic Function In Mixed Martial Arts Fighters Following A Single Competition
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 (No relevant relationships reported)

Head strikes are legal and commonly used in mixed martial arts (MMA) competitions, putting MMA fighters at substantial risk for brain injury. Following a knockout (KO) or technical KO (TKO), fighters typically receive time-based medical suspensions that do not include objective determinations for safe return-to-play. Fighters who do not suffer a KO or TKO may not receive any medical suspensions, even though they may have incurred an undiagnosed concussion or subconcussive brain injury. **PURPOSE:** To determine if participating in a single MMA competition is associated with impaired neurologic function of MMA fighters. **METHODS:** Neurologic function of ten amateur and professional MMA fighters (9 men, 1 woman; 26.1 ± 2.6 yr) was assessed before (61 ± 91.8 days; T1) and after (3.8 ± 1.3 days; T2) competition. Control participants (9 men, 1 woman; 27.1 ± 2.7 yr) were assessed on two separate occasions, 38 ± 15.2 days apart (T1, T2). All participants were evaluated for static balance (Wii Balance Board; SB), dynamic balance (Y Balance Test; DB), eye movement speed and accuracy (King-Devick test; KD), near point of convergence (Vestibular / Ocular-Motor Screening; NC), hand-eye reaction time (FITLIGHT Trainer; RT), visuomotor ability (FITLIGHT Trainer, VM), and multiple object tracking speed (NeuroTracker, MOT). **RESULTS:** Two MMA participants lost their competition by KO/TKO (one due to strikes). DB, KD and NC improved significantly in control subjects relative to MMA fighters ($\beta = -0.019$, $P = 0.005$; $\beta = 2.874$, $P = 0.039$; and $\beta = 5.662$, $P = 0.002$, respectively). However, SB, RT and VM improved significantly in MMA fighters relative to control subjects ($\beta = -1.042$, $P < 0.001$; $\beta = -0.017$, $P = 0.037$; $\beta = -0.062$, $P = 0.015$, respectively). Changes in MOT between T1 and T2 were not significantly different between groups ($\beta = 0.257$, $P = 0.285$). **CONCLUSION:** MMA fighters

had deficits in some assessments of neurologic function a few days after competition, yet they seemed to improve in other aspects. Measures of dynamic balance and eye function were impaired relative to control subjects, whereas static balance and reactive movement skills were improved in MMA fighters. Overall, it appears that some aspects of neurologic function may be more susceptible to impairment following MMA competition, though general abnormalities were not present.

2308 Board #227 May 28 2:00 PM - 3:30 PM
Assessment Of Neurological Function In Mixed Martial Arts Fighters Following A Single Training Session
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Mixed martial arts (MMA) is a combat sport that utilizes a variety of striking, grappling, and submission techniques in training and competition. Consequently, MMA fighters routinely incur head impacts that may put them at risk for mild traumatic brain injury (mTBI) and/or neurodegenerative brain disease later in life. Fighters compete rather infrequently, though often train year-round; thus, cumulative exposure to injury is higher during training than competition. However, the neurologic effects of MMA training sessions are unknown. **PURPOSE:** To determine if a single MMA training session is associated with impaired neurologic function of MMA fighters. **METHODS:** Ten amateur and professional MMA fighters (8 men, 2 women; 26.3 ± 2.6 yr) were evaluated at baseline and immediately following an MMA training session (post-training), using several objective assessments of neurologic function. Participants were evaluated for eye movement speed and accuracy (King-Devick test; KD); VOMS, near point convergence (Vestibular / Ocular-Motor Screening; NC), hand-eye reaction time (FitLight Trainer; RT), visuomotor ability (FitLight Trainer; VM), static balance (Wii Balance Board; SB), and multiple object tracking speed (NeuroTracker; MOT). **RESULTS:** Total KD times were significantly faster following a training session (35.86 ± 8.05 vs. 43.34 ± 8.92 s; $P < 0.001$). Likewise, RT (0.43 ± 0.04 vs. 0.48 ± 0.04 s; $P = 0.003$) and VM (1.06 ± 0.22 vs. 1.20 ± 0.25 s; $P = 0.011$) times improved significantly following training. MOT speed (2.15 ± 0.26 vs. 2.03 ± 0.34 m·s⁻¹; $P = 0.442$) and NC distance (5.18 ± 5.12 vs. 6.62 ± 5.85 cm; $P = 0.284$) also improved following training, although these changes were not significant. SB was virtually identical from baseline to post-training (2.27 ± 0.95 vs. 2.27 ± 1.30 cm²; $P = 0.994$). **CONCLUSION:** Compared to baseline measures, some assessments of neurologic function revealed significant changes after a single MMA training session. Contrary to what was expected, all significant changes were the result of improved performance from baseline to post-training. Based on these findings, neurologic function of MMA fighters does not appear to be impaired following a single training session. Furthermore, MMA training bouts may be associated with acute improvements in eye movement, reaction time and visuomotor ability.

2309 Board #228 May 28 2:00 PM - 3:30 PM
Smooth Pursuit And Saccadic Eye Movements Following Years Of Contact Collision Sports: A Pilot Study
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Repetitive head impacts (RHI) are the result of a blow to the head that does not elicit clinical signs or symptoms of a concussion. Recent evidence suggests that RHI from a single season of collegiate football can lead to a reduction in midbrain white matter integrity. The midbrain carries projecting fibers to the trochlear and oculomotor nerves, which if damaged may impair oculomotor control. **PURPOSE:** The purpose of this study was to evaluate oculomotor function following multiple years of Division I contact sports during a dynamic visual acuity (DVA) task. **METHODS:** Two NCAA Division I football defensive backs with no diagnosed concussion history (a first-year freshman [F1; age=18 years], senior [S1; age=21 years]) and a healthy control (CON; age=23 years), all with lower than 20/20 vision, completed a DVA task at pre-season. For the DVA task (optotype spatial range=1.0 to -0.3), participants were asked to complete 60 randomized trials of smooth pursuit (30°/s) and saccades (150°/s). Participants head were stabilized in a chin rest at a distance of 154cm away from the 26° visual field monitor (165Hz, 2560 x 1440 pixel resolution, 300 cd/m² luminance) while wearing a head-mounted binocular video ophthalmography eye tracker (Eyelink SR research, 500 Hz, Ottawa, CN). Using a 2-up-1-down staircase method, participants tracked a Landolt-C ring that moved across the screen (horizontally left to right) where the size of the gap in the C along with the orientation (left, right, up or down) adjusted based on the correct/incorrect responses during both smooth pursuit and saccadic trials. Smooth pursuit eye movement (SPEM) velocity gain and saccadic peak velocity were calculated using ternary eye movement classification from the transformed spherical coordinates via a custom MATLAB code (MATLAB 2019a, Natick, MA, USA).

No statistical analysis were performed given the single-subject design. **RESULTS:** SPEMs gain is lower for S1 (0.88) when compared to F1 (0.82) and CON (0.92). Similarly, during the saccadic trials, S1 had slower average saccadic peak velocity (S1=279.75°/s; F1=392.34°/s; CON=491.96°/s). **CONCLUSIONS:** These results may indicate that engaging in contact collision sport for 2+ years at the Division 1 level may result in less accurate (lower SPEMs gain) and slower saccadic eye movements. Supported by NIH P20GM103650

2310 Board #229 May 28 2:00 PM - 3:30 PM
Submaximal Exercise Does Not Increase Brain-Derived Neurotrophic Factor (BDNF) In People With Spinal Cord Injury

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Brain-derived neurotrophic factor (BDNF) has been implicated in repair and regeneration of peripheral neurons, and is important for brain health. Acute exercise (EX) increases circulating BDNF in an intensity dependent manner in able-bodied individuals. However, the response of BDNF to EX in people with spinal cord injury (SCI) is poorly understood. **PURPOSE:** to investigate the hypothesis that submaximal EX will increase serum and plasma BDNF in people with SCI. **METHODS:** Nine adults with SCI participated (M age = 39.2 ± 11.0 years; M years post-injury = 16.5 ± 9.2). After completing a maximal exercise test on an electromagnetically braked arm-crank ergometer to determine peak power output (PPO), participants completed two visits in randomized order: 1) submaximal EX (30 minutes maintaining 55-65 rpm @ 60% PPO); and 2) seated control (CTL). Ratings of perceived exertion (RPE) were measured during EX using the 6-20 visual Borg RPE scale. Heart rate (HR) and blood pressure (BP) were measured pre- and post-EX. BDNF was measured via ELISA in both serum and plasma from venous blood sampled at pre-, post-, and 90 min post-EX. For the CTL visit, participants rested quietly for 120 min and blood was sampled at equivalent time points to EX. A 2-factor repeated measures ANOVA was computed to assess BDNF responses by time and condition. Paired t-tests were computed to assess HR and BP responses to EX. Pearson correlations were computed to explore relationships between BDNF and physiological responses to EX and work rate. **RESULTS:** The average EX work rate was 47 ± 17 W and RPE was 13 ± 1. HR increased by 26 ± 33 bpm (+41%; p=0.059), whereas systolic and diastolic BP remained unchanged after EX. Contrary to our hypotheses, EX had no effect on serum (Pre vs. Post-EX = 22447.9 ± 9071.1 pg/mL vs. 26552.8 ± 6563.4 pg/mL; $F_{(1,12)} = 0.51$, p=0.53) or plasma (Pre vs. Post-EX = 1802.7 ± 1031.1 vs. 1662.7 ± 1390.0 pg/mL; $F_{(1,10)} = 0.77$, p=0.45) BDNF. Exploratory correlational analyses showed no relationships between changes in BDNF and the outlined parameters. **CONCLUSIONS:** Submaximal EX did not increase BDNF in people with SCI. Future studies should systematically investigate BDNF responses to higher EX intensities given the intensity-dependent response in able-bodied people. **FUNDING:** Rick Hansen Foundation through the Blusson Integrated Cures Partnership

2311 Board #230 May 28 2:00 PM - 3:30 PM
Beyond The Runners High: Cannabis And Exercise
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Cannabis use has been gaining wider social acceptance, and with increased legalization cannabis users are talking more openly about how and why they consume cannabis. While there is growing interest in combining cannabis with physical activity, there is a distinct lack of cannabis research in humans, particularly as it relates to physical activity. **PURPOSE:** To investigate how and why people use cannabis with exercise as well as categorizing the types of exercise users engage in. **METHODS:** 126 subjects (n = 63 male, 62 female, 1 non-binary) were recruited to complete an anonymous online survey if they reported both participation in regular physical activity and cannabis use. The survey consisted of five sections: cannabis with exercise, general exercise participation, general cannabis use, unanticipated experiences, and demographics. **RESULTS:** Over 44% of participants reported that they use cannabis every or almost every time before they exercise. Most smoke cannabis (53%) and use Sativa-dominant strains (65%) before exercise. Only 18% of participants used non-psychoactive CBD products during exercise. The highest reports of exercise participation under the influence of cannabis include hiking (61%), yoga (58%), aerobic machines (50%), walking (43%), and weight lifting (43%). The primary reasons for using cannabis before exercise include: helps me focus/concentrate (66%), helps me enjoy exercise (65%), enhances mind-body-spirit connection (64%), keeps me in the zone (61%), and enhances body awareness (52%). The majority (70%) of respondents reported feeling

more satisfied with their workouts under the influence of cannabis compared to when they do not use cannabis prior to exercise and have not suffered any unanticipated experiences (61%). **CONCLUSIONS:** This is the first study to investigate how and why people use cannabis with exercise. This study provides a starting point for future studies investigating the impact that cannabis consumption has on exercise participation and performance.

2312 Board #231 May 28 2:00 PM - 3:30 PM
Impact Of Exercise Intensity On Cue Reactivity In Heavy Alcohol Users

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Physical exercise has been shown to reduce craving for alcohol in alcoholics. There is a high prevalence of heavy alcohol use in college-aged adults (18-29 years of age). This can be predictive of an alcohol or other substance use disorder developing later in life. Acute exercise alters cue reactivity to addictive substances but it is unknown if the magnitude of change in cue reactivity is impacted by exercise intensity. **PURPOSE:** The purpose of this investigation is to examine the impact of acute aerobic exercise of varying intensities on cue reactivity to alcohol in heavy alcohol users. **METHODS:** Nine participants (8 females, 1 male) (Age = 21.5 ± 0.5 years, BMI=23.9 ± 0.1, $VO_{2Max}=32.25 \pm 1.06$ ml·kg⁻¹·min⁻¹) completed 3 experimental sessions. Heavy alcohol use was identified using an adapted version of the CAGE questionnaire. During one session subjects rested (REST) for 30 minutes and during the other two sessions subjects exercised for 30 minutes at a moderate (MOD: 53 ± 7% of Peak HR) or vigorous (VIG: 76 ± 2% of Peak HR) exercise intensity. Sessions were randomized for each participant. Prior to and immediately following each session, EEG data were collected using a 64-channel system while subjects were exposed to 210 images (90 alcoholic drinks (ALC), 90 non-alcoholic drinks (NON), 30 control images). Images were presented in a random order and proceeded by a fixation stimulus using a variable time span (0.5 to 1.5 sec). Adaptive mean amplitude for P300 (210-240 ms post stimulus) and mean amplitude for the late positive potential (LPP) (400-600 ms post stimulus) were calculated in parietal-occipital electrodes. **RESULTS:** The P300 response to ALC increased from pre to post in both REST (pre=2.69 ± 0.72 μV, post=3.41 ± 0.52 μV; p=0.002) and VIG (pre=1.62 ± 0.40 μV; post=2.95 ± 0.51 μV, p<0.001) conditions. In comparison, the P300 response to ALC decreased in the MOD (pre=1.31 ± 0.29 μV; post=0.66 ± 0.32 μV, p<0.001) condition. The LPP to ALC was much greater after REST (2.55 ± 0.69 μV) than after MOD (-0.10 ± 0.32 μV; p<0.001) and VIG (0.73 ± 0.78 μV; p=0.003). **CONCLUSION:** These findings suggest that the impact of exercise on cue reactivity to images of alcohol in heavy alcohol users is dependent on exercise intensity. Specifically, it appears that moderate intensity exercise has a greater benefit than vigorous exercise.

2313 Board #232 May 28 2:00 PM - 3:30 PM
Age Of First Exposure Influences Cerebrovascular Reactivity In High School Football Athletes
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Late-life physiological and clinical impairments are associated with age of first exposure (AFE) to tackle football. There is a dearth of literature describing how AFE may influence physiological outcomes in current high school football athletes. Cerebrovascular reactivity (CVR) measures the cerebral blood flow response to variations in carbon dioxide partial pressures. Understanding how AFE affects cerebrovascular function in high school athletes may offer insight into potential long-term deficits following cumulative head impact exposure. **PURPOSE:** To investigate how the age at which high school football athletes began playing tackle football influences baseline CVR. **METHODS:** High school football athletes [n=29; age=15.8 ± 1.1 yrs; height=175.8 ± 8.1 cm; mass=75.1 ± 12.6 kg] self-reported AFE (median AFE=13 years old, range=5-15). Transcranial Doppler (TCD) ultrasound was used to assess middle cerebral artery velocity (MCAv) prior to beginning the competitive season. Baseline MCAv was collected for 2 minutes. Changes in MCAv were measured in response to 5 breath-holding trials (20s breath-hold/40s rest) and 5 hyperventilation trials (20s hyperventilation/40s rest). We employed separate mixed effects models with quadratic mean structures to assess group differences in MCAv response to breath-holding and hyperventilation tasks. **RESULTS:** The AFE significantly predicted CVR during breath-holding ($F_{(1,170)}=5.27$, p=0.02) and hyperventilation ($F_{(1,170)}=4.08$, p=0.04). One-year increases in AFE were associated with a 0.69% reduction in average CVR response during breath-holding and a 0.58% increase in average CVR during hyperventilation. **CONCLUSIONS:** Though AFE is associated with CVR in high school football players, the underlying mechanisms driving the observed results

are unclear. The effect of cumulative head impact exposure at the high school level is understudied despite long-term neurophysiological deficits reported in retired professional football players. Studying neurophysiological responses in young football players may provide important insights into addressing cerebrovascular function and other late-life physiological health in athletes.

2314 Board #233 May 28 2:00 PM - 3:30 PM
Validation Checks Decrease Sandbagging On Baseline Neurocognitive Tests

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PURPOSE: To examine whether a second baseline test (Group 2B) in those scoring an invalid first test on CNS Vital Sign (CNSVS) is comparable to those achieving a valid baseline initially (Group 1).

METHODS: This is a retrospective cohort of 817 Division I collegiate student-athletes ages 17-26 who completed at least one valid baseline examination. Subjects were asked to complete a pre-participation computerized neurocognitive test (CNSVS) and those with invalid baseline exams were retested. The valid scores for the retest-group (Group 2B) were compared to subjects who earned a valid baseline exam on their first visit (Group 1). Standard scores were included for all CNSVS domains. The mean scores for all outcome variables of Group 1 and Group 2B were compared using ANOVA analyses with significance set at $p=0.05$.

RESULTS: In the majority (11/13) of cognitive test scores, subjects with an initial invalid baseline performed similarly in their second attempt (Group 2B) compared to subjects who had a valid baseline exam after one attempt (Group 1). The general memory (92.17 ± 15.56) and visual memory (93.26 ± 13.21) scores for Group 2B remained significantly lower than Group 1 (99.96 ± 15.15 ; 101.33 ± 13.97) ($p=0.015$, $p=0.006$), respectively, while motor speed for the re-test group (109.91 ± 12.48) was significantly higher than Group 1 (102.90 ± 12.30) ($p=0.02$). Interestingly, the total test time (seconds) and the testing duration (seconds) were significantly faster ($p < 0.001$; $p=0.008$) during the second testing session (Group 2B = 1745.74 ± 205.72 ; 1599.09 ± 196.59) compared to the those who earned valid scores in their initial attempt (Group 1 = 2042.53 ± 276.76 ; 1693.53 ± 167.16) respectively.

CONCLUSIONS: Subjects initially completing an invalid baseline examination for concussion testing show significantly worse results than their peers who complete valid baseline tests initially, but these poor results do not persist when given a retest. When computerized neurocognitive tests include validity measurements, "sandbagging" of results can be significantly mitigated, improving overall accuracy of post-injury concussion monitoring, thus decreasing the probability of returning an athlete too early following a concussive injury.

2315 Board #234 May 28 2:00 PM - 3:30 PM
NEUROPHYSIOLOGICAL CHANGES AFTER UPPER AND LOWER LIMB GRADED EXERCISE TESTING.

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Aerobic exercise, including graded exercise testing (GXT), may cause neurophysiological changes of circuits in the primary motor cortex (M1) related to mechanisms of fatigue and/or plasticity. Investigating M1 inhibitory circuit changes over time in exercising compared to non-exercising muscles after GXT of the upper limbs (UL) and lower limbs (LL) may distinguish between different post-exercise mechanisms. **PURPOSE:** To evaluate M1 inhibitory circuit changes resulting from UL and LL GXT and determine their associations with fitness. **METHODS:** Six healthy subjects (30 ± 6 yrs) participated. Transcranial Magnetic Stimulation (TMS), Peripheral Nerve Stimulation (PNS), and Electromyography (EMG) were used for neurophysiological testing. Gas analysis was performed to evaluate VO_{2max} (UL: 24.2 ± 4.8 , LL: 35.1 ± 5.9 mL/kg/min) during GXTs. Surface electrodes were placed over the first dorsal interosseous (FDI) and tibialis anterior (TA) muscles. Measures of M1 and M1-related afferent inhibition included cortical silent period (CSP) and short-latency afferent inhibition (SAI), respectively. SAI inter-stimulus intervals (ISI) between PNS and TMS stimulations were 21-23ms (UL), and 32-35ms (LL). TMS coil orientation (CO) was altered between posterior-anterior (PA) and anterior-posterior (AP) for both measures of CSP and SAI. CSP and SAI were taken 0-45 min (POST1) and 45-90 min (POST2) post-exercise and compared to pre-exercise. Repeated measures ANOVAs were performed to evaluate effects of exercise type, CO, time, and ISI. **RESULTS:** CSP decreased at POST1 and increased at POST2 in FDI ($97.9 \pm 1.2\%$ vs. $104.5 \pm 2.5\%$, $p < 0.05$) with a trend toward significance in TA ($99.3 \pm 2.5\%$ vs. $103.5 \pm 4.9\%$, $p = 0.19$). Although SAI was found for the TA at 32ms ($p < 0.05$) and FDI at 21-23ms ($p < 0.05$), the interaction of exercise type, CO, and ISI did not reach significance after Huynh-Feldt correction (FDI: $p = 0.10$, TA: $p = 0.10$). Univariate linear regression of VO_{2max} and SAI revealed a potential relationship reliant on exercise type and CO (UL: $R^2 = 0.91$, LL: $R^2 = 0.68$). **CONCLUSIONS:** Changes in

CSP suggest that exercise may cause early disinhibition followed by greater inhibition in M1 while changes in SAI may be influenced by fitness levels. Collectively, the results support UL and LL GXTs cause measurable M1 neurophysiological changes.

2316 Board #235 May 28 2:00 PM - 3:30 PM
Vestibular, Spatial Cognition And Mental Fatigue Status Of Female Soccer Players Before A Competitive Season

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PURPOSE: To examine visual-vestibular interaction and the relationship to visuospatial cognition, mental fatigue, and concussion history in female soccer players before the start of a competitive season. **METHODS:** Twenty-four NCAA Division 1 women's soccer athletes participated in the study. All players completed medical history including dates and number of prior concussions. Vestibular and visual interaction was assessed using the Dynamic Visual Acuity Test (DVAT) which examines the loss in visual acuity when the head is moving in the yaw plane at 85 deg/sec or more compared to head stationary. Visuospatial cognition was assessed using the Symbol Digit Modalities Test (SDMT) and the Ray-Osterrieth Complex Figure (ROCF) while current fatigue level was assessed using the Mental Fatigue Scale (MFS). Spearman's correlations examined the correlations between DVAT loss and MFS, SDMT, and ROCF. Comparison of MFS, SDMT score, and ROCF score between groups based on number of concussions was completed using t-tests.

RESULTS: Of the 24 participants (mean age 19.3 ± 1.3), 15 had a prior history of concussion (range 1-7). Mean loss of visual acuity in the pitch plane in logMAR upwards was 0.14 ± 0.08 and downwards was 0.19 ± 0.1 , and in the yaw plane was 0.15 ± 0.08 to the right and 0.14 ± 0.1 to the left (normative values for this age group are 0.08 ± 0.17 logMAR). The SDMT score was 59.88 ± 6.7 , ROCF score was 29.9 ± 5.4 , and MFS score was 6.9 ± 5.8 . Spearman's correlations showed significant relationships between DVAT loss to the right ($p=0.04$) and mental fatigue ($p=0.04$). Comparisons of athletes who had sustained 2 or more concussions compared to those with 0-1 showed significant differences in the MFS ($p=0.03$).

CONCLUSIONS: Greater loss of dynamic visual acuity was seen in female soccer players before the start of a competitive season. Gaze stability deficits are correlated with higher mental fatigue and athletes who had 2 or more concussions had more mental fatigue.

2317 Board #236 May 28 2:00 PM - 3:30 PM
Stress Response And Performance Changes Of Law Enforcement Officers' Marksmanship Under Varied Levels Of Stress

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PURPOSE: To investigate changes in shooting performance of law enforcement officers under varying levels of stress. This study determined how increasing levels of stress from operating a firearm on static targets changed when participants were subjected to simulated life threatening situations.

METHODS: Thirteen law enforcement officers completed three trials of handgun shooting trials using a battery-operated laser marking pistol. Trial one included a modified course from the Illinois State Firearms Qualification Course of Fire. Officers completed two separate simulation trials separated by 48 hrs (SIMCON1, SIMCON2). Each officer engaged in dangerous encounters with virtual suspects using a TI Simulator (TI Training, Golden, Colorado) requiring each officer to draw his weapon and fire against an armed assailant. Heart rate, blood pressure, salivary cortisol, and shooting performance data were collected throughout the courses of fire.

RESULTS: Compared with the qualification course of fire (99.23% hit rate of intended target), there was a statistically significant reduction $p < .001$ in percentage of shots hit during both SIMCON1 (hit rate 47.48%) and SIMCON2 (hit rate 50.13%) conflicts. Compared to trial 1 mean heart rate increased 16.46 BPM and 19.7 BPM and systolic blood pressure 18.77 mm Hg and 23.08 mm Hg respectively for SIMCON1 and SIMCON2 trials. Although a significant physiological effect was noted following both SIMCON trials, it did not statistically correlate with poor marksmanship performance.

CONCLUSIONS: Future research should collect physiological variables such as heart rate and blood pressure when the officers are on duty. This real-life situation would likely heighten the physiological responses versus that of simulated setting used in this study. It may provide better insight how real-life scenarios may negatively affect marksmanship performance.

2318 Board #237 May 28 2:00 PM - 3:30 PM
Effects Of Treadmill Exercise On DCX And A Beta1-42 In AD Mice

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PURPOSE: To investigate the effects of different load exercise on the hippocampal neurogenesis markers DCX and Aβ1-42 in adult AD mice.

METHODS: The 3-month-old APP/PS1 dual-transgenic AD mice were randomly divided into four groups: Control group(ADC), Low-load exercise group(ADL), Medium-load exercise group(ADM) and High-load exercise group(ADH), Wild-type control group(WTC) was also set, 6 mice in each group. ADC and WTC group mice were fed naturally for 5 months. Intervention with different loads of aerobic exercise for every exercise group. Low load running speed was 12 m/min, medium load running speed was 15 m/min, and high load running speed was 18m/min. 5d/w for 30 min/d for 5 months. Then, the Morris Water Maze (MWM) test was performed to estimate mice' learning and memory abilities, the immunofluorescence technique was used to determine the expression levels of DCX and Aβ1-42 in the hippocampus.

RESULTS: (1) In the process of navigation training, all mice' escape latencies gradually shortened. On the second day, the average escape latency of the ADC group was significantly higher than that of the WTC group ($p<0.05$). Compared with the ADC group and the ADL group, the mice in the ADM group were significantly reduced from the third day, and the mice in the ADH group were significantly reduced from the fourth day ($p<0.05$). In the MWM navigation experiment, for the time of through the area of the original platform, ADC group was significantly reduced than WTC group ($p<0.01$), ADM group and ADH group was significantly higher than ADC group and ADL group ($p<0.01, p<0.05$). (2) Compared with WTC group, the expression of DCX in ADC group was lower but Aβ1-42 was higher ($P<0.05$). Compared with ADC group, the expression of DCX in every exercise group was higher but Aβ1-42 was lower ($P<0.05, P<0.01$). Compared with ADL group, the expression of DCX in ADM group was higher but Aβ1-42 was lower ($P<0.05$).

CONCLUSIONS: Medium and high load exercise can significantly improve the spatial learning and memory ability of AD mice. Exercise, especially medium load exercise, can enhance the expression of DCX in AD mice and reduce the expression of Aβ1-42 in hippocampal.

2319 Board #238 May 28 2:00 PM - 3:30 PM
Effects Of Acute Aerobic Exercise On Working Memory Of Male Smoking College Students: An Erp Study

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 (No relevant relationships reported)

PURPOSE: Studies have shown a relationship between acute exercise and working memory among smokers. However, how acute aerobic exercise affects working memory of smoking college students is still under-researched. The current study was to explore the impact of different intensities of acute aerobic exercise on the working memory using behavioral and ERP assessment.

METHODS: Male smoking college students (n=64) aged 18-22 yrs were randomly selected. After signing the informed consents, they were assigned to a control group with 25-min reading at rest and three cycling exercise groups at light, moderate and high intensity. All participants completed a letter delay- and a space position delay-matching task pre- and post- intervention, both programmed in E-prime software. Reaction time and performance accuracy were measured. ERPs were recorded by NeuroScan EEG system. Amplitude and latency at FZ, FCZ, CZ, and PZ were collected by Curry 7 software. Statistical analyses were conducted with repeated measures ANOVA using SPSS 20.0. An alpha level was set at $P\leq 0.05$.

RESULTS: Three exercise groups had significantly shorter reaction times ($p<0.001$) and higher performance accuracy ($p<0.001$) in both tasks, compared with the control. Moderate exercise exhibited the best scores in both tasks. All exercise groups showed significantly higher accuracy scores in spatial working memory task than those verbal scores. ERP data revealed changes as follow: 1) significant differences were observed in N2 amplitude at FZ ($p=0.048$) and FCZ ($p=0.017$) and in P3 amplitude at FZ ($p=0.002$), FCZ ($p=0.000$), CZ ($p=0.002$) and PZ ($p=0.008$); 2) significant differences were found between different type of stimulus tasks, in N2 latency at FCZ ($p=0.045$) and PZ ($p=0.049$) and in P3 latency at FZ ($p=0.022$), FCZ ($p=0.013$), and CZ ($p=0.014$); 3) all exercise groups exhibited shorter P3 latency than the control at FCZ ($p=0.040$) and CZ ($p=0.031$) with the moderate and high intensity groups showing the shortest.

CONCLUSIONS: Acute aerobic exercise could improve male smoking college students' working memory, attention resource utilization, and cognitive processing speed. Moderate intensity exercise may have the greatest influence on these parameters. Acute aerobic exercise may have beneficial effects on cognition at behavioral and neuroelectric levels.

2320 Board #239 May 28 2:00 PM - 3:30 PM
Prefrontal Theta Rhythm As An Index Of Effortful Activity

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Cognitive tasks that tap executive functions and uncomfortable strenuous physical tasks require a deployment of mental effort. Several psychophysiological studies propose different indexes of this engagement in mental effort: for instance, pupillary dilation, power density of high frequency in heart rate variability, and pre-ejection period. More recently, it has been suggested that slow waves (4-8 Hz) recorded above prefrontal areas may also be a good candidate to assess effort engagement. **PURPOSE:** To determine whether theta oscillations recorded above prefrontal areas are a good index of mental effort deployed in a handgrip task. **METHODS:** Sixteen young voluntary adult participants performed three consecutive tasks in the same session: (1) a handgrip task in which they have to maintain an isometric contraction at 13% of maximal voluntary contraction (MVC) until exhaustion (H1), (2) a 30-min Stroop task aiming to deplete self-control resources and (3) the same handgrip task as previously (H2). A Biosemi system was used to amplify and record electroencephalographic (EEG) and electrooculographic (EOG) signals throughout the experiment. The sampling frequency of EEG was 2000 Hz and the bandwidth ranged between 0.1 and 40 Hz. **RESULTS:** A MANOVA was carried out with Time on task (TOT; T1-T4), Task (H1, H2), and Electrodes location (Fpz, AFz, Fz, FCz, Cz) as repeated measures factors on theta waves spectral density ($\mu V^2/Hz$) recorded during the handgrip task. Theta wave density significantly increased between T1 and T2 and between T3 and T4, during both handgrip tasks (H1 and H2). There was also a significant interaction between the Electrode location and the Handgrip task. Theta wave density was higher during H1 than H2 and this effect was larger on Fpz than on the other electrodes. Perceived effort, pain and fatigue significantly increased throughout both handgrip tasks. Perceived fatigue was higher after H2 than H1. **CONCLUSION:** As expected, theta wave spectral density increased with time on task and particularly above prefrontal areas. However, it is difficult to determine if this biomarker reflects an increase in mental fatigue throughout the task or an increase in mental effort to compensate for the increase in mental fatigue.

2321 Board #240 May 28 2:00 PM - 3:30 PM
Task-specificity Of Corticospinal Excitability: The Influence Of Contractile Properties

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Transcranial magnetic stimulation (TMS) is increasingly applied to investigate neurophysiological function during exercise interventions. Although often assessed in testing modalities that are different than the intervention, neurophysiological function may be task-specific. **PURPOSE:** To compare neurophysiological function between an isometric squat (SQT) and knee extension (KE). **METHODS:** Twenty-two young adults (2 women, 20 right-footed, age: 25 ± 5 yrs, BMI: 25.9 ± 3.1 , VO_2 : 46.2 ± 8.8 ml·kg⁻¹·min⁻¹) performed isometric SQT (N=7) or KE (N=15), with hip-, knee- and ankle-joints fixed at 90° as part of a larger study, exposing participants to operational stress for a 5-day period. Lower extremity strength and muscle activity (RMS) were recorded during maximum voluntary contractions (MVCs), using a linear force transducer and electromyography (EMG) sensors placed over the vastus lateralis, respectively. Motor-evoked-potential (MEP)-based stimulus response curves (SRC) were derived using TMS and a double cone coil placed over the dominant motor cortex leg hotspot during intermittent isometric contractions at 15% MVC. Forty stimuli were applied for two rounds of SRC, with stimulator output (SO) ranging from 5-100% in 5% increments and random order. Since neurophysiological function did not differ across days, grand averaged responses were compared using multivariate ANOVAs or Mann-Whitney U. **RESULTS:** Greater force and muscle activity were evident for KE compared to SQT (Force: 1303.9 ± 407.0 vs. 812.8 ± 189.5 N, $p=0.01$; EMG_{RMS} : 0.04 ± 0.003 vs. 0.06 ± 0.01 , $p=0.03$). KE corticospinal excitability was twice as high compared to SQT (1.4 ± 0.7 vs. 0.7 ± 0.4 mV, $p=0.04$), but similar when normalized to muscle activity (KE: 25.3 ± 13.9 vs. SQT: 17.4 ± 10.7 mV·EMG_{RMS}⁻¹, $p=0.21$). No difference was evident in SRC₅₀ and SRC_{SLOPE} (54 ± 9 vs. $62\pm 14\%$, $p=0.12$ and 5.0 ± 1.9 vs. 4.2 ± 1.1 , $p=0.35$). **CONCLUSION:** Contractile and corticospinal excitability appear to be task-specific, discouraging the assessment of neurophysiological function in modalities that are different from the intervention. Contractile function further seems

to influence corticospinal excitability, which may reflect the underlying differences in neuromechanics between the two movements. Supported by the Department of Defense W81XWH-16-PHTBIRP-CR3A.

2322 Board #241 May 28 2:00 PM - 3:30 PM

FRONTAL ASYMMETRY: A POTENTIALLY NOVEL BIOMARKER FOR SEDENTARY BEHAVIOR

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(No relevant relationships reported)

Consistent with other human behaviors, sedentary behavior appears to be modulated, at least in part, by emotional and motivational processes. Past research has found that various emotion and motivation interactions show different patterns of asymmetric frontal cortical activity (FCA). It is possible that the decision, motivation, or the intention to engage in sedentary behavior may depend on the FCA. However, FCA has yet to be investigated as a potential neurobiological marker to predict sedentary behavior. **PURPOSE:** To examine the relationship between sedentary behavior and resting frontal asymmetry using electroencephalography (EEG). **METHODS:** Forty-five college students participated in this study in exchange for partial course credit. A modified short version of the International Physical Activity Questionnaire was administered to determine habitual level of physical activity and sedentary time. Standard processing of EEG data was performed using BrainVision Analyzer software. Univariate correlation analyses were used to examine the relationship between frontal asymmetry and sedentary time. **RESULTS:** Average number of minutes spent sitting on a weekday ($r(22) = -0.45, p = 0.027$) and on a weekend day ($r(22) = -0.55, p = 0.005$) correlated with relative left frontal activity. **CONCLUSION:** To our knowledge, our data are the first to find a link between neurobiological markers of approach/avoidance motivation and sedentary activity, suggesting that reduced left frontal activity might be a novel neurophysiological marker for sedentary behavior.

2323 Board #242 May 28 2:00 PM - 3:30 PM

Test-retest Reliability Of Cognitive And Neuroimaging Measures In Older Adults

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PURPOSE: Exercise is a promising strategy to help maintain brain function during aging. Determining the efficacy of exercise interventions requires reliable clinical outcome measures. In addition to measurement error and biological variability, long-term test-retest values can also be influenced by biasing factors - namely aging and practice effects. The purpose of this study was to determine the 12-week test-retest reliability of cognitive and neuroimaging measures in older adults. **METHODS:** Twenty healthy older adults (14 females, 60-80 years of age) participated in two sessions of cognitive testing and multimodal 3T MRI scanning (Siemens MAGNETOM Prisma). All tests were performed by a single rater separated by a 12-week control period. The NIH Toolbox Cognition Battery (NIHTB-CB) was used to assess fluid and crystallized cognitive function. T-2 FLAIR images were processed for white matter lesion volume (WMLV, ml) using the Lesion Segmentation Toolbox. T-1 MPRAGE images were processed for gray matter volume (GMV, mm³) in 3 subcortical regions using FrecSurfer cortical segmentation. Statistical analyses were performed in SPSS (v.25) including mean percent difference, effect size, paired t-test, and two-way mixed intraclass correlation coefficient (ICC) with absolute agreement. **RESULTS:** Results are presented in Table 1. There were no significant t-test values indicating good agreement between the two sessions. As expected, reliability was excellent in crystallized cognition and moderate to good in fluid cognition. Last, all brain segmentations showed good to excellent reliability. **CONCLUSIONS:** The long-term (12-weeks) test-retest reliability of standard cognitive and neuroimaging measures were within an acceptable tolerance for use in future intervention studies. Although fluid cognition has the greatest implications for and neurobiological link to cognitive aging, investigators should consider the greater variability in these measures.

12-week test-retest results				
Measure	Mean % Difference ± SD	Effect Size	T-test p-value	ICC (3,1)
NIHTB-CB Fluid Composite Score	0.7 ± 6.4 %	0.06	0.71	0.77
- Attention	1.9 ± 7.2 %	0.21	0.26	0.64
- Working Memory	-1.4 ± 8.2 %	-0.18	0.37	0.69
- Executive Function	1.4 ± 4.5 %	0.17	0.25	0.81
- Processing Speed	-1.3 ± 11.8 %	-0.15	0.49	0.57
- Episodic Memory	3.2 ± 11.7 %	0.19	0.41	0.47
NIHTB-CB Crystallized Composite Score	0.4 ± 3.2 %	0.05	0.59	0.91
- Vocabulary	0.1 ± 3.9 %	0.02	0.88	0.89
- Reading Recognition	0.5 ± 2.5 %	0.07	0.41	0.93
WMLV	-0.1 ± 32.5 %	0.04	0.30	0.98
Caudate Nucleus GMV	4.5 ± 17.4 %	0.07	0.22	0.97
Putamen GMV	1.1 ± 4.8 %	0.07	0.41	0.93
Hippocampus GMV	-1.2 ± 2.5 %	-0.09	0.06	0.98

2324 Board #243 May 28 2:00 PM - 3:30 PM

Aerobic Fitness Is Associated With Greater Cortical Thickness In Functional Connectivity Networks

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Purpose: This study investigated the associations between cortical morphometry of functional connectivity networks and aerobic fitness (AF) in aging adults. **Methods:** Older adults (60-80 yrs; n=205) completed a graded exercise test to measure AF and a structural MRI. Cortical thickness was calculated and parcellated into 7 functional connectivity networks (Yeo et al., 2011). The associations between AF and thickness were investigated by calculating 5000 bootstrapped samples of a correlation coefficient between AF and either whole brain or network parcellated cortical thickness. Age and sex were used as covariates. Whole-brain exploratory analysis was conducted to examine the spatial extent of network morphometry and AF. First, correlation coefficients for each vertex and AF were calculated and bootstrapped. Next, a shuffled distribution was calculated across 100,000 permutations and the proportion of permutations greater or equal to the number of significant vertices was used to assess significance. **Summary of Results:** Greater AF was associated with greater whole brain cortical thickness ($r = 0.29, p < .001, 95\% CI [0.17 0.41]$), greater cortical thickness in the visual ($r = 0.23, p < .001, 95\% CI [0.12 0.35]$), somatomotor ($r = 0.33, p < .001, 95\% CI [0.22 0.44]$), dorsal attention ($r = 0.22, p = .002, 95\% CI [0.10 0.33]$), salience ($r = 0.30, p < .001, 95\% CI [0.18 0.42]$), limbic ($r = 0.26, p = .001, 95\% CI [0.14 0.38]$), and default mode ($r = 0.24, p = .002, 95\% CI [0.12 0.36]$) networks. However, no such effect was observed for the frontoparietal control network after correcting for multiple comparisons ($r = 0.21, p = .010, 95\% CI [0.12 0.36]$). The whole brain exploratory analysis found that both the somatomotor and salience networks showed the largest extents of significant vertices. **Conclusion:** These findings indicate the beneficial associations between aerobic fitness and brain health in an aging population. Cortical thickness was associated with AF across 6 of the 7 major functional connectivity networks investigated. In addition, exploratory analyses revealed that the somatomotor and salience networks had the largest extent of significant vertices. As the world's population is aging, aerobic fitness may provide a lifestyle benefit to brain health. Supported by NIA Grant R37 AG025667.

2325 Board #244 May 28 2:00 PM - 3:30 PM

Expression Of Tyrosine Hydroxylase In The Nucleus Accumbens Are Not Altered By Diet Or Fecal Transplantation In Male C57bl/6j Mice

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Multiple studies have indicated that regulation of physical activity may be largely controlled by central neural factors, such as dopamine (DA) signaling in the nucleus

accumbens (NAc). It was hypothesized that metabolites produced from the gut microbiome influence DA signaling by altering the rate-limiting enzyme tyrosine hydroxylase (TH). **PURPOSE:** To determine whether microbial transplants from high active C57Bl/6J male mice eating a chow diet (CH) altered TH expression in the NAc of C57Bl/6J male mice made low active through intake of a high fat high sugar (HF) diet. **METHODS:** Mice were randomly assigned to one of four groups: a chow diet (CH/CH), a high fat to chow diet plus a microbial transplant (HF/CH+), a high fat diet to chow diet (HF/CH), or a high fat diet plus a microbial transplant (HF/HF+). Changes to group base diets and microbial transplants began at week 14. Transplants were completed once a week using sample donated from the CH/CH group via oral gavage. Mice were sacrificed at the end of 17 weeks, the NAc was dissected on ice, and flash frozen in liquid nitrogen. Immunoblotting was performed using NAc lysate probed with TH antibody. Bands were normalized using β -actin and an analysis of variance was conducted. **RESULTS:** There were no significant differences between group means for CH/CH (1.023 ± 0.59), HF/CH+ (0.8810 ± 0.21), HF/CH (0.882 ± 0.27), or HF/HF+ (1.069 ± 0.32) as determined by a one-way ANOVA, ($p = 0.51$). **CONCLUSION:** TH expression in the NAc was not altered by diet or microbial transplantation from the active CH/CH group. Funding for this study was provided by the Omar Smith Endowment at Texas A&M University.

D-70 Free Communication/Poster - RPE, Pain and Fatigue

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
Room: CC-Exhibit Hall

2326 Board #245 May 28 2:00 PM - 3:30 PM

The Relationship Between Patient Expectations And Outcomes Of Injections For Knee Osteoarthritis

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The Relationship Between Patient Expectations and Outcomes of Injections for Knee Osteoarthritis

Purpose: Patient expectations have been shown to be related to outcomes after surgery. The relationship between expectations and outcomes after less invasive treatments, such as injections for knee osteoarthritis (OA), has not been studied. The objective of this prospective study was to assess the relationship between expectations and outcome of injections for knee OA.

Methods: We measured knee injection (intra-articular steroid or hyaluronic acid) expectations using a modified version of the Knee Replacement Expectations Scale (KRES) and Roland-Morris Disability Questionnaire. Patients were re-evaluated at 4 weeks post-injection for pain and disability outcomes. A multiple regression linear analysis was applied to model expectation entry scores; association between change in outcomes and expectation scores were studied through linear regression models, controlling for baseline scores as covariates.

Results: Forty-nine ($n = 49$) knee OA patients completed the study with improvement in knee weakness being the highest symptomatic improvement expected (mean score 4.8/5). Patients had the lowest expectations of pain relief and ability to walk (mean 1.3 and 1.1/5). Multivariate linear regression modeling did not show an association between demographic/clinical variables and global expectation scores. Injection treatment did significantly reduce pain (mean pain reduction 2.3, $p < 0.001$, and disability ($p < 0.001$)). Baseline expectation score had a low but significant association with change in pain and disability (NPRS $R^2 = 0.1$, $p = 0.056$ and $R^2 = 0.14$, $p = 0.02$).

Conclusion: Knee injections improved pain and disability in this cohort of patients, and expectations before treatment had a small but significant association with patient reported outcomes. Studying a larger number of subjects and incorporating physical and psychological outcomes may further advance knowledge in this area.

2327 Board #246 May 28 2:00 PM - 3:30 PM

Effects Of Mental Fatigue On Maximal Exercise Test Performance In Physically Active And Sedentary Adults

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PURPOSE: This study examined the effects of mental fatigue on maximal treadmill walking exercise performance.

METHODS: 50 young male ($n = 25$) and female ($n = 25$) adults were recruited to perform a maximal treadmill walking exercise test to volitional exhaustion on two

occasions. Prior to the exercise test, participants performed a cognitive task in a randomized, counterbalanced manner for 30 minutes, with the incongruent Stroop task in the mental fatigue condition, and leisure magazine reading in the control condition. Subjective ratings of perceived mood, fatigue, and motivation to exercise were assessed before and after the cognitive task. Perceptual and physiological responses were collected throughout the exercise test.

RESULTS: Significant decrease in perceived mood ($p < 0.001$) and motivation ($p = 0.001$), and significant increase in fatigue ($p = 0.028$) were found in the mental fatigue condition. Participants were found to rate their perceived physical exertion higher during the exercise test in the mental fatigue condition ($p = 0.042$). However, there were no significant differences in physiological responses and test exhaustion time. **CONCLUSIONS:** Mental fatigue increased perceived physical exertion during maximal treadmill walking exercise but did not impair exercise performance in both active and sedentary adults.

2328 Board #247 May 28 2:00 PM - 3:30 PM
Effects Of Self-selected Or Experimenter-selected Music On Psychological Responses During A Sprint Interval Training Session

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Music is widely used as an ergogenic aid before and during exercise to enhance performance. The ergogenic effects of music seem to be influenced by its choice and exercise intensity. However, little is known concerning its effects during sprint interval training (SIT). **PURPOSE:** The purpose of this study was to analyze the effects of self-selected and experimenter-selected music on perceptual (affective responses, perceived exertion, attentional focus, and enjoyment), and performance (power output) during a SIT protocol compared to a control condition. **METHODS:** 14 active males (27.0 ± 3.9 years; 79.0 ± 9.1 kg; 176.4 ± 5.3 cm) performed SIT sessions composed by 8 x 15s all-out bouts against a fixed load of 9% of body mass interspersed by 120s of passive recovery under three conditions: self-selected music (playlist of high-tempo subject's favorite music), experimenter-selected music ("Power Workout" playlist from an online streaming music platform) and no-music (control). Affective responses, perceived exertion, and power output were measured throughout the protocols. Enjoyment and attentional focus (effort and recovery) were measured after each exercise session. **RESULTS:** Perceived exertion did not differ between conditions, but a main effect of time was detected ($F_{2,26} = 1.67$; $p = 0.208$; $\eta_p^2 = 0.114$), with lower values in the first bout when compared to all others moments ($p < 0.001$). The affective responses differed between conditions ($F_{2,26} = 4.02$; $p = 0.030$; $\eta_p^2 = 0.236$), but the post-hoc indicated only a tendency ($p = 0.067$) of lower values for the self-selected music (1.3 ± 1.3 a.u.) compared to experimenter-selected music (2.0 ± 1.2 a.u.). Attentional focus also differed between conditions ($F_{2,26} = 6.62$; $p = 0.005$; $\eta_p^2 = 0.337$), however, just between self-selected (70.2 ± 30.3 a.u.) and no-music conditions (42.9 ± 27.1 a.u. $p = 0.043$). Enjoyment and power output measures did not differ between conditions, however, a main effect of time was observed for peak power ($F_{2,26} = 0.96$; $p = 0.393$; $\eta_p^2 = 0.069$), and mean power ($F_{2,26} = 1.23$; $p = 0.307$; $\eta_p^2 = 0.087$), throughout the bouts ($p < 0.001$). **CONCLUSIONS:** Although there were no significant differences between conditions concerning performance, perceived exertion, and enjoyment, listen to the self-selected music during the SIT session increased the attentional focus.

2329 Board #248 May 28 2:00 PM - 3:30 PM
Validity Of The Session Rpe For Detecting Accumulated Fatigue

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Studies have shown that the ratio of blood lactate concentration to Rating of Perceived Exertion (HLA/RPE) and session RPE (sRPE) may be considered useful to detect overreaching and accumulated fatigue. However, no study has investigated their relationship. **PURPOSE:** To examine the relationship between HLA/RPE and sRPE during a period of intensified training. **METHODS:** Twelve young adults performed incremental exercise to assess their max power output (MPO). They performed 30 and 60-min interval workouts on a cycle ergometer over a 2-week period. Each session started with a 5-min warm-up at 25% MPO followed by 5-min at 50% MPO, 2-min at 25% MPO, 5-min at 75% MPO, 2-min at 25% MPO, 2-min at 100% MPO, 2-min at 25% MPO and 7-min at 50% MPO, which finished the 30-min session. During the first week, 4 sessions consisting of 30-min on Monday, Tuesday, Wednesday and a 60-min (30-min session back to back) on Thursday, were organized. After 3 days off,

the second week consisted of 3 consecutive 60-min sessions (Monday to Wednesday) with the last day (Thursday) being of 30-min. HLa and RPE were measured at the end of each stage of the interval training, and HLa/RPE computed for each session. sRPE was obtained after the sessions. Non-linear regression analysis was used to assess the relationship between HLa/RPE and sRPE. **RESULTS:** A very large negative relationship ($r = -0.70$, Root-mean-squared error = 0.59, $p < 0.0001$) was found (Figure 1). **CONCLUSIONS:** The negative relationship supports the concept that sRPE is a sensitive tool that, in addition to information about relative exercise intensity, might provide further information on accumulated fatigue. Coaches and exercise scientists without access to HLa measurement may gain insight into accumulated fatigue during periods of increased training by using sRPE.

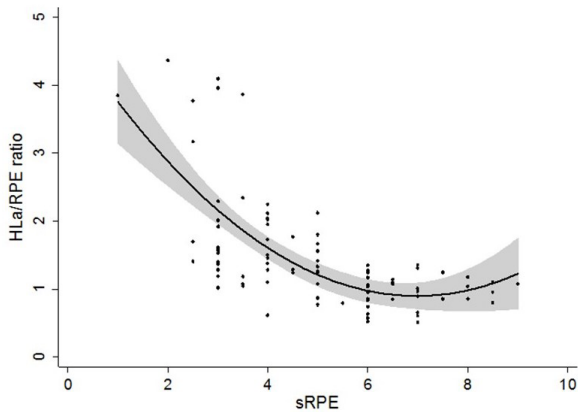


Figure 1. Relationship between HLa/RPE and sRPE

Black dots represent all subjects' training session; black line represents the predicted mean; the grey shade area represents the 95% confidence interval of the predicted mean.

2330 Board #249 May 28 2:00 PM - 3:30 PM
Association Between Perceived Recovery And Heart Rate In A Submaximal And Maximal Task In Firefighters

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The job of a firefighter is physically and mentally demanding and requires maximal or near maximal effort. As time on a shift progresses, these tasks may be performed in an under recovered state due to stressors of the work. Prior research in athletes has explored the relationship between subjective measures of stress/recovery and performance on exercise tests. As such, it is possible that a firefighter's subjective assessment of recovery may influence objective measures of performance on an exercise test. **PURPOSE:** To determine the association between perceptions of recovery and heart rate (HR) response in both a submaximal and maximal task in firefighters. **METHODS:** 16 (14 male, 2 female) active-duty firefighters (35.3 ± 8.0 years, 179.1 ± 6.2 cm, 91.1 ± 16.9 kg) volunteered to participate. Participants completed a submaximal Queens College Step Test (SUBMAX) and a maximal treadmill test (MAX) with 24-72 hours separating each test. Prior to testing, participants stated their perceived recovery status (PRS; 0-10 scalar measure) to assess current state of recovery. Upon completion of each test, participants reported a rating of perceived exertion (RPE). HR was recorded at the conclusion of each test (HR_{PEAK}) and after 60 seconds of seated recovery (HR_{60}). Bivariate Pearson correlations determined the relationship between PRS, RPE, HR_{PEAK} , and HR_{60} on both SUBMAX and MAX tests. An alpha of 0.05 determined statistical significance. **RESULTS:** Significant correlations were identified in the SUBMAX test between HR_{PEAK} (137.5 ± 12.7 bpm) and RPE (10.8 ± 1.8) ($r = 0.707$, $P = 0.002$), and HR_{60} (95.4 ± 18.8 bpm) and RPE ($r = 0.619$, $P = 0.011$), but neither were related to PRS (6.8 ± 2.4). On the MAX test, HR_{PEAK} (183.0 ± 9.7 bpm) and HR_{60} (147.4 ± 13.7 bpm) were not related to either RPE (18.2 ± 1.1) or PRS (6.0 ± 2.1). **CONCLUSION:** These results suggest that among firefighters, PRS may not be a meaningful instrument to understand readiness for performance, regardless of task intensity. In addition, the task specific response for RPE may suggest self-reporting of effort is not an effective method to evaluate intensities greater than a submaximal level. Firefighter-specific measures should be developed to better determine subjective recovery and effort to guide implementation strategies with which to optimize health and performance readiness.

2331 Board #250 May 28 2:00 PM - 3:30 PM
Reducing Sedentary Time In Fibromyalgia (ReSeT-FM): A Feasibility Study

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(No relevant relationships reported)

Fibromyalgia (FM) is characterized by chronic widespread musculoskeletal pain, impaired functional mobility and extreme sedentary behavior (SB). Research suggests that individuals with FM who spend more time in SB experience greater clinical pain and overall impact of FM, irrespective of time spent in moderate to vigorous physical activity (PA). To date, no studies have investigated the potential impact of reducing SB on key clinical outcomes in FM. **PURPOSE:** To evaluate the feasibility of an 8-week behavioral intervention designed to replace SB with light PA in Veterans with FM. **METHODS:** Nine veterans with FM completed an 8-week intervention designed to reduce sedentary time, which included: 1) Education on the risks of being sedentary, 2) Wearing an activity tracker that provided behavioral prompts to move during prolonged sedentary behavior and synched with a phone app to self-monitor activity and stationary time, 3) Weekly 30-minute meetings with a study coach to set and review progress towards goals aimed at reducing time in SB. PA levels (Sedentary, High and Low light PA, High and Low moderate PA) were objectively measured at baseline and during the last week of the intervention with accelerometers worn for 1-week at each assessment. Participants also completed the Fibromyalgia Impact Questionnaire-Revised (FIQR) and Brief Pain Inventory pre and post intervention. **RESULTS:** While the results trended in the right direction, the paired t-tests indicated no significant differences between pre and post sedentary levels ($p = .23$), low light PA ($p = .32$), high light PA ($p = .12$), low moderate PA ($p = .18$) and high moderate PA ($p = .89$). Pain severity ($p = .022$), pain interference ($p = .002$), and total FIQR score ($p = .035$) significantly decreased from pre to posttest. Bivariate correlations indicated that greater increases in high light PA were associated with greater reductions in pain severity ($r = -.750$, $p = .020$) and total FIQR score ($r = -.803$, $p = .009$). **CONCLUSION:** While the intervention did not significantly decrease sedentary time or increase light PA in veterans with FM, these results suggest that increasing light PA in FM patients could potentially have a positive impact on pain outcomes. This study was funded by the School of Health and Human Sciences at IUPUI.

2332 Board #251 May 28 2:00 PM - 3:30 PM
Impact Of Mental Fatigue In Endurance Sports Performance

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(No relevant relationships reported)

PURPOSE: The aim of the present study is to evaluate the effect on the overall perception of well being (OPWB) in the sports performance, as measured by an incremental treadmill running test, in mentally fatigued volunteers. **METHODS:** 34 volunteers participated in the study, 18 males and 16 females. They were divided into 2 groups and each volunteer performed 2 incremental treadmill running tests (2 minutes stage) in different dates. The tests were interrupted at the request of the volunteer. After the first test, the volunteers were randomly divided into 2 groups of 17 individuals each. One of the groups was driven to a mental fatigue by taken a mathematics test, 30 minutes before the test. The second group (control group), was led to mental fatigue. The mental fatigue group filled a questionnaire immediately after the test, to check the impact of the mathematics test on the OPWB. The OPWB questionnaire presented 5 possible classifications (1 very bad, 2 reasonable, 3 good, 4 very good, 5 excellent). The treadmill running tests were performed 72 hours apart. **RESULTS:** From the group that was driven to fatigue (17 volunteers), 9 were female and 8 males. 44% of the females had no change in the OPWB score, as did 37.5% of the males. Therefore, in this study, males were more susceptible to mental fatigue after performing the mathematics test. By taking an average of the scores, before and after the mathematics test, the overall score went from 3.94 to 3.12 (4.00 to 3.22 for females and 3.88 to 3.00 for males). In other words, a reasonable reduction in OPWB was observed in volunteers undergoing the mathematics test, which indicates that they were fatigued. Another interesting aspect was to evaluate the impact of the worsening in OPWB on the performance of the volunteers. In the group not led to mental fatigue (control group), there was a positive variation of 12% between the first and the second test. However, in the group driven to mental fatigue there was a reduction of 11.82% in their performance (same was measured taken in consideration the duration of the test), being 12.26% for the male volunteers and 11.45% for females. **CONCLUSIONS:** The present study showed that mental fatigue seems to impact sports performance. Therefore, searching for training strategies to support greater mental fatigue seems to be relevant.

2333 Board #252 May 28 2:00 PM - 3:30 PM
Three Weeks Of Mental Strength Training Improves Cycling Performance By Changing Key Physiological Parameters

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Short-term grit and resilience training, as well as internal self-talk training have increased physical performance. However, little is known about longer mental training. **PURPOSE:** Perform 21 days of mental training to observe how performance and physiological variables change.

METHODS: Participants were 33 college-aged (16 mental strength (MS), 17 control (CON)) individuals (20.7 ± 1.2yrs, weight 72.3 ± 9.3kg, height 1.77 ± .09m, VO_{2peak} 47.9 ± 9.3mL/kg/min). A VO_{2peak} was performed on a cycle ergometer on day one. Subsequent visits consisted of time trials to exhaustion (TTE) performed 10% above ventilatory threshold. MS groups watched one of four 10-minute videos daily for 21 days. VO₂, ventilation (VE), respiratory rate (RR), tidal volume (TV), heart rate (HR), RPE, and VAS scores (0-100) for pain and fatigue were recorded during pre- and post-time trials. Participants took GRIT-S and CD-Rise psychological surveys before pre- and post-TTE. RM-ANOVA were done to compare group, time, and trial differences as a percentage of total time as well as absolute times (0-3 minutes).

RESULTS: TTE significantly increased for MS (8.8 ± 13.2%) and decreased for CON (-6.6 ± 14.6%, p < 0.05). VO₂, VE, RPE, fatigue, and pain as a percentage of total time were unchanged. HR was significantly higher after 21 days of MS compared to CON at 40, 60, 80, and 100% of TTE (p < 0.05). When compared at absolute times, there were significant decreases in VO₂ at minute 3 (p < 0.05) and VE at minute 2 and 2.5 (p < 0.05). RR was lower following MS (p < 0.05) though there was no difference in TV. There was a trial x group interaction in RPE (F(1,25) = 4.823, p < 0.05) with MS experiencing a decrease in RPE after training.

CONCLUSION: MS training for three weeks allowed participants to cycle longer before exhaustion. HR increased as a percentage of TT time post-MS training, perhaps due to increased duration post-TTE leading to measuring HR at later absolute times. By measuring HR later, metabolites would be expected to be higher, thus increasing HR. Decreases in VE and RR may be due to one of the mental strategies that involved instruction to reduce stress and anxiety by taking deeper and slower breaths, which may contribute to a reduced perception of effort. Finally, MS training reduced O₂ consumption, contributing to a decreased RPE and increased TTE duration.

2334 Board #253 May 28 2:00 PM - 3:30 PM
The Effects Of Essential Oils On Perception Of Exertion, Task Pleasantness And Time On Task

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 (No relevant relationships reported)

Essential oils have become wildly popular in recent years for their therapeutical and health-related benefits. Research that focuses on essential oils and their ergogenic effects may be helpful in increasing adherence to exercise by making the task more pleasant and/or less exertive (Basevitch, 2011; Jaradat et al, 2016). **PURPOSE:** The purpose of this study was to test the effects of essential oils on perception of exertion, exercise task pleasantness and total time on task. **METHODS:** Thirty college students (24 females, 6 males) were recruited to perform a handgrip squeezing task. They were randomly assigned to one of three groups: placebo, bergamot essential oil, or peppermint essential oil (n_{Peppermint} = 10, n_{Placebo} = 10, n_{Bergamot} = 10). Adhesive strips with each essential oil were placed under the noses of all participants. Participants in the placebo group had a strip with no essential oil. After establishing participants' baselines for maximal voluntary contraction, participants squeezed a handgrip dynamometer at 30% of their baseline for as long as they could tolerate. Participants' session RPE, perceived exercise-task pleasantness and total grip time were recorded at session completion. **RESULTS:** Results from ANOVA analysis showed no significant group effect for RPE session (p > .05). Chi square analyses indicated that participants in the placebo group rated the exercise task most pleasant, (n=6, Pleasant). Participants with bergamot essential oil rated the task as mildly pleasant, (n=5, Mildly Pleasant). Participants with peppermint essential oil rated the task as least pleasant (n=6, Neutral) and these differences were significant (p < .05). Due to small size in each group and the skewness of the distribution, group medians were also analyzed as more robust and sensible signs of central tendency. Results indicated that participants with bergamot essential oil squeezed the dynamometer longer durations than others with peppermint essential oil or placebo (M_{Bergamot} = 18.07 minutes; M_{Placebo} = 15.31 minutes;

and M_{Peppermint} = 12.27 minutes). **CONCLUSION:** These findings suggest that bergamot essential oil may help optimize exercise-related affects and increase exercise duration. Studies with larger sample sizes are needed to confirm these findings.

2335 Board #254 May 28 2:00 PM - 3:30 PM
Effects Of Transcranial Direct Current Stimulation During Aerobic Exercise On Cognition, Perceived Exertion And Cycling Performance

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(No relevant relationships reported)

PURPOSE: Interest in harmless but effective and easy-to-use methods such as transcranial direct current stimulation (tDCS) and aerobic exercise (AE) to improve cognitive performance in health and disease is growing. Recent research suggests that a combined application of both methods in a multimodal manner (e.g. tDCS before, during or after AE) could lead to improved cognitive improvement. Also tDCS could be a potential tool to modulate sports performance parameters such as perceived exertion and endurance capacity. Thus, here we investigated the impact of tDCS during moderate AE (cycling) on cognition, perceived exertion and power output. **METHODS:** Data from 101 healthy subjects (average age = 25.31, SD = 2.05, female = 45) were collected in five separate experiments (EXP). Each experiment had a crossover design. EXP-1: anodal tDCS vs. sham during active control (AC); EXP-2: cathodal tDCS vs. sham during AC; EXP-3: AE vs. AC; EXP-4: a. tDCS vs. sham during AE; EXP-5: c. tDCS vs. sham during AE. High-resolution (HD-)tDCS was applied for 25 minutes at 1 mA to the left dorsolateral prefrontal cortex (DLPFC) using a 4x1 ring electrode configuration (stim electrode at F3). For AE, subjects ran at 75% of their maximum heart rate (moderate intensity) for 25 minutes, while rating of perceived exertion (RPE) and power output (watts) were recorded every four minutes. As a measure of cognition, response inhibition was assessed before and after 20 minutes during the ongoing intervention by a flanker task. **RESULTS:** A relevant TIME x CONDITION interaction for cognitive performance was only found in EXP-5. Cathodal tDCS during cycling led to a decrease in accuracy whereas accuracy remained constant for sham tDCS during cycling, F(1,23) = 4.58, p = .043, η_p² = .17. A sig. TIME x CONDITION x SEX showed that men were better able to maintain their cycling performance (measured in watts) during the intervention if when receiving anodal tDCS, F(2,32,44.03) = 3.27, p = .041, η_p² = .15. No interaction effects could be demonstrated for RPE and heart rate. **CONCLUSIONS:** Contrary to current literature only the multimodal, but not unimodal application of tDCS and AE had an influence on cognitive performance. The application of anodal tDCS during moderate AE led to improved cycling performance in men, a finding requiring further consideration in the future.

2336 Board #255 May 28 2:00 PM - 3:30 PM
Impact Of Operational Stress On Motor Evoked Potentials In Military Personnel

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Sleep restriction is a prevalent operational stressor that may degrade neurophysiological performance in military personnel. Transcranial magnetic stimulation (TMS) is an established non-invasive brain stimulation technique capable of assessing corticospinal excitability that is not extensively investigated in military populations. **PURPOSE:** To examine the influence of operational stress (i.e., sleep restriction) on corticospinal excitability in military personnel. **METHODS:** Thirty-one male and seven female service members (25.1 ± 4.9yr) performed two series of stimulus response curves (SRCs) at 15% maximum voluntary muscle contraction for five consecutive days (D0-D4) using single-pulse TMS and a figure-of-eight coil. A familiarization day served as D0 with baseline testing on D1. Participants were allowed eight hours to sleep on D0, D1 and D4. On D2 and D3, participants had their sleep restricted for two 2-hour segments. For the SRC, stimulator outputs were randomly administered from 5-100% in 5% increments. Motor evoked potentials of the first dorsal interosseous muscle were quantified as the peak-to-peak electromyography amplitude of the 50ms post TMS stimulus. Corticospinal excitability was assessed by fitting MEP responses to a Boltzmann sigmoidal curve (BSC) via nonlinear regression and determining BSC_{MAX} and BSC_{V50} (i.e., stimulator output at the mid-point between

BSC_{MIN} and BSC_{MAX}). Repeated-measures one-way ANOVAs with Tukey post-hoc tests were used to compare BSC properties over time. **RESULTS:** ANOVAs revealed a main effect of time for both BSC_{MAX} and BSC_{V50} ($F(3.31, 122.40)=2.71, p=.04$ and $F(2.96, 109.50)=3.26, p=.02$, respectively). No significant pairwise comparisons were detected for BSC_{V50}. BSC_{MAX} revealed to be significantly greater on D3 compared to D0 (5.21 vs 4.56 mV, $p=.02$) and D1 (5.21 vs 4.44 mV, $p=.02$) but similar to D2 and D4 ($p>.05$). **CONCLUSION:** Our findings suggest corticospinal excitability is a sensitive biomarker for subtle alterations during simulated operational stress. Furthermore, BSC_{MAX} remained elevated on D4, suggesting one day is inadequate recovery time after operational stress. Supported by the Department of Defense W81XWH-16-PHTBIRP-CR3A.

2337 Board #256 May 28 2:00 PM - 3:30 PM
The Effect Of Moderate-intensity Intermittent Interval Walking On Heart Rate And Enjoyment In Middle-aged Women

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PURPOSE: The purpose of this study was to investigate heart rate (HR) and exercise enjoyment during and following three walking protocols in middle-aged women. **METHODS:** Ten women (mean \pm SD = 55 \pm 4 years) completed three walking protocols of the same work volume (90 MET-min) in a randomized, counter-balanced order. The protocols consisted of one 30-min bout of low-moderate continuous walking (CW) (3 METs; ~ 4.8 km/h), three 10-min bouts of low-moderate intermittent walking (IW), and three 8-min 40-s bouts of intermittent interval walking (IIW) with cycles of 30 s:120 s of high-moderate (5 METs; ~ 6.4 km/h): low-moderate intensities. HR and exercise enjoyment were assessed during six evenly distributed exercise increments and post-exercise (0-min, 10-min). The Exercise Enjoyment Scale (EES) was utilized to assess enjoyment during and post-exercise, while the Physical Activity Enjoyment Scale (PACES) only assessed post-exercise enjoyment. Repeated measures ANOVA was used to analyze mean HR and enjoyment differences between experimental treatments. **RESULTS:** IIW (112.0 \pm 16.0) elicited a significantly higher during exercise HR than IW (105.0 \pm 14.0; $p = 0.01$), but HR during CW (107.0 \pm 14.0; $p > 0.05$) was not different from the other treatments. Immediately following exercise (0-min), both CW (108.0 \pm 14.0; $p = 0.004$) and IIW (109.0 \pm 16.0; $p = 0.03$) elicited a significantly higher HR than IW (102.0 \pm 14.0). However, 10 min later, CW (82.0 \pm 18.0) elicited a significantly higher HR than IW (73.0 \pm 12.0); IIW (77.0 \pm 13.0; $p > 0.05$) did not differ from the other treatments. Despite during and post-exercise HR differences, exercise enjoyment during (CW: 4.0 \pm 0.82; IW: 4.0 \pm 0.61; IIW: 4.0 \pm 1.2) and following (EES 0-min: CW: 4.0 \pm 0.99; IW: 4.0 \pm 0.68; IIW: 4.0 \pm 1.4) (PACES 0-min: CW: 89.0 \pm 10.1; IW: 89.0 \pm 11.5; IIW: 88.0 \pm 22.4) (EES 10-min: CW: 4.0 \pm 1.1; IW: 4.0 \pm 0.66; IIW: 4.0 \pm 1.2) (PACES 10-min: CW: 89.0 \pm 15.0; IW: 88.0 \pm 12.6; IIW: 86.0 \pm 20.2) exercise were not different amongst treatments (all $p > 0.05$). **CONCLUSION:** Based on the results of the present study, it is possible to conclude that moderate-intensity intermittent interval walking may be a viable exercise prescription suitable for middle-aged women to progress to higher exercise intensities and address the barrier of time.

2338 Board #257 May 28 2:00 PM - 3:30 PM
Perceptions Of Pain Over A 4-week Neuromuscular Electrical Stimulation Treatment In Older Adults

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Neuromuscular electrical stimulation (NMES) evokes involuntary muscle contraction and may be a safe and effective treatment option for muscle strengthening. However, little research exists on patient tolerance to NMES in older adults. **PURPOSE:** The aim of this study was to determine changes in stimulation intensity and perceived pain pre-post 4 weeks of NMES training in older adults. **METHODS:** Participants ($n = 9$) were healthy, older adults (69.9 \pm 2.4 years). Subjects performed maximal voluntary contractions (MVC) of the quadriceps muscles on an isokinetic dynamometer to determine maximal strength. Participants were seated in the isokinetic dynamometer with the knee at 60° and a 40-min NMES treatment was applied to the quadriceps muscles of each leg 3 times per week for 4 weeks. Stimulation frequency was 60 Hz with repeated cycles of 10s on and 15s off. Stimulation intensity was set to achieve 15% MVC and was increased every 5 minutes if the torque dropped below 15% MVC. Using a standard pain scale, participants were asked to rate perceived pain (0 = no pain, 10 = worst pain possible) during the NMES at 1, 20, and 40 minutes of stimulation on each leg during treatment day 1, 7, and 12. Stimulation intensity was also recorded. Pain scores and stimulation intensity were averaged across right and left leg. Pain score and stimulation intensity were each analyzed with a 3 x 3

repeated measures analysis of variance (DAY x MIN), with significance set at $p \leq 0.05$. **RESULTS:** For perceived pain, there was a significant main effect for MIN ($p = 0.011$) and DAY ($p = 0.004$). For MIN, perceived pain significantly increased (MIN 1: 3.2 \pm 0.8 vs MIN 20: 4.5 \pm 0.7; $p = 0.009$) and then remained stable (MIN 40: 5.2 \pm 0.8; $p = 0.052$). For DAY, perceived pain decreased 36.2% (DAY 1: 5.8 \pm 0.8 vs DAY 7: 3.7 \pm 0.7; $p = 0.001$) and then remained stable (DAY 12: 3.4 \pm 0.9; $p = 0.488$). For stimulation intensity, there was a significant main effect for DAY ($p = 0.001$). Stimulation intensity for DAY increased (DAY 1: 13.3 \pm 0.9 vs DAY 7: 16.3 \pm 1.5 mA; $p = 0.003$) and then decreased (Day 12: 14.8 \pm 1.3 mA; $p = 0.012$). **CONCLUSION:** Findings indicate that participants experienced moderate discomfort during the first NMES treatment. However, perceived pain decreased significantly by day 7, demonstrating that NMES may be a feasible muscle strengthening option for older adults.

2339 Board #258 May 28 2:00 PM - 3:30 PM
No Sex Differences In Conditioned Pain Modulation Or Exercise-induced Hypoalgesia Following Lower Body Isometric Exercise

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 (No relevant relationships reported)

Women are more at risk than men for developing chronic pain conditions. Differences in endogenous pain-modulatory function could be a contributing factor. **PURPOSE:** The aim of this study was to compare conditioned pain modulation (CPM) and exercise-induced hypoalgesia (EIH) responses between adult men and women. **METHODS:** In a cross-sectional, non-randomized study with two independent groups of college aged males ($n = 52$) and females ($n = 45$), pressure pain thresholds (PPT) were assessed bilaterally in the vastus lateralis (VL) and brachioradialis (BR) muscles using a pressure algometer prior to and immediately following a conditioning stimulus (placing their foot in an ice bath) and performing isometric knee extension exercise to failure at 25% of maximal strength. **RESULTS:** Men had higher baseline PPTs than females (LBR: 372 \pm 217 vs. 303 \pm 119; RBR: 396 \pm 236 vs. 315 \pm 143; NDVL: 552 \pm 281 vs. 434 \pm 157 DVL: 572 \pm 253 vs. 454 \pm 147; $P < 0.01$). PPTs increased significantly ($P < 0.05$) following the conditioning stimulus in both males and females (LBR: 387 \pm 264 to 453 \pm 318 kPa, and 315 \pm 126 to 359 \pm 145 kPa; RBR: 400 \pm 225 to 450 \pm 280 kPa; and 325 \pm 135 to 372 \pm 161 kPa; DVL: 579 \pm 289 to 658 \pm 349 kPa; and 470 \pm 200 to 541 \pm 201 kPa; NDVL 542 \pm 263 to 623 \pm 326 kPa; and 433 \pm 174 to 503 \pm 185 kPa in the males and females, respectively) indicating a CPM response in all limbs tested. PPTs increased significantly ($P < 0.05$) following isometric knee extension exercise to a similar extent in both males and females in all limbs tested (LBR: 387 \pm 177 to 466 \pm 245 kPa; and 305 \pm 140 to 353 \pm 162 kPa; RBR: 409 \pm 172 to 462 \pm 228 kPa; and 312 \pm 147 to 355 \pm 173 kPa. DVL: 572 \pm 253 to 763 \pm 366 kPa; and 454 \pm 147 to 611 \pm 252 kPa; NDVL: 552 \pm 281 to 633 \pm 353 kPa and 434 \pm 157 to 526 \pm 210 kPa) There was no interaction between the group x testing site for either the CPM response ($P = 0.314$) or the EIH response ($P = 0.242$). **CONCLUSIONS:** Men had a higher resting pain threshold than women. However, men and women exhibited similar endogenous pain inhibitory function both locally and systemically following a conditioning stimulus and isometric lower body exercise.

2340 Board #259 May 28 2:00 PM - 3:30 PM
Concurrent Pain Effects On Exercise Tolerance, Neuromuscular Fatigue And Perceptual Responses, Preliminary Data.

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Exercise-induced fatigue and pain negatively affect exercise tolerance; however, the influence of these sensations on regulation of neuromuscular (NM) and perceptual responses during locomotor exercise has yet to be determined. **PURPOSE:** To investigate the effects of one leg exercise-induced fatigue and pain on the contralateral leg exercise tolerance, NM and perceptual responses. **METHODS:** Nine healthy young men (age: 26 \pm 7 years) performed right leg sustained contraction at 25% of isometric maximal voluntary contraction (25%IMVC) to task failure. In three testing sessions, the 25%IMVC protocol was preceded by one of the three left leg interventions including: i) 6 min rest (CON) ii) cycling to exhaustion at 80% of peak power output (CYCL) and iii) CYCL immediately followed by blood flow occlusion to right leg task failure (OCCL). The experimental sessions were selected randomly. NM function was characterized by assessing IMVC and voluntary activation (VA) using twitch interpolated technique. Right leg pain and rating of perceived exertion (RPE) were also recorded during sustained contraction. **RESULTS:** 25%IMVC to task failure was longer in CON (221 \pm 106 s) than CYCL (141 \pm 67 s) and OCCL (119 \pm 51 s) ($p < 0.05$). Relative to baseline, the drop on IMVC was similar for CON (-40 \pm 10%), CYCL

($-36 \pm 18\%$) and OCCL ($-32 \pm 17\%$) ($p = 0.09$). VA drop was also similar for CON ($-6 \pm 12\%$), CYCL ($-9 \pm 11\%$) and OCCL ($-15 \pm 18\%$) ($p > 0.05$). The potentiated twitch force decline was lower for OCCL ($-44 \pm 25\%$) when compared to CYCL ($-53 \pm 24\%$) and CON ($-51 \pm 23\%$) ($p < 0.05$). During the 25%IMVC, RPE at the onset was lower for CON (7 ± 2) compared to CYCL (13 ± 3) and OCCL (14 ± 3) ($p < 0.001$) but no difference was observed between the three conditions at the task failure (18 ± 2 , 19 ± 1 and 19 ± 1 , respectively) ($p > 0.05$). Right leg pain increased from onset to exhaustion for CON (2 ± 2 and 9 ± 1), CYCL (2 ± 2 and 9 ± 1) and OCCL (2 ± 1 and 9 ± 1) ($p < 0.05$). Left leg pain decreased from the onset of the right leg exercise to task failure for CYCL (6 ± 1 and 3 ± 2) ($p < 0.05$) however it stayed high during OCCL (9 ± 1 and 9 ± 1) ($p < 0.05$). **CONCLUSION:** Our preliminary data suggest that one leg exercise-induced fatigue and pain decreased the contralateral leg exercise tolerance, exacerbated perceptual pain and RPE, and blunted peripheral fatigue during subsequent exercise.

2341 Board #260 May 28 2:00 PM - 3:30 PM
Internal Load Metrics In Division III Men's And Women's Soccer: The Significance Of Sleep Quality

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Wearable technology is the number one fitness trend for 2019. Sleep quality (SQ), sleep duration, mood, stress, soreness, and fatigue have been associated with performance in sports through physiological and psychological mechanisms. Division III (DIII) schools are the biggest participant in NCAA. In terms of number of athletes, soccer is the second most popular sport in NCAA.

PURPOSE: To investigate the relationship of SQ with sleep duration, mood, stress, soreness, and fatigue in a DIII men's and women's soccer team.
METHODS: All 56 players agreed to participate ($M_{age} = 19.42$, $SD = 1.09$). Data were collected using readiness surveying based on the Titan 1+ sensor protocol. Subjective information on SQ, sleep duration, mood, stress, soreness, and fatigue was reported by each athlete before every practice and game. All data, but sleep (in hours), were quantified via a 0-10 visual analog scale (e.g., SQ: 0=Excellent, 10=Poor). In total, 200 assessments took place in pre- and in-season. The analysis consisted of Pearson correlations, t tests, and regression analysis in R .

RESULTS: The correlations of SQ with the other variables were: sleep duration ($r = -.43$), mood ($r = .70$), stress ($r = .62$), soreness ($r = .53$), and fatigue ($r = .83$). There were no statistically differences between male and female athletes on any of the variables included in the analysis. Therefore, the data were analyzed in aggregate. The regressions were estimated to examine the expected increase in these outcomes for a one-point improvement in reported SQ (e.g., a one-point improvement in SQ is associated with an expected 0.98-point improvement in reported fatigue; $p < .001$).
CONCLUSIONS: On average, the findings indicate a strong relationship between SQ and hours of sleep, mood, stress, fatigue, and soreness in this DIII soccer program. Therefore, there is preliminary evidence to support that all stakeholders may need to focus on SQ strategies (including sleep duration) as means to manipulate several internal load variables that affect performance in sports. Future studies should add external metrics (e.g., speed/sprint/impact metrics), investigate differences between practice and game-day data and Divisions, and collect information from larger samples. Possible limitations include convenience sample and self-reported data.

2342 Board #261 May 28 2:00 PM - 3:30 PM
Session RPE During A Constant Load Submaximal Treadmill Exercise

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Session-RPE (S-RPE) is a measure of perceived exertion experienced for an entire exercise session but estimated post-exercise following a prior defined period of rest (Thekkada, 2006). **PURPOSE:** To study the relationship of S-RPE with differentiated (Leg-RPE, Chest-RPE) and undifferentiated (Overall-RPE) RPE during constant load submaximal treadmill exercise. **METHODS:** A total of 18 participants (Males = 8, and Females = 10; 21.5 years \pm 2.4 years) non-athletes healthy physically active (as per ACSM guidelines) participants from Cabrini University volunteered for the study. Each subject completed a 15-minute moderate intensity constant-load treadmill exercise. During exercise, at minute 5, 10, and 15; L-RPE, C-RPE, and O-RPE were estimated using the Adult OMNI-Walk/Run Scale. The average RPE for leg (L-RPEavg), chest(C-RPEavg), and overall body (O-RPEavg) for entire exercise session was also calculated. 5-minute post-exercise S-RPE was obtained for overall body. **RESULTS:** S-RPE was significantly correlated ($r = 0.41-0.55$, $p < 0.01$) with O,L,C- RPEavg and O,L,C- RPE for 5,10, and 15 minute. The highest correlation ($r = 0.55$, $p < 0.01$) was observed between S-RPE and O- RPEavg. **CONCLUSION:** The current study shows that S-RPE was strongly related to average of entire exercise

session O-RPE. Previous literature has shown that a single session-RPE rating may accurately reflect the intensity of an exercise session (Haddad, 2017). Future studies should explore the effect of varied duration, intensity, and mode of exercise on S-RPE.

2343 Board #262 May 28 2:00 PM - 3:30 PM
The Effects Of Mental Imagery Use On Perceived Exertion And Exercise Tolerance

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 (No relevant relationships reported)

Physical inactivity is the main public health concern of the 21st century (Blair, 2009). Perceptions of exertion and physiological stress are important contributors to the problem of physical inactivity (Lind, Welch, & Ekkekakis, 2009). **PURPOSE:** The purpose of this study was to test the effectiveness of two types of mental imagery (associative vs. dissociative) on perceived exertion and physiological stress. **METHODS:** Forty-five college students (22 males, 23 females) were randomly assigned to dissociative imagery, associative imagery, and control (i.e., no imagery) conditions. Participants completed a progressive cycling task to volitional fatigue. Ratings of perceived exertion (RPE), attention focus and heart rate (HR) were monitored at 1minute intervals. Lactate accumulation (LA) was recorded at RPE=12 and at task completion. **RESULTS:** Participants using associative imagery reported the highest RPEs ($p < .05$). These participants also tended to tolerate the task longer as compared to both the dissociative imagery group ($ES = .04$) and the control group ($ES = .14$). Participants in the associative imagery condition focused more on internal cues of exertion ($p < .01$). Participants using either type of imagery seemed to expend increased effort as demonstrated by higher ($p = .102$) means for lactate accumulation during and at the completion of the task. **CONCLUSION:** Using associative imagery might cause individuals to focus on internal cues of exertion thus increasing the subjective perception of effort. However, using associative imagery may help increase exercise tolerance compared to dissociative imagery or no imagery. These findings are consistent with previous research and may have important implications for promoting exercise tolerance.

2344 Board #263 May 28 2:00 PM - 3:30 PM
Exercise-induced Hypoalgesia Differ At Sites Local And Remote To The Exercising Muscle Group

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Dysfunction of endogenous pain-inhibitory function such as exercise-induced hypoalgesia (EIH) may predict development of chronic pain conditions. While EIH has been shown to occur in both the exercised muscle group and in remote unexercised muscle group, few studies have compared the magnitude of EIH in an exercised muscle and remote muscle groups in the same individuals following the same exercise bout. **PURPOSE:** The purpose of the study was to examine the EIH response at four different sites following a bout of single legged isometric exercise. **METHODS:** Pressure pain thresholds (PPT) of 102 participants (50 females; 52 males) were assessed bilaterally in the vastus lateralis (VL) and brachioradialis (BR) using a pressure algometer before and after isometric knee extension at 25% of maximal voluntary contraction held until task failure using their dominant leg. The percent difference between post and pre measures was defined the EIH response. **RESULTS:** PPT's increased in the left BR ($18.1\% \pm 24.7$; $p < 0.001$, $d = 0.275$), right BR ($14.4\% \pm 26.1$; $p < 0.001$, $d = 0.233$), non-dominant VL ($17.4\% \pm 24.0$; $p < 0.001$, $d = 0.318$) and the dominant VL ($34.5\% \pm 28.3$; $p < 0.001$, $d = 0.643$). There were no differences between the left and right BR and the non-dominant VL with regards to the EIH response ($p > 0.05$), however the exercised leg demonstrated a greater EIH response compared to the remote, unexercised limbs ($p < 0.001$). **CONCLUSION:** EIH occurred in all sites. However the EIH response in the exercised leg was significantly more robust than the remote, unexercised sites. This findings suggests the magnitude of EIH is determined by both local and systemic factors and this should be taken into consideration when comparing EIH among studies.

2345 Board #264 May 28 2:00 PM - 3:30 PM
Relationship Between Enhanced Cognitive Function And Autonomic Nervous Activity After A Subjectively Selected Intensity Exercise
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 (No relevant relationships reported)

PURPOSE: The purpose of this study was to identify a practical method for engaging in exercise that could improve cognitive function. We tested whether cognitive function improves after exercise at subjectively selected intensity by using ratings of perceived exertion (RPE). In addition, we examined the relationship between the improvement in cognitive function and cardiac autonomic nervous system.

METHODS: Twelve participants performed cognitive tasks in a running or resting condition with a randomized crossover design. In the running condition, the participants ran on a treadmill for 10 min at the running speed correspond to the RPE10-12 for each participant. Cognitive tasks including the Spatial Delayed Response task and Go/No-Go task were performed before and after running or resting. Cardiac autonomic nervous activity was obtained by calculating from heart rate variability during cognitive tasks.

RESULTS: In the running condition, the RPE was 11.1 ± 0.8 immediately after running. Running at the RPE10-12 significantly improved reaction time in the Go trials (688 ± 191 [Pre] vs 568 ± 159 ms [Post], $P < 0.05$). In the resting condition, cognitive performance was unchanged throughout the experiment (628.5 ± 163.1 ms [Pre] vs 666.9 ± 139.7 ms [Post], $P > 0.05$). Parasympathetic nervous activity remained lower after running at RPE10-12 (586 ± 424 ms² [Pre] vs 373 ± 322 ms²), but sympathetic nervous activity was not changed. Moreover, the Δ reaction time (Post-Pre) tended to be positively correlated with Δ parasympathetic nervous activity ($r = 0.514$, $P = 0.088$). In contrast, Δ reaction time was not associated with Δ sympathetic nervous activity ($r = 0.177$, $P = 0.581$).

CONCLUSIONS: The present study demonstrated that subjectively selected intensity of exercise can improve cognitive function. The improvement in cognitive function after exercise may be associated with cardiac autonomic nervous activity.

2346 Board #265 May 28 2:00 PM - 3:30 PM
Heart Rate And Rating Of Perceived Exertion During High-intensity Interval Training: Implications For Prescribing Intensity
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 (No relevant relationships reported)

High-intensity interval training (HIIT) is a popular and effective time-efficient alternative to moderate-intensity continuous training for improving cardiorespiratory fitness in a wide range of populations. However, there is limited research investigating the most effective and practical way to prescribe training intensities for HIIT.

PURPOSE: To determine heart rate (HR) and rating of perceived exertion (RPE) responses across a single bout of HIIT. Additionally, the relationship between HR and RPE were examined. **METHODS:** Young adults ($n=16$; age 21.8 ± 1.4 years; 10 females) visited the lab on two separate occasions. At the first visit, participants completed an incremental exercise test on a cycle ergometer to determine peak power output (PPO). Participants completed the HIIT session during their second lab visit. The HIIT protocol involved ten, 1-minute bouts of cycling at 80% PPO interspersed with 1-minute of active rest cycling at 20% PPO. HR and RPE were measured at the end of the first, fifth and tenth work interval. RPE was measured using the CR10 Borg scale. One-way repeated measures ANOVAs were used to determine HR and RPE responses across the HIIT session. Pearson correlations were utilized to assess relationships between HR and RPE. **RESULTS:** HR and RPE both significantly increased from the first (HR 157 ± 16 bpm; RPE 5.0 ± 1.8) to the fifth interval (HR 174 ± 14 bpm; RPE 6.8 ± 1.7 ; $p < 0.05$ for both). However, there were no significant differences in HR or RPE between the fifth and tenth interval (180 ± 12 bpm; RPE 7.7 ± 1.9 $p > 0.05$ for both). There were no significant relationships between HR and RPE for any of the time points ($r = -0.01$ to -0.34 , $p = 0.19$ to 0.89) or the average of the session ($r = 0.37$, $p = 0.16$). **CONCLUSIONS:** HR and RPE both increased initially during the HIIT session with no further increase after mid-point. There were no significant relationships between HR and RPE. These findings suggest that RPE, using the CR10 Borg scale, may not replicate HR for determining intensity during HIIT. Future research may be beneficial to determine a practical method for prescribing exercise intensity during HIIT. Further, it would be beneficial to examine the use of RPE and HR as methods of prescribing intensity in long-term, real-world intervention studies.

2347 Board #266 May 28 2:00 PM - 3:30 PM
Perception Of Moderate Intensity Physical Activity By Onset Of Obesity: A Randomized Crossover Trial
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 (No relevant relationships reported)

Moderate intensity physical activity is typically recommended for inactive adults with overweight or obesity. However, it is unknown whether there is a difference in the perception of moderate intensity by onset of obesity (childhood versus adulthood). **PURPOSE:** To determine if there was a difference in selection of moderate intensity between inactive adults with juvenile-onset (JO) and adult-onset (AO) overweight or obesity. **METHODS:** Participants ($N=38$; JO=18 and AO=20) completed an initial study visit where height, weight, fitness (time to 85% of age predicted HR_{max}), and weight history (modified Cincinnati Weight History Questionnaire) were assessed. After stratification by age of obesity onset, participants were randomly assigned the order to complete 20-minute moderate intensity exercise sessions on the treadmill and cycle ergometer (separate visits). A standardized script was used to instruct participants to exercise at a moderate intensity. Participants were given an opportunity to change the speed of the treadmill or cycle ergometer power output every 5 minutes of the session. VO_2 , METs, and HR were measured continually during exercise sessions. Multiple linear regression was used to determine whether exercise intensity (average MET value and % age-predicted HR_{max}) differed significantly between onset groups while controlling for age and gender. **RESULTS:** On the treadmill, JO and AO participants selected an average intensity of (mean \pm sd) 3.5 ± 0.9 vs. 3.7 ± 0.9 METs which equated to 64.0 ± 7.7 and 64.9 ± 7.5 % of their age-predicted HR_{max} , respectively. On the cycle ergometer, JO and AO participants selected an average intensity of 3.3 ± 0.9 vs. 3.3 ± 1.0 METs. This represented 65.2 ± 8.8 and 60.7 ± 7.2 % of their age-predicted HR_{max} , respectively. After adjusting for age and gender, AO participants expended on average 0.13 more METs on the ergometer (0.03 METs on the treadmill) than JO participants ($p=0.50$, 0.90 , respectively). For HRmax, findings were similar ($\beta=0.34$, -0.01 ; $p=0.08$, 0.95) for the ergometer and treadmill, respectively. **CONCLUSION:** Perception of moderate intensity did not differ by onset of obesity. However, inactive individuals with obesity selected an intensity at the low end of moderate intensity for both treadmill and cycle exercise resulting in lower overall energy expenditure.

2348 Board #267 May 28 2:00 PM - 3:30 PM
Conditioned Pain Modulation And Blood Pressure Responses To Cold Pressor Test Among Resistance Exercisers
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 (No relevant relationships reported)

Conditioned pain modulation (CPM) examines central pain inhibitory processing by assessing changes of sensitivity to the first pain stimulus after exposure to the second pain stimulus compared to baseline, and serves as risk factor of chronic pain. Aerobically-trained individuals typically show greater CPM compared to controls, but little is known regarding CPM among resistance exercisers (REs) who habitually engage in resistance exercise/strength training. REs often show elevated resting blood pressure (BP), which is associated with greater BP responses to cold pressor test (CPT) of immersing a hand into a cold water bath. Given past research showing the positive association between CPM and BP responses to CPT as the second pain stimulus, REs may exhibit greater CPM, along with augmented BP responses to CPT. **Purpose:** To compare CPM and BP responses to CPT between REs and controls. **METHODS:** REs were primarily recruited from weight lifting and power lifting teams ($n = 15$). Controls were healthy, normally active individuals (NAs) ($n = 15$). The participants completed the CPM test to evaluate changes in pain ratings (0-100) to electrical stimuli delivered to the ankle after CPT for a maximum of 2 minutes compared to baseline. The magnitude of CPM was calculated as change scores: post-CPT pain ratings - baseline pain ratings, with smaller pain ratings indicating greater pain inhibition. BP was assessed at baseline and every minute during CPT. CPM and BP data were analyzed using a mixed model ANOVA. The relationship between CPM and BP was tested using a correlational analysis. **Results:** Each group consisted of young, 9 men and 6 women (REs: 23 ± 5 yrs vs. NAs: 22 ± 2 yrs, $p > 0.05$). REs reported spending 9.1 ± 4.5 hours/week for resistance exercise. REs and NAs exhibited comparable CPM (Change scores. REs: -12 ± 12 vs. NAs: -14 ± 12 , $p > 0.05$), but REs showed greater systolic BP responses to CPT compared to NAs (Mean SBP. REs: 129 ± 11 mmHg vs. NAs: 119 ± 14 mmHg, $p < 0.05$). No significant association was found between systolic BP and CPM in REs (Resting: $r = 0.2$, $p > 0.05$ & Reactivity: $r = -0.2$, $p > 0.05$), but resting

systolic BP was positively associated with CPM in NAs (Resting: $r = 0.5$, $p < 0.05$ & Reactivity: $r = -0.1$, $p > 0.05$). **Conclusion:** The role of BP in CPM is likely complex, and the potential role of exercise in central pain processing needs to be studied.

2349 Board #268 May 28 2:00 PM - 3:30 PM
Psychological Flexibility And Catastrophizing Predict Pain Interference In Veterans With Chronic Pain: Physical Therapy Considerations

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(No relevant relationships reported)

The opioid crisis has made imperative the need for effective biopsychosocial interventions for chronic pain. The Empower Veterans Program (EVP) at the Atlanta VA is an interdisciplinary 10-week outpatient program involving group psychoeducation, psychotherapy, and physical therapy for Veterans with chronic pain. The aim is to improve patients' self-management of pain through increasing coping skills and functioning. Increasing psychological flexibility, the ability to persist or change behavior in pursuit of goals and values, and decreasing pain catastrophizing are two processes that may contribute to the impact of pain, and therefore may influence the efficacy of physical therapy.

PURPOSE: To determine whether psychological flexibility and pain catastrophizing predict pain interference in Veterans with chronic pain.

METHODS: Baseline measures were assessed in a sample (N=373) of Veterans enrolling in EVP. Stepwise linear regression was used to predict self-reported pain interference (Multidimensional Pain Inventory- Interference/MPI). Model predictors included general and pain-specific measures of psychological flexibility (General = Acceptance and Action Questionnaire/AAQ-II; Specific = Chronic Pain Acceptance Questionnaire/CPAQ), pain catastrophizing (Pain Catastrophizing Scale/PCS), and average pain intensity (Numeric Rating Scale/NRS). Demographic (age, gender and race) and physical performance (Timed Up and Go) were included in the model as covariates.

RESULTS: Sample characteristics were age (55.5 ± 0.4), gender (69.2% male), and race (15.9% white/ 79.1% black). The overall adjusted R² of the model was 0.48 ($p = 0.008$). Psychological flexibility (CPAQ $\beta = -.26$; AAQ $\beta = .23$), pain catastrophizing (PCS $\beta = .15$), and pain intensity (NRS $\beta = .24$) were significant predictors of pain interference.

CONCLUSIONS: Psychological flexibility and pain catastrophizing are two important psychological processes that contribute to pain interference. Rehabilitation strategies should consider the impact and response to treatment related to these constructs, especially aligning exercise and physical activity with values and behavior change principles.

2350 Board #269 May 28 2:00 PM - 3:30 PM
The Influence Of Sex And Cuff Width On Discomfort To Blood Flow Restriction In The Lower Body

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Wide cuffs cause arterial occlusion at lower pressures but may produce greater discomfort immediately following blood flow restricted exercise compared to more narrow cuffs in the upper body. Whether this is true in the lower body or if this differs by sex is currently unknown. **PURPOSE:** To determine the impact of cuff width, sex, and pressure on perceived discomfort in the lower body. **METHODS:** Experiment 1 (n=99) compared discomfort at rest between a 5 and 12 cm cuff. Experiment 2 (n=96) compared discomfort between a 5 and 12 cm cuff after four sets of knee extension exercise. For Experiments 1 and 2, the cuffs were inflated to 40% of the arterial occlusion pressure for each cuff. Experiment 3 (n=95) used the same exercise protocol as Experiment 2 to compare the discomfort between a 12 cm cuff inflated to pressure meant for a narrow cuff and a 12 cm cuff inflated to the appropriate pressure. Discomfort was rated following the 4th set (0: no discomfort, 100: maximal discomfort). Following the exercise bout in Experiments 2 and 3, participants were asked to choose which condition they would prefer to use regularly. A Bayesian repeated measures analysis with a between subject factor of sex was used to assess differences in discomfort. A contingency table was used to determine if cuff preference differed by sex. Bayes Factors (BF₁₀) were used to quantify evidence. **RESULTS:** In Experiment 1, the narrow cuff had higher discomfort than the wide cuff [16 vs 12 AU, BF₁₀=31]. In Experiment 2, men reported greater discomfort [58 vs 48 AU, BF₁₀=4.9], however, there were no differences in discomfort (52 vs. 53 AU) between

cuffs [median difference (95% credible interval) of -0.5 (-3, 1.8) AU, BF₁₀=0.17]. Narrow cuffs were preferred by most participants. Experiment 3 found cuffs inflated to pressure intended for narrow cuffs had greater ratings of discomfort [73 vs 52 AU, BF₁₀=1.2e+19] and participants preferred to use it less. Of note, the pressure for the 5 cm cuff had to be estimated for the majority of participants. **CONCLUSIONS:** The inability to directly assess arterial occlusion on the majority of the sample limits the conclusions that can be made. There was no strong evidence that discomfort differed between cuff widths though there was some indication that participants preferred the narrow cuff and the cuff inflated to the appropriate relative pressure.

2351 Board #270 May 28 2:00 PM - 3:30 PM
The Perceptual Responses Of Multiple Sclerosis Patients To Traditional Versus Blood Flow Restriction Resistance Exercise

Eduardo D. S. Freitas, Ryan M. Miller, Aaron D. Heishman, Japneet Kaur, Keldon M. Peak, Cameron Combs, Debra A. Bembem, FACSM, Rebecca Larson, Hugo M. Pereira, Michael G. Bembem, FACSM. University of Oklahoma, Norman, OK. (Sponsor: Michael G. Bembem, FACSM)

(No relevant relationships reported)

PURPOSE: To investigate the perceptual responses (ratings of perceived exertion [RPE] and discomfort [RD]) of multiple sclerosis patients (MS) to low-load resistance exercise (RE) with blood flow restriction (BFR) and to traditional high-load RE without BFR. **METHODS:** Thirteen individuals (males = 3, females = 10) with a confirmed diagnosis of relapsing-remitting MS were randomly assigned to the following RE conditions: 1) low-load RE with BFR (LL-BFR) and 2) high-load RE without BFR (HI). Participants performed 4 sets (30-15-15-15 reps) of bilateral leg press (LP) and knee extension (KE), at 20% of their one-maximum repetition (1-RM), and with 50% of BFR for the LL-BFR exercise trial. For the HI exercise condition, participants completed 4 sets (10-10-10-10 reps) of the same exercises at 70% of 1RM. There was a 3-minute rest period between sets and 5 minutes between exercises. RPE was assessed after each set using the OMNI-RES scale, with scores ranging from 0 to 10. The RD were assessed immediately before and after each set using a visual numeric pain scale, with scores ranging from 0 to 10. Data were analyzed using the Friedman's and the Wilcoxon non-parametric tests with Bonferroni correction, and with p set at 0.05. Data are winsorized means \pm SD. **RESULTS:** Greater RPE values were observed for the HI exercise condition compared to LL-BFR following the first set of LP (6.83 ± 1.17 vs 4.84 ± 2.05 , $p < 0.05$), but not after sets 2 (6.83 ± 1.48 vs 4.2 ± 2.14), 3 (7.62 ± 1.63 vs 4.82 ± 2.09), and 4 (7.94 ± 1.44 vs 4.98 ± 1.87). During KE, HI elicited significantly ($p < 0.05$) higher RPE after sets 2 (8.07 ± 1.06 vs 6.47 ± 1.52), 3 (8.86 ± 1.02 vs 6.84 ± 1.26), and 4 (9.02 ± 1.17 vs 6.84 ± 1.26 , but not set 1 (8.24 ± 0.66 vs 6.54 ± 1.74). For the RD, LL-BFR induced significantly ($p < 0.05$) greater RD than HI only after the first set of both LP (2.26 ± 1.46 vs 0.80 ± 0.54) and KE (4.69 ± 1.80 vs 2.52 ± 1.65). For the RD measured immediately before each set, LL-BFR was significantly greater ($p < 0.05$) than HI only before sets 3 (3.13 ± 1.41 vs 0.52 ± 0.68) and 4 (3.14 ± 1.92 vs 1.10 ± 1.09) of LP, and before sets 2 (3.75 ± 1.93 vs 0.94 ± 1.10) and 3 (3.15 ± 1.41 vs 1.15 ± 0.96) of KE. **CONCLUSION:** LL-BFR results in similar RPE and RD compared to HI. However, the RD perceived immediately before a subsequent set remained partially elevated following some of the sets of LL-BFR.

D-71 Free Communication/Poster - Clinical Exercise Testing

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
 Room: CC-Exhibit Hall

2352 Board #271 May 28 3:00 PM - 4:30 PM
Re-occurrence Of Oscillatory Ventilation During Cardiopulmonary Exercise Testing Post Left Ventricular Assist Device Implantation

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(No relevant relationships reported)

Oscillatory ventilation, characterized by cyclic fluctuations in minute ventilations, is recognized as a significant prognostic indicator of adverse outcomes in heart failure patients. Assessing for exercise induced oscillatory ventilation (EOV) during cardiopulmonary exercise tests (CPET) is a valuable non-invasive parameter in evaluating HF. Various reversibility studies using pharmacological, valvular surgery, cardiac transplantation, exercise training, and nocturnal adaptive servo-ventilation have been associated with an attenuation of EOV, but no studies have assessed if the incidence of EOV is reduced post LVAD implantation during routine CPET.

PURPOSE: To quantify the reoccurrence of EOv during CPET in HF patients that previously demonstrated EOv during a CPET prior to their LVAD implantation surgery.

METHODS: A retrospective analysis of HF patients that received LVAD implantation surgery from 1988-2018 was conducted. CPET data was collected and evaluated for EOv from patients that had testing done within one year both pre and post LVAD. EOv was defined as oscillatory ventilations that persist for at least 60% of the exercise test and amplitude of 15% or more of the average resting value.

RESULTS: Among 325 participants with LVAD's, 32 underwent CPET testing within one year both pre and post-surgery. Basic demographics are as follows: 81% male, age = 57 ± 8.8, and BMI = 32 ± 7. Forty four percent (n=14) of the participants demonstrated EOv during their pre LVAD CPET and 12% (n=4) demonstrated EOv on their post LVAD. This represents a 71% decrease in the occurrence of EOv which is significant at p<.05. No participant newly developed EOv post LVAD.

CONCLUSION: Among HF people with EOv during a CPET, LVAD implantation is associated with an attenuation of EOv. Future study is warranted to determine if EOv post LVAD correlates with early hospital re-admission or cardiovascular mortality.

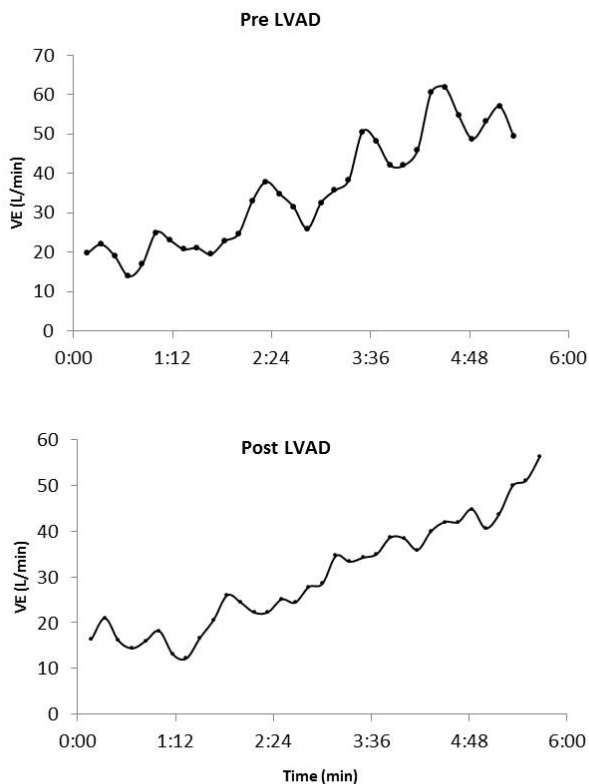


Figure. Ventilation from a representative patient before and after LVAD implantation surgery displaying reduction of amplitude and cycle length of EOv

METHODS: A total of 117 female participants (age: 38.7 ± 7.6 years) underwent muscle mass (dual-energy x-ray absorptiometry), muscle strength (*knee extensors* isokinetic *peak torque at 60 °/s*), and physical function (sit-to-stand, timed up-and-go, and six-minute walk tests) evaluation. *Spearman's rank correlation coefficient* was used to identify associations. Mann-Whitney U test was used to compare the physical function of participants in the lowest and highest quartiles of muscle mass and strength.

RESULTS: The table below presents the association between muscle mass, muscle strength and physical function. Of the studied muscle-related phenotypes, only muscle strength was significantly related to physical function. Compared to the highest quartile of muscle strength, participants in the lowest quartile exhibited significantly worse performance in the timed-up and go test (6.3 ± 0.9 s vs. 5.8 ± 0.9 s; p= 0.048), but did not reach statistical significance the sit-to-stand (14.6 ± 2.9 vs. 16.3 ± 4.0; p= 0.124) and six-minute walk (569.6 ± 54.9 m vs. 599.8 ± 82.1 m; p= 0.178) tests.

CONCLUSION: Muscle strength, but not muscle mass, is associated with physical function in long-term gastric by-pass women; which support a growing body of evidence demonstrating that strength has a better prognostic value compared to muscle mass to predict worsening disability.

Keywords: Gastric bypass, Muscle strength, physical functional performance.

The association between muscle mass, muscle strength and physical function in long-term gastric by-pass women.		
	Muscle mass	Muscle strength
Sit-to-stand test	-0.112	0.245*
Timed up-and-go test	0.120	-0.216*
Six-minute walk test	0.096	0.198*

* Denotes significant correlation (p<0.005).

2354 Board #273 May 28 3:00 PM - 4:30 PM
Clinical Application Of Duke Activity Status Index To Select An Appropriate Cardiovascular Stress Test Protocol

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(No relevant relationships reported)

Patients referred for cardiovascular stress testing with limited functional capacity due to age, deconditioning, or clinical comorbidities may be unable to achieve an adequate exercise stress level to render a diagnostic cardiovascular stress test. The Bruce treadmill protocol is the current clinical standard, but may be inappropriate for some patients due to large changes in speed/grade between stages. The Duke Activity Status Index (DASI), a validated 12-item questionnaire that utilizes self-reported physical work capacity to estimate metabolic equivalents (METs), may help clinicians select the most appropriate stress test protocol. **PURPOSE:** To determine if DASI estimated MET levels can predict the achievement of an adequate diagnostic exercise stress test using the Bruce treadmill protocol. **METHODS:** DASI questionnaires were administered to patients prior to stress testing. DASI estimated METs were calculated from the total score. Measured METs were determined from peak treadmill speed and grade. Criteria for determining a suboptimal exercise stress was defined as inability to complete stage 1 of a Bruce protocol. **RESULTS:** A total of 400 patients completed the DASI questionnaire. Mean DASI estimated METs and measured METs were 8.1 ± 1.7 and 8.4 ± 2.8, respectively. Logistic regression analysis showed DASI estimated and measured METs predicted a suboptimal test result (P<0.001). Receiver operator characteristic curve (Figure 1) demonstrated a DASI estimated MET level ≤ 7.4 was the optimal threshold to predict a suboptimal test result, AUC=0.883, SE=0.037 (0.811-0.956), sensitivity= 94%, specificity= 73%, P<0.0001. **CONCLUSIONS:** Findings suggest the Duke Activity Status Index may be an effective way to stratify stress type in the clinical setting. Further study is needed to assess if more conservative exercise protocols with smaller incremental changes in workload would increase the likelihood of achieving a diagnostic cardiovascular stress result.

2353 Board #272 May 28 3:00 PM - 4:30 PM
Muscle Strength, But Not Mass, Is Associated With Physical Function In Long-term Gastric By-pass Women

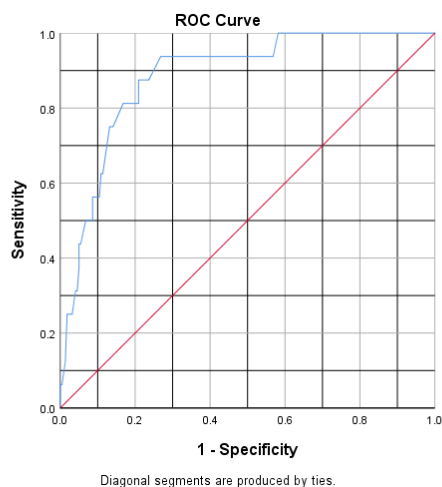
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Muscle strength, but not mass, is associated with physical function in long-term gastric by-pass women

Muscle-related phenotypes have been linked to physical function in the general population; however, this relationship has yet to be examined in long-term gastric by-pass women.

PURPOSE: To examine the association between muscle mass, muscle strength and physical function in women who have been doing gastric by-pass for over 2 years.

THURSDAY, MAY 28, 2020



2355 Board #274 May 28 3:00 PM - 4:30 PM

Does Low Volume, High-intensity Interval Training Impact Right Ventricular Size And Function?

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(No relevant relationships reported)

PURPOSE

The minimum volume of exercise training required for the right ventricular (RV) adaptation's changes to occur is unknown. We aimed to determine possible effects on RV size and function with extremely low volume, high-intensity exercise training (HIT) in previously untrained subjects.

METHODS

Healthy, young subjects not performing regular training were recruited for six weeks of supervised HIT, three times per week. Each of the 18 sessions consisted of three 30 seconds all-out sprints on a bicycle ergometer (breaking force 7.5% of the subject's body weight), separated by two minutes of low intensity cycling. A maximal cardiopulmonary exercise test (CPX) and an echocardiogram (echo) at rest were performed before and the week after the last session. Right atrial volume (RAV), RV inflow-tract diameter (RVId) and end diastolic area (RVEDA) were measured. RV systolic function was determined as fraction area change (FAC), tricuspid annular plane systolic excursion (TAPSE) and global longitudinal strain based on 2D speckle tracking in 6 segments of free wall and septum (RVGs).

RESULTS

Maximal oxygen uptake ($\dot{V}O_2$ max) was determined in 27 subjects and increased from 3.0 ± 0.8 L/min to 3.4 ± 0.8 L/min post training, mean +14%, $p < 0.001$. Pre- and post HIT echo data were available in 28 subjects (27±5 yrs, 16 male, BMI 24 ± 2 kg/m² (18-28). RVEDA was larger post training (19.6 ± 4.1 vs 18.3 ± 3.6 cm², $p = 0.003$) while RVId showed no difference (3.7 ± 0.4 vs 3.7 ± 0.5 cm, $p = 0.9$). FAC, TAPSE and RVGs remained unchanged after the training period (51.3 ± 7 vs $52.9 \pm 6\%$, $p = 0.2$; 2.4 ± 0.3 vs 2.8 ± 1.8 cm, $p = 0.3$; -23.1 ± 3.6 vs $-22.9 \pm 3.6\%$, $p = 0.6$). RAV showed a tendency to larger values post training but not statistically significant (46.0 ± 15.7 vs 49.6 ± 17.3 mL, $p = 0.07$). There was a significant correlation between $\dot{V}O_2$ max, RVEDA and RAV at baseline and post training ($r^2 = 0.32$, $p = 0.003$ resp. $r^2 = 0.21$; $p = 0.01$ and $r^2 = 0.20$, $p = 0.04$ resp. $r^2 = 0.45$, $p = 0.0001$).

CONCLUSION

Larger RV chamber size was present after less than 5 min high-intensity exercise training per week for six weeks. This was not proportional to changes in $\dot{V}O_2$ max. The systolic RV function remained unchanged.

2356 Board #275 May 28 3:00 PM - 4:30 PM
Abstract Withdrawn

2357 Board #276 May 28 3:00 PM - 4:30 PM
Peak Responses To Graded Exercise Protocols In Young Children

Tori L. Vogelaar, Lilly A. Bradley, Kathryn R. Lanphere, Mark Vranicar, Jody L. Clasey, FACSM. University of Kentucky, Lexington, KY. (Sponsor: Jody L. Clasey, FACSM)
(No relevant relationships reported)

The Bruce protocol (Bruce) is a progressive treadmill test with an aggressive initial grade that was developed for use in adults, and is often used to assess cardiac patients. Due to the steep grade, young children may terminate the Bruce prematurely. The University of Kentucky Pediatric Exercise Physiology Lab has developed a protocol (PEP Lab) with lower grades which we hypothesized would be better tolerated and potentially elicit greater peak $\dot{V}O_2$ and cardiovascular responses. **PURPOSE:** To compare peak oxygen uptake ($\dot{pV}O_2$; ml·kg⁻¹·min⁻¹), heart rate (pHR; bpm), systolic blood pressure (pSBP; mmHg), and respiratory exchange ratio (pRER) responses to the Bruce versus the PEP Lab in 43 (22 boys) young (7-11 yr old) children of varying adiposities. We also evaluated each subject's perception of difficulty between the two protocols.

METHODS: Subjects completed the Bruce and the PEP Lab protocols in a random order 1 week apart. $\dot{pV}O_2$ and pHR were determined with an integrated metabolic system, and pSBP was determined by manual auscultation. Verbal encouragement was provided during both testing sessions and test completion based on volitional fatigue. Results are expressed as mean ± SE and significance $p < 0.05$.

RESULTS: The Bruce versus PEP Lab $\dot{pV}O_2$ (43.6 ± 1.5 vs 43.9 ± 1.5) and pHR (186.6 ± 2.0 vs 188.2 ± 2.2) did not significantly differ. However, pSBP during the Bruce was significantly lower (136.4 ± 1.4 vs 141.3 ± 1.1) and the Bruce pRER was significantly higher (1.065 ± 0.018 vs 1.013 ± 0.014) than the PEP Lab. Bruce and PEP Lab protocol $\dot{pV}O_2$, pHR, pSBP, pRER were significantly correlated ($r = 0.61, 0.47, 0.53$ and 0.42 , respectively). The majority (88%) of the children perceived the Bruce to be more difficult.

CONCLUSIONS: A less steep protocol can elicit similar cardiopulmonary results as the Bruce. Protocols that are perceived as less difficult may help guarantee that children do not terminate their exercise tests prematurely to reaching their true $\dot{pV}O_2$. Supported by the University of Kentucky Pediatric Exercise Physiology Lab Endowment; NIH National Center for Advancing Translational Sciences through grant number UL1TR001998. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

2358 Board #277 May 28 3:00 PM - 4:30 PM
Ventilatory Constraint Analysis During Maximal Exercise Testing In Elite Youth Athletes

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PURPOSE: Assessment of ventilatory constraint has become essential in the assessment of exercise performance. However, minimal data exists regarding a systematic evaluation of these constraints in an elite athletic population. The study was performed to provide new normative data and preliminary analysis of how these variables correlate.

METHODS: Twenty four individuals were analyzed as part of a human performance evaluation. 16 individuals competed in Div 1 soccer (16F, age 18-22 yrs) and 8 in AAA hockey (8M, age 13-14 yrs). A graded maximal exercise test was performed (Bike: Lode Excalibur) with breath by breath gas analysis (Med Graphics). Expiratory flow limitation (EFL%), VE/MVV, ventilatory reserve capacity (VRC%), shift in EELV (IC/VC%), shift in EILV (VT/IC%), and inspiratory reserve (IR) were recorded. Spearman coefficients were determined between ventilatory constraint and exercise variables. Unpaired Student t tests were performed for comparison within constraint variables. Values are expressed as mean±SD with significance set at $p < 0.05$.

RESULTS: All constraint variables were obtained except IR (incomplete data). EFL% (37.8 ± 26.5), VRC% (90.2 ± 1.7), IC/VC% (65.1 ± 8.9), VE/MVV% (100.4 ± 8.5) and VT/IC% (83.5 ± 7.7) did not vary by sport. EFL% correlated to VRC% ($r = 0.57$, $p < 0.05$) and weakly correlated to IC/VC% ($r = 0.35$, $p = 0.09$) but not VE/MVV% or VT/IC%. No relationship existed between the remaining variables. $\dot{V}O_2$ (ml/kg lean body mass) was higher for VE/MVV >100% than <100% (64.2 ± 6.1 vs 59.9 ± 3.4 , $p < 0.05$). Peak work capacity (PWC)/LBM, % of predicted, was similarly affected (142.5 ± 10.5 vs 153.6 ± 10.2 , $p < 0.05$). For IC/VC%, higher PWC (297.7 ± 47.3 vs 265.8 ± 22.3 Watts, $p < 0.05$)

and VO_2 (3.32 ± 0.51 vs 2.98 ± 0.29 liters, $p < 0.05$) were seen in the low IC/VC group (<65%) compared to the high group (>65%). EFL% and VT/IC% did not correlate with PWC or VO_2 .

CONCLUSIONS: Ventilatory constraint analysis yielded normative data. EFL was associated with ventilatory reserve. However, unlike previous data in cystic fibrosis, VE/MVV was not correlated to ventilatory constraint. While a shift in EELV (IC/VC%) may be considered abnormal in underlying respiratory diseases, the ratio in this study was associated with increased exercise performance reflecting different underlying compensatory breathing mechanics.

2359 Board #278 May 28 3:00 PM - 4:30 PM
The Index Of Physical Performance In Muscle Damage Biomarker In Youth Athletes

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PURPOSE: To investigate the index of the physical performance among different levels of serum creatine kinase in youth athletes.

METHODS: 53 youth male athletes ages of 12 to 18 years were divided into three groups, low-level group (LL, $n=17$), middle-level group (ML, $n=20$), and high-level group (HL, $n=16$) by CK level of serum (reasonable CK range: 82-1,083 U/L for male athletes). Fasting blood samples of CK and myoglobin were collected in the morning. The physical performance test included gripping, low back muscle strength, curl up, standing broad jump, lower limb flexibility, 30m sprint, vertical jump, whole-body reaction time, agility, and yo-yo test for aerobic endurance. One-way ANOVA and Pearson's correlation were used to determine the difference between physical performance and biomarkers.

RESULTS: In biomarkers, the value of CK had positive correlation between low back muscle strength ($r=0.278$, $p < 0.05$) and reaction time ($r=0.412$, $p < 0.01$). There was a negative correlation between CK and aerobic endurance ($r=-0.288$, $p < 0.05$). The myoglobin of LL (19.76 ng/ml) was significantly lower than ML and HL (25.18 ng/ml; 28.96 ng/ml) ($p < 0.05$). The aerobic endurance of LL was significantly higher (26.6%) than HL ($p < 0.05$). In the reaction time, LL and ML (267.12ms; 284.95ms) were significantly faster than HL (367.27ms) ($p < 0.05$). There were no significant differences in other physical performance.

CONCLUSIONS: This study suggested that the performance of whole-body reaction time and yo-yo test perhaps to be reminded for muscle damage or fatigue in the reasonable CK range. In addition, future research can regularly implement both physical indexes to track muscle fatigue.

2360 Board #279 May 28 3:00 PM - 4:30 PM
Chronotropic Intolerance In Patients With Chronic Lyme Disease Identified By Serial Cardiopulmonary Exercise Testing

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 (No relevant relationships reported)

In the U.S., annual incidence of Lyme disease is approximately 300,000. In an estimated 5-30% of cases, post-treatment Lyme disease syndrome (PTLDS) develops; symptoms include post-exertional malaise characteristic of myalgic encephalomyelitis. The contribution of autonomic regulation has not been elucidated. **PURPOSE:** To evaluate cardiovascular responses to serial cardiopulmonary testing in patients with PTLDS. **METHODS:** 14 patients with PTLDS and 8 sedentary controls underwent 2 maximal exercise tests separated by 24 hours. Heart rate (HR) was measured continuously via electrocardiogram. Expired air was collected for determination of anaerobic threshold (AT) using V-slope methodology and maximal exertion was defined as a respiratory exchange ratio > 1.09 . Independent-samples t-tests compared baseline characteristics of PTLDS patients and controls. Linear regression determined the effect of PTLDS diagnosis on HR at AT and peak holding workload constant. **RESULTS:** Patients were 44.0 ± 10.1 years old, weighed 69.8 ± 16.2 kg, and achieved a peak VO_2 of 23.8 ± 6.2 mL/kg/min during test 1. HR was 116.2 ± 21.8 bpm at AT and 162.6 ± 25.1 at peak. PTLDS and controls did not differ in peak VO_2 during test 1 ($p=0.161$), test 2 ($p=0.134$), or the difference between test 1 and test 2 ($p=0.498$). HR at AT was comparable in test 1 ($p=0.127$) but different in test 2 ($p < 0.001$). HR at peak was different in test 1 ($p=0.001$) and test 2 ($p < 0.001$). During test 1, holding workload constant, PTLDS patients had lower peak HR by 19.5 bpm ($p=0.033$; 95% CI: -37.3 to -1.8). During test 2, holding workload constant, PTLDS predicted a lower HR by 26.8 bpm at AT ($p=0.004$; 95% CI: -43.9 to -9.8) and 24.3 bpm at peak ($p=0.007$; 95% CI: -40.9 to -7.7). **CONCLUSIONS:** Patients with PTLDS demonstrated abnormal cardiovascular responses to exercise. Despite accomplishing the same VO_2 , and holding workload constant, the HR response was diminished in the post-exertional state, potentially indicating dysautonomia in PTLDS.

2361 Board #280 May 28 3:00 PM - 4:30 PM
Normalizing Cardiorespiratory Fitness To Fat-free Mass Improves Mortality Risk Prediction In Overweight Adults From The Ball St Cohort

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PURPOSE: Cardiorespiratory fitness (CRF) is a significant predictor of mortality outcomes in various populations, including overweight and obese adults. However, CRF is commonly expressed normalized to total body weight ($\text{VO}_{2\text{peakTBW}}$) which may weaken the relationship in obese adults as fat-free mass (FFM) is directly related to CRF, and increased body fat is associated with lower CRF in adults. Therefore, this study aimed to assess the relationship between CRF normalized for FFM ($\text{VO}_{2\text{peakFFM}}$) and all-cause mortality, as well as compare the predictive ability of $\text{VO}_{2\text{peakFFM}}$ and $\text{VO}_{2\text{peakTBW}}$ in a cohort of self-referred overweight and obese adults.

METHODS: Participants included 1,021 overweight and obese adults (520 men, 501 women; BMI: 30.8 ± 5.3) who completed a cardiopulmonary exercise test (CPX) and body composition assessment between 1970-2016 to determine CRF. Participants were included if their BMI > 25 kg·m⁻² and/or waist circumference was > 88 cm in women and > 102 cm in men. FFM was estimated using the skinfold method to estimate FFM. Participants were followed for 17.8 \pm 10.8 years after their CPX and body composition assessments for mortality outcomes. Cox-proportional hazard models were performed to determine the relationship of $\text{VO}_{2\text{peakFFM}}$ with mortality outcomes. A Wald Chi-square test of equality was performed to compare the predictive ability of CRF expressed as $\text{VO}_{2\text{peakTBW}}$ and $\text{VO}_{2\text{peakFFM}}$.

RESULTS: Overall, $\text{VO}_{2\text{peakFFM}}$ was inversely related to all-cause mortality, with an 11.8% lower risk per 1 mL·kgFFM⁻¹·min⁻¹ improvement, respectively ($p < 0.01$). $\text{VO}_{2\text{peakFFM}}$ was shown to be a significantly stronger predictor of all-cause mortality than $\text{VO}_{2\text{peakTBW}}$ (parameter estimates: -0.44 vs. -0.18, $p < 0.05$ respectively).

CONCLUSIONS: Body composition is an important factor when considering the relationship between CRF and mortality risk. Clinicians should consider normalizing CRF to FFM when feasible, especially in individuals with excess body fat as it will strengthen the predictive power of the measure.

2362 Board #281 May 28 3:00 PM - 4:30 PM
Hemodynamic Performance In Patients With A Bicuspid Aortic Valve During Treadmill Ramp Exercise Testing

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PURPOSE: To evaluate the effect of a bicuspid aortic valve on the hemodynamic response to a treadmill ramp protocol in pediatric patients. **METHODS:** We evaluated 18 patients with a bicuspid aortic valve (BAV) and 18 normal subjects (C), age and size matched, using a Ramp Treadmill protocol. Neither group was treated with a Beta Blocker. Resting aortic valve peak gradient (PG) and shortening fraction (SF) were evaluated by echocardiography for the BAV group. Systolic blood pressure (SBP), cardiac output and stroke volume (SV) were obtained at rest and maximal exercise. Maximal oxygen pulse (MO2P), percent predicted oxygen pulse (%PO2P) and respiratory exchange ratio (RER) were obtained at maximal exercise. **RESULTS:** There were no significant differences between the BAV and C groups in age (14.6 ± 2.1 vs 15.8 ± 3.1 (yr)), height (1.63 ± 0.1 vs 1.66 ± 0.12 (m)) or weight (55.7 ± 15.1 vs 57.6 ± 13.2 (kg)). The BAV group had a resting PG of 16.5 ± 8 mmHg and a SF of 39.5 ± 4.9 %. The SBP in the BAV group was significantly decreased at rest (113 ± 9 vs 120 ± 10 mmHg) $p < 0.05$ and exercise (160 ± 14 vs 174 ± 19 (mmHg) $p < 0.02$) compared to the C group. BAV group had a significantly decreased SV (56 ± 13 vs 64 ± 21 (ml/beat) $p < 0.04$) compared to C at rest. The decreased MO2P in the BAV group approached significance (6.6 ± 1.7 vs 7.6 ± 1.6 ml/beat $P=0.06$) compared to C. In BAV, %PO2P was significantly decrease (94 ± 24 vs 113 ± 18 (%)) $p < 0.01$. Max RER was not significantly different in BAV and C groups (1.19 ± 0.08 vs 1.19 ± 0.06). MO2P significantly correlated to cardiac output ($r=0.67$ $p < 0.05$). Significance was set at $p < 0.05$. **CONCLUSION:** BAV and C groups reached the same intensity of exercise as reflected by the RER. The BAV group had decreased systolic blood pressure and O2Pulse response to exercise. These data suggest that in the face of a mild aortic valve gradient and normal shortening fraction, these BAV patients had a diminished hemodynamic response to exercise.

2363 Board #282 May 28 3:00 PM - 4:30 PM
Abstract Withdrawn

2364 Board #283 May 28 3:00 PM - 4:30 PM
Predictors Of Achieving An Adequate Heart Rate Response During Cardiovascular Exercise Stress Testing

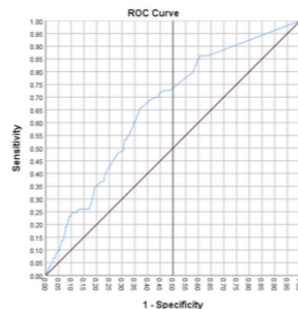
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Cardiovascular exercise stress testing is a noninvasive, diagnostic tool to assess for myocardial ischemia. Achievement of $\geq 85\%$ of age-predicted maximal heart rate (APMHR) is commonly used as criteria to define an adequate stress test. **PURPOSE:** The purpose of this study was to determine if patient characteristics could predict ability to achieve an adequate heart rate response during exercise stress testing. **METHODS:** Baseline characteristics including age, race, gender, height, weight, body mass index (BMI), referring provider type, Duke Activity Status Index (DASI) score and stress type (pharmacologic versus exercise) were collected on all patients who completed cardiovascular stress testing. All exercise tests were performed using a standard Bruce treadmill protocol. Criteria for determining an adequate exercise stress test was $\geq 85\%$ of age-predicted maximal heart rate. **RESULTS:** Out of 608 cardiovascular stress tests, 354 performed exercise stress. Patient characteristics of those who underwent exercise stress was as follows: female= 175 (49%), Caucasian=173 (47%), African American=146 (45%), mean age was 57 ± 13 years, mean BMI= 31.4 ± 8.1 kg/m², mean DASI estimated METS= 8.1 ± 1.7 and mean METS achieved= 8.4 ± 2.8 . Fifty-eight (19%) patients did not achieve $\geq 85\%$ APMHR. Exercise time, DASI estimated METS and METS achieved were significant predictors of achieving $\geq 85\%$ APMHR (all P's <0.02). Age, race, gender, height, weight, BMI, provider type were not significant (all P's >0.11). **CONCLUSIONS:** In conclusion, exercise duration during graded exercise testing predicted achievement of adequate stress response during cardiovascular stress testing. Strategies to select an appropriate exercise test protocol allowing longer exercise duration may improve the ability to reach target heart rate during cardiovascular stress testing.

Prediction of Suboptimal Effort (<85%PMHR) by DASI est.METS

AUC = 0.659 (0.589-0.730) P<0.0001

Optimal Threshold for Suboptimal Effort = 8.0 DASI est.METS
 Sensitivity=65%, Specificity=65%



2365 Board #284 May 28 3:00 PM - 4:30 PM
Effect Of Combined Exercise On Lung Function, Blood Vitamin D, Calcium And Bone Metabolism Hormones In Elderly Women

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 (No relevant relationships reported)

PURPOSE: This study was to investigate the effects of a combined exercise training regimen on lung function, blood vitamin D, calcium and bone metabolism hormones (calcitonin, osteocalcin) in elderly women. **METHODS:** Thirty healthy elderly female volunteers, were randomly assigned to combined exercise group (n=13) trained for 12-week or to a "non-exercise" control group (n=17). The combined exercise program was conducted for 60 minutes per session three times a week at the following intensities: Aerobic exercise intensity was 40-50%HRR (RPE 12-13) for 1-4 weeks, 50-60% HRR (RPE 13-14) for 5-8 weeks, and 60-70%HRR (RPE 14-15) for 9-12 weeks. Resistance exercise intensity was set at 3-4 in OMNI-RES for 1-4 weeks, 5-6 in OMNI-RES for 5-8 weeks, 7-8 in OMNI-RES for 9-12 weeks.

RESULTS: FEV1 showed interaction effects group \times time, FVC and FEV1 were significantly increased in the exercise group. Vitamin D and calcium showed interaction effects between group \times time, vitamin D was significantly increased in the both group, and calcium was decreased in the control group. Calcitonin and osteocalcin of bone metabolism showed interaction effects group \times time, osteocalcin was significantly decreased in control group. **CONCLUSIONS:** Our findings indicate that combined exercise were effective in improving the lung function and bone metabolism hormones in elderly women due to decreased physical activities.

2366 Board #285 May 28 3:00 PM - 4:30 PM
Pilot Study On Effect Of Ipsilateral Long Kinetic Chains On Shoulder Elevation Strength

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 (No relevant relationships reported)

There is growing evidence to suggest that kinetic chains extend far beyond the core muscles, following myofascial meridians that interestingly appear to overlap with classically-known acupuncture channels. Strengthening programs during the rehabilitation of musculoskeletal injuries utilize kinetic chain exercises; however, how lower extremity strength potentially directly affects upper extremity strength has not been quantified. **PURPOSE:** To examine quantitatively the effect on shoulder elevation strength (SES) in the sagittal plane on ipsilateral lower extremity tibialis anterior muscle activation. **METHODS:** Twenty young healthy adult volunteers (half women, half men), ages 20-60 years, having no shoulder pain were recruited. Participants had baseline SES evaluated with a hand-held dynamometer applied just proximal to the radial styloid with the arm held in 90-degree elevation in the sagittal plane. The participants underwent the following interventions: SES and ipsilateral anterior tibialis muscle activation (IATMA) while standing, SES and IATMA while seated with legs dangling, and SES with ipsilateral gastrocnemius activation while seated with legs dangling. **RESULTS:** In females, IATMA, in standing and seated position, reduced SES by a mean percentage of 12.57 and 14.88, respectively, from baseline. SES with gastrocnemius activation (reciprocal relaxation of anterior tibialis) reduced SES by a mean percentage of 3.93 from baseline. In males, IATMA, in standing and seated position, reduced SES by a mean percentage of 5.58 and 10.84, respectively, from baseline. SES with gastrocnemius activation (reciprocal relaxation of anterior tibialis) reduced SES by a mean percentage of 3.3 from baseline. **CONCLUSIONS:** IATMA directly reduces SES; it also produces a greater decrement in SES compared to ipsilateral gastrocnemius activation. This kinetic chain effect appears coincident with known myofascial meridians.

2367 Board #286 May 28 3:00 PM - 4:30 PM
Cardiovascular Response During Exercise In Patients With Hypertension And Patients With Hypertension With Diabetes

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Purpose: Heart rate product (RPP) can be used to predict cardiovascular diseases (CVD) and can be regarded as an index for continuous monitoring of ejection fraction and myocardial oxygen consumption. Exercise can improve patients' cardiovascular function and reduce the risk of having CVD. The purpose of this study was to investigate changes in heart rate (HR) and blood pressure (BP) of patients who suffer from hypertension or hypertension with diabetes mellitus during exercise and at post-exercise recovery period.

Methods: This study recruited 85 diagnosed hypertension subjects and diagnosed hypertension with diabetes mellitus subjects (40-69 years of age), who were divided into hypertension group (HTN, n = 66) and hypertension with diabetes mellitus group (HDM, n = 19). The modified Bruce protocol was adopted in this study, in which patients pedaled the cycle ergometer, starting from the level of 25W, for 3min per stage and then increasing the levels gradually. HR, BP, RPE and oxygen saturation (SPO₂) were measured at rest, during exercise and at recovery and RPP and pulse pressure difference (SBP minus DBP) were calculated.

Results: (1) The HTN group had a significantly lower resting HR than the HDM group (P<0.05, 76.12 \pm 10.73 vs 86.50 \pm 16.80 bpm, respectively). Resting RPP is significantly lower in HTN group than in HDM group (P<0.05, 88.30 \pm 26.57 vs 106.50 \pm 40.44 times \cdot mmHg/100, respectively) (2) RPP at 50W is significantly lower in the HTN group, compared with the HDM group. (P<0.05, 160.86 \pm 41.10 vs 186.68 \pm 29.86 times \cdot mmHg/100, respectively) (3) SBP at 100W (P<0.05, 186.62 \pm 17.10 vs 206.25 \pm 17.58 mmHg, respectively) and pulse pressure difference at 100W (P<0.05, 97.00 \pm 18.87 vs 127.25 \pm 25.38 mmHg, respectively) were significantly lower in HTN group. (4) The HTN

group had a significantly lower pulse pressure at the time of 5-minute post-exercise recovery than the HDM group ($P < 0.05$, 54.29 ± 15.54 vs 72.59 ± 28.71 mmHg, respectively). (5) SBP at the time of 15-minute post-exercise recovery in HTN group were significantly higher than in the HDM group ($P < 0.05$, 121.81 ± 13.70 vs 111.78 ± 8.94 mmHg, respectively).

Conclusions: The responses of heart rate and blood pressure of patients with hypertension was superior to those with hypertension with diabetes both in exercise and at post-exercise recovery period.

2368 Board #287 May 28 3:00 PM - 4:30 PM

Effect Of Graded Exercise On Ror And Blood Oxidative-stress In Trained And Untrained Subjects

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Submaximal graded exercise testing is a commonly used method to assess cardiovascular stress. Reserve of repolarization of the heart (RoR) is an ECG-based, non-invasive method to monitor the heart's stress response, and assesses cardiac cells ability to reestablish their membrane potential. RoR has been shown to be a useful indicator of cardiovascular disease risk in cardiac patients. This study examined RoR difference between trained (T) and untrained (U) individuals and correlate this outcome with blood stress markers. **PURPOSE:** To determine if RoR and blood stress markers in response to a graded exercise in T and U cohorts differ. **METHODS:** Thirty-nine (male and female) subjects (23.6 ± 5.6 yrs) were recruited. Subjects arrived after overnight fast between 7-9 am and rested for 20 minutes. Subjects completed a fitness questionnaire to determine training status (T or U). ECGs (12 lead) were monitored before, during and after exercise to obtain RoR. A graded walking test (GXT) on a treadmill until 85% of estimated maximum heart rate was performed. Blood obtained at rest and immediately after exercise were analyzed using HPLC for glutathione (oxidized [GSSG], reduced [GSH], total [TGSH]). Repeated measures ANOVAs were utilized to analyze the results using SPSS v24 with significance set at $\alpha = 0.05$. **RESULTS:** There were significantly lower resting HRs ($p = .023$) and higher workloads achieved during testing ($p = .002$) between T vs U groups. Resting RoR (independent of group) was significantly reduced from $75 \pm 5\%$ pre-test to $26 \pm 10\%$ RoR at the end of exercise ($p < .001$). Final stage RoR was significantly lower for T compared to U group (T: $20 \pm 9.4\%$; U: $31 \pm 9.4\%$, $p = .041$), but T group performed significantly greater stages ($p = 0.002$). The GXT induced a reduction in blood GSH (Pre 366 ± 161 μ M, Post 273 ± 180 μ M, $p < .001$) and an increase of GSSG (Pre 135 ± 62 μ M, Post 157 ± 83 μ M, $p = .038$) with no difference between groups. GSSG/TGSH decreased after GXT ($p = 0.028$) independent of group. **CONCLUSIONS:** These data suggest that a GXT induces a different stress response in T and U individuals. The oxidative stress at end GXT was similar but needed more workloads to get to this same internal stress level in the T group. Further studies are needed to ascertain stress responses with RoR and relative workloads.

2369 Board #288 May 28 3:00 PM - 4:30 PM
Determining An Appropriate Cardiopulmonary Exercise Testing Protocol For Individuals With Neuromuscular Disease

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(No relevant relationships reported)

PURPOSE: To review published standards and recommendations for people with neuromuscular disease and establish a graded ramp-up protocol to assess exercise tolerance for individuals who have moderate to severe muscle weakness. **METHODS:** A review of literature for muscular dystrophy or neuromuscular disease and exercise testing was performed to assess different methodologies in Cardiopulmonary Exercise Testing (CPET) using cycle ergometry CPET. A progressive ramp-up protocol was developed and administered with patients who attend Stanford's multidisciplinary clinic to determine feasibility and test termination criteria that may limit the ability to achieve maximum oxygen consumption. **RESULTS:** Literature search resulted in 43 research studies. The study breakdown included Myopathies and McArdle disease =20; Pompe=5; FSHD; SMA, Metabolic Myopathies=3; DMD/BMD=2, Myotonic Dystrophy=2; CMT=1; IBM=1. Studies greatly ranged in mode of testing. Most study participants were ambulatory. Most protocols used a graded 1-2 minute progressive ramping protocol up to the point of exhaustion indicated by a Visual Analog Scale and heart rate. Early termination resulted from participants voluntarily stopping due to muscle weakness.

We developed a progressive ramp up protocol with 1-minute increment increase in workload at 5-watt intervals to avoid early termination from large increases in workload. We tested 3 individuals with neuromuscular disease and 2 controls. Only 2 participants (1 with NMD and 1 control) were able to reach an RER of 1.1 of

maximal oxygen uptake (VO₂max). Reasons for early termination were consistent with the published literature including heart rate, voluntary stop and muscle weakness. **CONCLUSIONS:** With promising treatments on the horizon for neuromuscular diseases, physical therapists are asked to determine appropriate exercise prescriptions for individuals with a range of functional abilities and muscle weakness. Currently, CPET protocol methodology varies for weaker individuals. Our results will contribute to developing a proposed submaximal clinical exercise tolerance test protocol to establish safe exercise prescriptions and determine treatment intervention benefits for patients with neuromuscular disease.

D-72 Free Communication/Poster - Obesity/Weight-loss

Thursday, May 28, 2020, 2:00 PM - 4:30 PM

Room: CC-Exhibit Hall

2370 Board #289 May 28 3:00 PM - 4:30 PM

ACUTE RESPONSE OF BLOOD LIPID PROFILES TO DIFFERENT INTENSITIES OF EXERCISE IN OBESE MEN

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(No relevant relationships reported)

PURPOSE: This study was conducted in order to examine the blood lipid profile changes following lower or higher-intensity exercise in obese men. The changes in blood lipid profiles include TC, TG, LDL-C, HDL-C following moderate or high intensity exercise in obese males. **METHODS:** In a randomized, cross-over design, fifteen obese (BMI > 30 kg/m²) sedentary (less than 2 days per week of physical activity) male volunteers, the ages between 18 and 30 participated in the study. The participants performed a single bout of cycling exercise (average energy expenditure ~300 kcal) at two different intensities in random order [moderate-intensity: 50% of maximal heart rate and high-intensity: 80% of maximal heart rate]. Overnight fasting blood samples were collected at baseline, immediate post-exercise (IPE), 1-hr PE, and 24-hr PE for each intensity of exercise to determine blood lipids and lipoproteins (TC, TG, LDL-C, and HDL-C). A 2(intensity) X 4 (time) ANOVA with repeated measures was used to examine the mean differences in intensity and time on blood lipids and lipoproteins. The Bonferroni pairwise comparisons were conducted as post hoc to locate the significant mean differences. A p -value < .05 was set for the statistical significance. **RESULTS:** TG, LDL-C or HDL-C did not change, while TC (209.31 ± 28.89 mmol/L) at 24-hrPE decreased ($p = .041$) from IPE (217.80 ± 32.55 mmol/L) following higher-intensity exercise. However, the main effects of time ($p = .272$) or intensity ($p = .735$) demonstrated no statistically significant differences in TC. **CONCLUSIONS:** The acute higher-intensity exercise can lower TC. However, acute different intensities of exercise may not alter significantly blood lipid profiles in obese men due to the short volume and duration. Therefore, future research should determine if different intensities of chronic exercise alter blood lipid profiles in obese men.

2371 Board #290 May 28 3:00 PM - 4:30 PM

Sleep Quality Is Associated With Habitual Physical Activity In Overweight, Older Adults

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(Sponsor: Kyle Timmerman, FACSM)

(No relevant relationships reported)

Poor sleep quality has been associated with negative health outcomes. This relationship has mostly been documented in middle-age and young adults with less focus on older adults. Therefore, the **PURPOSE** of this cross-sectional study was to examine relationships between sleep duration/quality with body composition, physical activity, blood lipids, and indicators of blood glucose control. **METHODS:** In 34 overweight (BMI ≥ 27 kg/m²) older adults (≥ 58 years) enrolled in a longitudinal weight-loss and exercise training study, baseline measures of body composition [skeletal muscle mass (SMM), visceral fat area (VFA) and fat mass (FM)]; cardiorespiratory fitness (VO₂max, indirect calorimetry); moderate-to-vigorous physical activity (MVPA, 7-day accelerometry); blood lipids/glucose/HbA1c (point-of-care analyzer); and sleep quality and duration (Pittsburgh Sleep Quality Index .PSQI) were assessed. PSQI scores can range from 0-21 with higher values representing lower sleep quality. Pre-intervention relationships among these variables were analyzed utilizing partial correlations, controlling for age and sex. Significance was set at $\alpha < 0.05$. **RESULTS:** Mean values were age: 64.3 ± 4.5 years; BMI: 35.3 ± 5.0 kg/m²; VFA: 217.8 ± 41.5 cm²; sleep duration: 6.8 ± 1.2 hours; PSQI score: 10.6 ± 1.3 ; VO₂max: 15.6 ± 3.8 ml/kg/min; MVPA:

45.6±22.8 min/day; HbA1c:5.5±0.5%. Sleep score was correlated with MVPA (-0.41, $p < 0.05$), but not BMI, VFA, FM, or VO2max. **CONCLUSION:** These preliminary data suggest that higher levels of MVPA were associated with better sleep quality in older adults. However, unlike previous studies, we found no relationship between indices of body composition and sleep quality. This study was supported by a grant from the National Institute on Aging (R15 AG055923-01)

2372 Board #291 May 28 3:00 PM - 4:30 PM
The Need For Exercise Recommendations For Children And Adolescents Post-Bariatric Surgery: A Systematic Review

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 (No relevant relationships reported)

Bariatric surgery is an effective treatment option for children and adolescents with severe obesity. Yet, pediatric post-bariatric surgery (PBS) exercise recommendations are elusive. **PURPOSE:** To perform a systematic review assembling professional pediatric PBS exercise recommendations. **METHODS:** To gather PBS exercise recommendations, databases were searched from inception to 2/22/19 with terms related to exercise, pediatric obesity, bariatric surgery, and weight status. This search located no records so another PubMed search was performed to identify randomized controlled trials (RCTs), published in peer-reviewed English language journals, examining the effects of exercise on body mass index (BMI) and percent body fat (%BF) among participants 2-19yr with obesity from inception to 3/20/19. The standardized mean difference effect sizes (d_e) were calculated following random-effects models for BMI and %BF and then back-converted to the original unit for clinical interpretation. We assessed inconsistencies in d_e with the I^2 statistic transformed from the Q statistic. **RESULTS:** The second search identified 556 reports with 9 qualifying RCTs. Of these, 7 were combined resistance and aerobic and 4 aerobic interventions only. All participants ($n=342$, 53.8% girls, 13±2yr) had obesity. The moderate-to-vigorous intensity exercise interventions lasted 13.5±4.0 wk, 3.5±0.8 d/wk for 56.8±6.4 min/session. Exercise interventions ($k=11$) elicited moderate BMI reductions ($d_e=-0.40$, 95%CI: -0.73, -0.06; $-1.03\text{kg}\cdot\text{m}^{-2}$) vs non-exercise control, with moderate-to-high heterogeneity ($I^2=61.3\%$, 95%CI: 25.3, 80.0). Exercise interventions ($k=7$) also elicited moderate %BF reductions ($d_e=-0.61$, 95%CI: -0.90, -0.31; -4.63%) vs non-exercise control, with low heterogeneity ($I^2=20.5\%$, 95%CI: 0.0, 64.0). **CONCLUSIONS:** We found limited but favorable evidence of the effects of moderate-to-vigorous exercise training on BMI and %BF among children and adolescents with obesity but were unable to locate any professional pediatric PBS exercise recommendations. Due to the increasing number of pediatric bariatric surgeries performed, there is an urgent need for professional guidance on exercise in this clinical population. Supported by the University of Connecticut Center on Excellence in Teaching and Learning

2373 Board #292 May 28 3:00 PM - 4:30 PM
The Role Of Exercise In Preventing Weight Regain In Adults Post-weight Loss Surgery

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 (No relevant relationships reported)

The steady increase in the prevalence of obesity is reflected in the rising rate of weight loss surgeries, and repeat surgery for weight regain that occurs 1-2 yr post-weight loss surgery (PWLS). **PURPOSE:** We performed a systematic review of randomized control trials (RCTs) to determine if exercise was associated with attenuation of weight regain in adults PWLS. **METHODS:** We searched 5 databases with terms related to exercise, weight, weight regain, and weight loss surgery, and found no systematic reviews of exercise interventions ≥1yr PWLS among adults ≥18 yr, nor did we locate professional exercise guidelines for this population. We then performed a search in PubMed for randomized controlled trials (RCTs) involving exercise interventions in adults ≥18 yr PWLS. Other inclusion criteria were RCTs in peer-reviewed journals published in English, that included the frequency, intensity, type and time of the exercise intervention, and a control group receiving usual care consisting of diet and exercise advice. The standardized mean difference effect sizes (d_e) were calculated following random-effects models for body weight lost, and back-converted to the

original unit for clinical interpretation. We assessed inconsistencies in d_e with the I^2 statistic transformed from the Q statistic. **RESULTS:** The second search yielded 442 reports, with only 3 RCTs qualifying. Participants ($n=132$) were mostly white women 46.8±3.9yr, and 13.1±6.7mo PWLS. Interventions were supervised; lasted 40-60min/session, 2-5d/wk for 12-26wk; and involved moderate-to-vigorous intensity, combined aerobic and resistance training, while 1 added flexibility exercises. Compared to usual care, exercise interventions elicited moderate reductions in body weight ≥1yr PWLS ($d_e=-0.46$, 95%CI: -1.12, 0.21; -4.1kg) that did not reach significance ($p=0.069$) with high levels of heterogeneity ($I^2=62.9\%$, 95%CI: 0.0, 89.4). **CONCLUSIONS:** In a very limited literature, exercise interventions elicited clinically important reductions in weight of ~4kg representing ~4% of baseline weight ≥1yr PWLS. There is an urgent need for professional exercise guidelines and RCTs examining the effects of exercise on weight regain PWLS with larger, more diverse samples. Supported by the University of Connecticut Center on Excellence in Teaching and Learning

2374 Board #293 May 28 3:00 PM - 4:30 PM
Resistance Training, Regardless Of Protein Supplementation, Improves Muscular Phenotypes In Women Long-term After Bariatric Surgery

Ricardo M. Lima¹, Gabriela S. de Oliveira¹, Fernando L. Pardo², Gustavo N. S. Gomes¹, Flávio T. Vieira³, Kênia M. B. de Carvalho¹, Eliane S. Dutra¹. ¹University of Brasília, Brasília, Brazil. ²Universidade Federal do Estado do Rio de Janeiro, Rio de Janeiro, Brazil. ³Universidade Católica de Brasília, Brasília, Brazil.
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PURPOSE: This double-blind placebo-controlled study investigated the effects of resistance training (RT), with and without protein supplementation (PRO), on body composition, muscle strength and physical function in long term Roux-en-Y bypass (RYGB) female patients.

METHODS: A total of 45 women (age 40.4 ± 8.5 yrs, BMI 29.0 ± 4.7 kg/m²) with 4.1 ± 1.4 yrs after RYGB surgery were divided into four groups: Control + Placebo (CON+PL; $n = 11$), Control + PRO (CON+PRO; $n = 10$), RT+PL ($n = 12$), and RT+PRO ($n = 12$). Patients were evaluated before and after the 12-weeks study protocol for body composition (Tetrapolar Bioelectrical Impedance), knee extensors isokinetic strength and physical function (timed up and go [TUG], 30-seconds sit to stand, and 6-minutes walking). PRO and PL were administered in a double-blind fashion and respectively consisted of daily 0.5 g of whey protein powder per kg of ideal body weight and an isocaloric placebo powder, both throughout the study period. Training protocol comprised 3 sets of 8-12 reps for 8 exercises targeting all major muscle groups and with progressive loads. ANOVA was used to assess time by group interactions.

RESULTS: No significant between-groups differences were observed for any variable at baseline (all $P > .05$). Significant improvements were observed in the exercised groups, but not in the nonexercised groups, for skeletal muscle mass (RT+PL 0.6 ± 0.3, $P = .02$; RT+PRO 0.8 ± 0.2, $P < .01$; CON+PL -0.1 ± 0.3, $P = .68$; and CON+PRO 0.3 ± 0.3 kgs, $P = .31$), isokinetic peak torque (RT+PL 12.9 ± 3.1, $P < .01$; RT+PRO 8.7 ± 2.6, $P < .01$; CON+PL -4.4 ± 2.9, $P = .15$; and CON+PRO -3.1 ± 2.9 Nm, $P = .30$), TUG (RT+PL -1.1 ± 0.2, $P < .01$; RT+PRO -0.7 ± 0.2, $P < .01$; CON+PL -0.2 ± 0.2, $P = .38$; and CON+PRO -0.3 ± 0.2 seconds, $P = .23$), six-minutes walking (RT+PL 48.4 ± 20.6, $P = .02$; RT+PRO 37.4 ± 17.8, $P = .04$; CON+PL -0.9 ± 21.9, $P = .97$; and 4.4 ± 19.5 meters, $P = .82$) and seat to stand test (RT+PL 3.2±0.7, $P < .01$; RT+PRO 1.7±0.6, $P < .01$; CON+PL 1.1±0.7, $P = .13$; and CON+PRO 0.7 ± 0.6 repetitions, $P = .25$). No differences for the improvements were observed between exercised groups (all $P > .05$). Also, no significant alteration occurred for percent body fat in any group (all $P > .05$).

CONCLUSIONS: A 12-weeks RT program, regardless of PRO, improves muscle mass, knee extensors isokinetic strength and physical function in long term RYGB female patients.

- 2375** Board #294 May 28 3:00 PM - 4:30 PM
A 5-month High-intensity Interval Neuromuscular Training Program Improves Cardiometabolic Health In Obese Women.
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 (No relevant relationships reported)

Obesity epidemic is a complex and multifactorial chronic condition affecting one in three adults globally while it is associated with high metabolic risk factors enhancing chronic illness. On the other hand, high-intensity interval training (HIIT), group training, body weight training, and functional fitness training have been recently reported as some of the top worldwide trends in the health and fitness industry. **PURPOSE:** This randomized controlled trial investigated the effects of a 5-month high-intensity interval-type neuromuscular training program (DoIT) with adjunct portable modalities on cardiometabolic health in previously inactive obese women. **METHODS:** Forty-nine premenopausal Caucasian obese female volunteers (n = 49; 36.4 ± 4.4 years; 29.1 ± 2.9 kg/m²; 46.8 ± 5.0% body fat; 0.87 waist-to-hip ratio) were randomly assigned to control group (C, n = 21) or to training group (TR, n = 28). The exercise protocol was a supervised, low-volume, progressive, and time-efficient (<30 min) training program incorporating HIIT and functional fitness into a real-world gym setting. Neuromotor exercises (10-12 integrated movements) with alternate portable modalities at prescribed work-to-rest intervals (20-40 sec) in a circuit fashion (2-3 rounds) were implemented on nonconsecutive days for 5 months. Blood samples were drawn to determine cardiometabolic risk factors at pre- and post-training. **RESULTS:** After 20 weeks, TR demonstrated changes in waist circumference (-6.6%, p < 0.05; TR vs. C: -6.3%, p < 0.05), total cholesterol/high-density lipoprotein ratio (-14.1%, p < 0.05; TR vs. C: -17%, p < 0.05), mean arterial blood pressure (-4.1%, p < 0.05; TR vs. C: -4.6%, p < 0.05), and metabolic syndrome severity z score (-327%, p < 0.05; TR vs. C: -283%, p < 0.05). No change in homeostasis model assessment of insulin resistance (HOMA-IR) was observed from pre- to post-intervention in both groups, whereas HOMA-IR did not differ between groups at any time-point. **CONCLUSIONS:** These findings suggest that high-intensity interval neuromuscular training may improve cardiometabolic health in previously inactive obese women following a 20-week intervention. This study provides critical evidence for implementation of this nontraditional hybrid-type exercise regimen from adults with obesity into a real-world gym setting.

- 2376** Board #295 May 28 3:00 PM - 4:30 PM
Exercise Suppresses The Ubiquitin-proteasome System In The Skeletal Muscle Of Obese Women Following Bariatric Surgery
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 (No relevant relationships reported)

Muscle wasting observed in obese women undergoing bariatric surgery is likely related to altered abnormal intramyocellular signaling. Exercise may reestablish the anabolic capacity in this condition. **PURPOSE:** We examined the effects of exercise training on the main pathways related to skeletal muscle plasticity in obese women undergoing bariatric surgery. **METHODS:** Women with severe obesity were randomly allocated to either bariatric surgery (RYGB) or bariatric surgery followed by exercise (RYGB+ET). A 6-month, three-times-a-week, supervised, combined aerobic and resistance training program started 3 months after surgery for RYGB+ET, while RYGB followed standard of care. We assessed the transcriptome (RNA-seq) from skeletal muscle samples obtained by muscle biopsies (n = 6 per group) at baseline (PRE) and 9 months after surgery (POST9). We tested whether a set of genes defined *a priori* were differentially expressed utilizing the Gene Set Enrichment Analysis. Significance was assumed at a fold change > 1.5, P-value < 0.05, and FDR (false discovery rate) < 0.1. To validate the RNA-seq findings, we performed real time-polymerase chain reaction assays (n = 15 per group) for targeted genes. **RESULTS:** Pathway-level analysis showed that exercise significantly suppressed ubiquitin mediated proteolysis pathway (normalized enrichment scores [NES]: 1.7, P=0.01, FDR=0.09). *Atrogin-1* gene expression was suppressed in the exercised group at POST9 in comparison to PRE, and POST3,

and also when compared with the non-exercised group at POST9 (estimated mean difference [RYGB vs. RYGB+ET at POST9]: -1.97, CI95%=-3.0 to -0.8, P=0.01). *MuRF-1* gene expression decreased after surgery and kept reduced after the intervention for both groups (main time effect: P<0.01 for both). **CONCLUSIONS:** Our data suggest that a 6-month, exercise training program suppresses the ubiquitin-proteasome system via the downregulation of *Atrogin-1* in obese woman undergoing bariatric surgery. This may elucidate a molecular mechanism that partially explains muscle wasting following bariatric surgery and the exercise-induced hypertrophic effect in this condition. Clinicaltrials.gov: NCT02441361

- 2377** Board #296 May 28 3:00 PM - 4:30 PM
Estimation Of Visceral Adipose Tissue: A Device Comparison
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 (No relevant relationships reported)

Many body composition devices now provide an estimate of visceral adipose tissue (VAT), a significant risk factor for cardiometabolic disease. **PURPOSE:** To evaluate the relationship between estimates of VAT from bioelectrical impedance (BIA), ultrasound (US), and dual-energy x-ray absorptiometry (DXA). **METHODS:** VAT was estimated in 124 adults (66% Female; Mean ± SD: Age: 25.4±8.9 yrs; BMI: 25.4±5.5 kg·m⁻²; %BF: 29.7±10.5%). VAT area (cm²) was estimated from a BIA system specific algorithm. VAT thickness (cm) was estimated using US, quantified as the distance between the linea alba and aorta. VAT volume (cm³) was estimated from the DXA predefined android region. Linear regression was used to evaluate the relationship between estimates and to identify factors that may contribute to estimate differences in the entire group and by sex. **RESULTS:** In the full group, VAT estimates from all three methods were significantly correlated [BIA-DXA (R=0.768; R²=0.589); BIA-US (R=0.545; R²=0.297); DXA-US (R=0.785; R²=0.616) (p<0.001)]. In men, stronger relationships were observed with DXA [BIA-DXA (R=0.852; R²=0.727); BIA-US (R=0.774; R²=0.600); DXA-US (R=0.878; R²=0.772) (p<0.001)]; in women, weaker relationships were observed with US [BIA-DXA (R=0.890; R²=0.793); BIA-US (R=0.567; R²=0.321); DXA-US (R=0.690; R²=0.477) (p<0.001)]. In men, total body water (TBW) explained 31.9% and 12.0% of the variance in the difference between BIA-DXA and BIA-US, respectively; %BF explained 13.1% of the variance in the difference between DXA-US (all p<0.05). In women, %BF explained 28.9%, 34.0%, and 15.6% of the variance in the difference between BIA-DXA, BIA-US, and DXA-US, respectively (all p<0.001). **CONCLUSIONS:** BIA and US are cost-effective alternatives to DXA. BIA may provide a more comparable estimate to DXA, while greater variability may occur when comparing with US, especially in women. Differences between estimates may be influenced by TBW and %BF.

- 2378** Board #297 May 28 3:00 PM - 4:30 PM
Inter-individual Variation In Cardiometabolic Outcomes Following 6-months Of Endurance Training In Overweight And Obese Youth.
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Inter-individual variation in response to exercise training (ET) is broad and can lead to individuals, termed 'non-responders', who do not experience the anticipated improvements. The inter-individual variation in cardiometabolic response to ET among overweight and obese youth and prevalence of non-responders is poorly understood. **Purpose:** To investigate inter-individual variation following 6-months of high-intensity or moderate-intensity ET, and estimate the proportion of overweight and obese youth expected to respond. **Methods:** One hundred and six overweight and obese youth were randomized to high-intensity ET (70–85% of heart rate reserve), moderate-intensity ET (40–55% heart rate reserve), or a control group for 6 months. Cardiometabolic response to ET was assessed by insulin sensitivity (IVGTT), hepatic triglyceride content (¹H-MRS), visceral adipose tissue (MRI), and cardiorespiratory fitness. Participants with ≥70% adherence were included in this secondary analysis. Inter-individual variation within each study arm was determined using the standard deviation of individual responses (SD_{IR}), calculated as: SD_{IR} = √(SD_{Intervention}² - SD_{Control}²). The proportion of responders (defined as a change surpassing the smallest worthwhile difference) to each program was estimated using the variance (SD_{IR}) around the mean treatment effect. **Results:** Inter-individual variation resulting from high-intensity ET was observed in visceral adipose tissue (SD_{IR} = 5.92) and cardiorespiratory fitness (SD_{IR} = 1.33), with

51.2% and 79.1% of overweight and obese youth estimated to respond. Inter-individual variation resulting from moderate-intensity ET was observed in hepatic triglyceride content ($SD_{tr} = 9.64$) and cardiorespiratory fitness ($SD_{tr} = 2.15$), with 34.3% and 71.8% of overweight and obese youth estimated to respond. Inter-individual variability was not detected among changes in insulin sensitivity following either program. **Conclusion:** These data support the concept of inter-individual variation in cardiometabolic health outcomes following high- and moderate-intensity ET in overweight and obese youth. High-intensity ET was estimated to produce a higher proportion of cardiorespiratory fitness responders compared to moderate-intensity ET.

2379 Board #298 May 28 3:00 PM - 4:30 PM
Effects Of High-Intensity Interval Training On Cardiometabolic Risk Factors And Motivation To Exercise In Women With Abdominal Obesity

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(No relevant relationships reported)

There has been recent interest in high-intensity interval training (HIIT) as an alternative to moderate-intensity continuous training (MICT) to reduce body composition, adiposity and cardiometabolic risk factors in obese patients. Despite the promising evidence supporting HIIT in this population, there is limited research targeting women with abdominal obesity. **PURPOSE:** The objective of this study was to compare the effects of MICT and energy-matched HIIT on cardiometabolic risk factors in women characterized by abdominal obesity. **METHODS:** Twenty abdominally obese women (age range, 28-56 years) were submitted to 12 weeks of intervention and were randomly allocated into 2 groups: MICT (n=10) and HIIT (n=10). The MICT group performed a 38 to 62-minute continuous exercise at 70 % of the maximal heart rate. The HIIT group training performed 3 to 6 sets of 4-minute bouts at a running velocity corresponding to 90 % maximal heart rate, interspersed by a 4-min active recovery period at 50 % maximal heart rate. Anthropometric parameters, maximal oxygen uptake (VO_{2max}) and cardiometabolic risk variables were measured at the beginning and after 12 weeks. Self-determined motivation toward physical activity was also evaluated with a validated questionnaire. **RESULTS:** MICT intervention led to significant improvements in VO_{2max} (29.9 to 32.7 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$, $p=0.005$), with no change in HIIT group. However, at the beginning of the study, VO_{2max} was significantly lower in the MICT group when compared to the HIIT group ($p=0.04$). During the intervention, no significant difference was found in cardiometabolic risk factors in the MICT group. However, HIIT resulted in statistically significant reduction in triglycerides levels (1.91 to 1.58 mmol/l, $p=0.046$) even though waist circumference was significantly increased (98.0 to 100.7 cm, $p=0.038$) after the 12-week intervention program. In addition, the HIIT group increased self-determined motivation toward physical activity in a greater magnitude when compared with the MICT group ($p=0.016$). **CONCLUSION:** HIIT appears to provide greater benefits to MICT for improving triglyceride levels. In addition, as HIIT is associated with a greater improvement in self-determined motivation toward physical activity, HIIT could be associated with promising long-term adherence to exercise.

D-73 Free Communication/Poster - Sports Medicine Fellow Research Abstracts

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
 Room: CC-Exhibit Hall

2380 Board #299 May 28 3:00 PM - 4:30 PM
Intensive Behavioral Therapy For Obesity Utilizing Cardiopulmonary Exercise Testing: The Bridge Project Pilot Study.

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(No relevant relationships reported)

PURPOSE: To gather preliminary pilot data on dietary and exercise prescription utilizing Cardiopulmonary Exercise Testing (CPET) incorporated into Medicare and Medicaid Services-based Intensive Behavioral Therapy for Obesity (IBT-O) in a primary care setting. **METHODS:** A prospective cohort of 30 subjects completed a World Health Organization Quality of Life (WHOQOL) questionnaire, and performed a cardiopulmonary exercise test (CPET) on a treadmill using a modified Balke protocol at baseline as well as following 6 and 12 months of exercise conditioning. With a cardiovascular exercise prescription developed from CPET data delivered to the subjects' Smartphone through an interactive app. Subjects were also provided with a resistance training prescription and YMCA membership. Consistent with CMS criteria,

subjects participated in weekly physician directed IBT-O appointments throughout the first month, and then bi weekly for the next 5 months. If subjects lost 6.6 lbs (3 kg) in the initial 26 weeks (6 months) they qualified to continued physician once a month for an additional 6 months. **RESULTS:** With the 30 subjects initially enrolled, there were 9 enrollment failures. There was an overall follow up rate of 76% of the 21 successfully enrolled, with 19 completing all 6 months. At the 6 months, 14 subjects lost 6.6lbs required by CMS to continue for an additional 6 months, and 11 completing all of the 12 months. Data reported in table using mean \pm standard deviations for all continuous variables. All analyses were two-tailed and were performed at a significance level of 0.05.

CONCLUSIONS: In addition to improvements in QOL and clinically meaningful weight loss >5% at 12 months, there was also an increase CRF. Improvements in CRF has been reported in the literature with annual cost savings per MET/year of \$5,193 and \$3,603 for individuals with and without diabetes, respectively. Also, increases of 1-2 METs are associated with 10%-30% lower adverse cardiovascular event rates.

	N	Mean	Q1	Median	Q3	P value
Weight Loss (lbs)	11	24.73	17	21	34	<0.000*
% weight Loss	11	10.9%	8.0%	10.6%	11.6%	0.0003*
BMI decrease	11	4.02	3.02	3.92	5.33	<0.0001*
VO_{2peak}	11	4.19	1.4	4.0	5.6	0.0013*
MET peak	11	1.21	0.4	1.2	1.6	0.0015*
WHOQOL QOL Score	11	0.73	0	0	2	0.0236*
WHOQOL Health Satisfaction Score	11	1.73	1	2	3	0.0032*
WHOQOL Physical Health Score	11	15.28	0	6	31	0.0105*
WHOQOL Psychological Score	11	16.09	6	00	32	0.0076*
WHOQOL Social Relationships Score	11	7.09	0	6	12	0.0796
WHOQOL Environment Score	11	13.55	0	12	19	0.044*

2381 Board #300 May 28 3:00 PM - 4:30 PM
Do Different Wet Bulb Globe Temperature Reading Cutoffs Change Outdoor Heat Injury Frequency And Severity?

Christina S. Gutta¹, Ellen E. Shanley², Vicki R. Nelson¹. ¹*Prisma Health, Greenville, SC.* ²*ATI Physical Therapy, Greenville, SC.*
 (Sponsor: Dr. Franklin Sease, FACSM)
(No relevant relationships reported)

PURPOSE: To evaluate differences in injury frequency and severity between two different heat participation policies in South Carolina high school and collegiate athletics.

METHODS: Retrospective cohort study of Division II collegiate & high school athletes looking at injury frequency & severity between 2 different heat participation policies. Fifty middle & high schools as well as 2 Division II colleges with a total of 16,832 athletes were investigated over 3 years. Inclusion criteria were reported heat illnesses between July 1 & November 30th for 12 outdoor sports resulting in 86 injuries that were analyzed. Chi square analysis was used to compare injury frequency & severity between no outdoor workouts with a wet bulb globe temperature (WBGT) > 90 (policy 1) versus WBGT > 92 (policy 2).

RESULTS: For policy 1 there was a mean of 31 heat illnesses/year with an average of 16 days for illness resolution. For policy 2 there was a mean of 24 heat illnesses/year but the average of 41 days for illness resolution was significantly higher ($p=0.02$). Grading heat illness severity was based on guidelines developed by Rauh et. al. Mild to moderate injury was defined as 0-21 days for return to activity while severe injury >21 days for return to activity. With policy 1, 4.8% of heat illnesses met severe criteria while 20.8% of heat illnesses in policy 2 were severe showing an odds ratio of heat illness with policy 2 is 5.2 times higher than policy 1 (OR 5.2, 95% CI 1.1-23.7). Conversely the percentage of mild to moderate illness was statistically lower with policy 2 compared to policy 1 ($p=0.022$) suggesting that policy 2 resulted in more severe heat illness. Policy 1 was in place for several years with no record of EMS transport for heat illnesses however within the first season of policy 2, there was 3 athletes transported. The average age at time of injury was 16 years old & not statistically different between policies. There was an average of 45 minutes of practice per week lost with the WBGT cutoff of 90 compared to cutoff of 92.

CONCLUSIONS: Although the total number of heat illnesses did not change between policies, there was a statistically significant increase in severity of illness & time for return to sport with raising the WBGT participation cutoff from 90 to 92. Our data suggests that a cutoff of 90 reduces the frequency of severe heat illness in athletes.

2382 Board #301 May. 28 3:00 PM - 4:30 PM
Differences In Baseline Concussion Symptom Reporting Across Age And Gender
 Joshua Pacious, Franklin Sease, FACSM, Vicki Nelson. *Prisma Health- Center for Family Medicine, GREENVILLE, SC.*
(No relevant relationships reported)

Purpose:

Previous studies have identified significant differences across age and gender in post-concussion symptoms reporting, with female and high school aged athletes reporting both a higher number of symptoms and a greater symptom severity. This study evaluates differences in baseline symptom reporting across age group and gender.

Methods and Study Design:

Between 2007-2019, concussive symptoms were reported by middle school (MS), high school (HS) and collegiate athletes (CA) utilizing the post-concussion symptom scale at baseline. Excluded athletes included those with invalid testing, age > 24y or < 10y, learning disabilities, ADHD, autism, or a prior history of concussion. ANOVA was performed assessing the total number of symptoms and the total symptom severity score as reported by age group, and gender. Results: (1000)25,694 athletes (60% male and 40% female) were included: 4.6% MS (n=1,179), 89.7% HS (n=23,047) and 5.7% CA (n=1,468). Among the different age groups, there were no significant differences in number of symptoms (p=0.21) or symptom severity score (p=0.48). However, there were significant differences noted between male and female athletes. Males reported fewer symptoms than females (1.75 ± 3.0 vs 2.50 ± 3.6, p<1x10⁻⁷⁰). Males also reported a lower baseline symptom severity (3.34 ± 6.7 vs 4.96 ± 8.7, p<1x10⁻⁶²). This difference between genders held true across age levels with significant differences in the number of baseline symptoms reported (MS p<0.001, HS p<1x10⁻⁶⁰, CA p<0.001) and symptom severity score (MS p<0.001, HS p<1x10⁻⁵¹, CA p<0.01).

Conclusion: This study identifies symptom differences between genders at baseline. These baseline differences may contribute to the post-concussive discrepancies seen previously. In contrast, baseline differences are not present between age groups possibly suggesting a pathophysiologic underpinning to the post-concussive discrepancies of higher total symptoms and higher severity noted in high school athletes.

Significance of Findings: Significant differences in concussive symptom reporting by age level, despite comparable baselines shown here, may reflect pathophysiologic, rather than reporting discrepancies, necessitating specific evaluation and management strategies across age levels.

2383 Board #302 May. 28 3:00 PM - 4:30 PM
Assessing Knowledge And Confidence In Musculoskeletal Medicine Among Primary Care Specialties
 Jessica Mofidi, Cindy Ong, Michael Fong, Marissa Vasquez. *Kaiser Permanente Los Angeles Medical Center, Los Angeles, CA.* (Sponsor: Aaron Rubin MD, FACSM)
(No relevant relationships reported)

Prior studies suggest primary care clinicians lack knowledge and confidence in how to diagnose and treat musculoskeletal (MSK) disorders. One showed 64% of academic primary care attendings scored <70% on an MSK knowledge exam, while another noted that primary care residents scored an average of 56% on an MSK competency exam. Few studies examine differences among Family Medicine, Internal Medicine, and Pediatrics in knowledge and confidence in diagnosing and treating MSK conditions. **Purpose:** To determine if a significant difference exists between primary care specialties for both residents and non-fellowship trained attendings in knowledge and confidence in diagnosing MSK conditions. To assess whether a focused lecture series can increase resident knowledge and confidence in diagnosing MSK disorders. **Methods:** An anonymous shoulder, hip, knee, and ankle survey was emailed to Pediatric, Internal Medicine, and Family Medicine residents and attendings at a local teaching hospital. Sports Medicine Fellows lectured Internal Medicine and Pediatrics residents, focusing on exam and common conditions for each joint. Family Medicine was excluded from the lectures, as MSK education is a part of their ACGME requirement. Pre and post lecture surveys with 5 knowledge questions and two 5-point Likert scale confidence measures were administered to Pediatric and Internal Medicine residents. Two-tailed t-tests were used with a p value set at <0.05. **Results:** Pediatric residents showed a significant increase in shoulder knowledge scores (60% vs 72.8%, p=0.04), shoulder confidence scores (2.2 vs. 3.11; 2.13 vs. 2.94; p<0.001), and confidence in doing an appropriate knee exam post lecture (2.6 vs. 3.4, p=0.03). There was no significant difference between Family Medicine, Internal Medicine, or Pediatrics regarding general MSK knowledge and confidence. There was no significant difference for Internal Medicine between pre and post lecture scores for all joints. There was no significant difference for pre and post lecture scores on the hip and ankle for Pediatrics. **Conclusion:** Dedicated lectures related to the MSK exam and common MSK conditions can increase the knowledge and confidence among primary care residents, but further studies with a greater number of subjects are needed.

2384 Board #303 May. 28 3:00 PM - 4:30 PM
Documentation Of Obesity On The Problem List And Referral Rates Among Obese Children And Adults
 Heidi Walls, Christina Holt, Amy Haskins, William Dexter, FACSM. *Maine Medical Center, Portland, ME.*
(No relevant relationships reported)

Obesity is a serious public health concern that is overwhelming primary care providers. Studies have shown that simply documenting obesity on the problem list promotes action about obesity. **PURPOSE:** To determine the rate of obesity documentation on the problem list and referrals to obesity medicine specialists and dietitians among obese adult and pediatric patients at 14 primary care offices in a regional health network in Southern Maine. **METHODS:** All patients with BMI > 30 (adults) or BMI > 95th percentile for age (pediatrics) between 5 - 100 years old, who were seen at one of 14 primary care clinics in Maine between July 1, 2017 and June 30, 2019 were included for retrospective review. Variables requested included age, BMI, inclusion of obesity on the problem list, various comorbidities, and any referrals to dietitian or obesity medicine specialists. The percentage rate of inclusion of obesity on the problem list and rate of referrals were calculated for both pediatric and adult patients.

RESULTS: We obtained records for 20,461 patients, 2,780 under 18 and 17,681 over 18. Obese children had obesity on the problem list in 31.2% of cases, and received any referral 12.5%. Obese adults had obesity on the problem list 54.2% of the time, and a referral in 8.4% of cases. For both children and adults, more referrals were made for patients with obesity on the problem list compared to those without this problem listed (in children: 20.2% vs 9.0%; for adults: 12.12% vs 3.9%, p values < 0.0001). Similarly, a statistically significant higher proportion of referrals were made for those with higher BMI (in children: 26.6% vs 8.6% for those with a BMI ≥ 99 percentile; adults: 19.88% vs 5.75% for those with a BMI ≥ 40, p values < 0.0001), and for those with a greater number of comorbidities on the problem list (referrals in 20.2% vs 10.7% for children with ≥ 1 comorbidity vs 1 or fewer, and in 22.68% vs 5.13% of adults with ≥ 3 comorbidities compared to 0 comorbidities, p values < 0.0001).

CONCLUSIONS: The inclusion rate of obesity on the problem list for obese children and adults was found to be low overall, but inclusion was associated with higher proportion of referrals to obesity medicine specialists and dietitians. There was also more likely to be a referral among patients with higher BMI and multiple comorbidities.

2385 Board #304 May. 28 3:00 PM - 4:30 PM
Improving The Diagnosis Of Menstrual Dysfunction Through Quality Improvement
 Kayla E. Daniel, Amy Valasek. *Nationwide Children's Hospital, Columbus, OH.* (Sponsor: Anastasia Fischer, FACSM)
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(No relevant relationships reported)

PURPOSE: Prevalence of menstrual dysfunction in female high school athletes ranges from 19-54%. Menstrual dysfunction can be screened and treated. Consequences of menstrual dysfunction include decreased bone mass, increased risk of stress fractures, increased rate of musculoskeletal injuries with prolonged recovery time, endothelial dysfunction, and effects on future fertility. Early recognition and intervention are crucial to prevent long term consequences. The purpose of this Quality Improvement (QI) project is to optimize the institution's Epic Best Practice Advisory (BPA) screening tool and synthesize new patient questionnaire responses to diagnose menstrual dysfunction in female athletes greater than 12 years of age presenting to a pediatric sports medicine clinic.

METHODS: Using QI methodology, we evaluated the clinic work flow, Epic BPA tool, and actions by the physician following appropriate firing of the menstrual dysfunction BPA. Menstrual dysfunction was defined in our BPA as criteria for Amenorrhea, Oligomenorrhea, or Irregular Menstruation Unspecified which was further specified as menstrual cycles effected by training in sport. Staff education, patient education, and BPA provider alert fatigue were identified as appropriate areas for intervention. Staff were educated to ensure appropriate intake and implementation of survey data, a menstrual dysfunction handout was created and provided to newly diagnosed patients, and the BPA alert was changed to promote identification and diagnosis of menstrual dysfunction. We implemented interventions using progressive monthly Plan-Do-Study-Act (PDSA) cycles to encourage change and optimize our screening process.

RESULTS: The rate of appropriate diagnosis of menstrual dysfunction in female athletes greater than 12 years of age seen at a pediatric sports medicine clinic increased from a baseline of 1.5% to 27% over a 3-month period.

CONCLUSIONS: Through QI methodology we are optimizing our menstrual dysfunction screening tool and subsequently increasing the rate of appropriate diagnosis of menstrual dysfunction among our female athletes. Identifying the appropriate diagnosis improves patient education and provides the framework for applicable interventions, further work-up, and follow-up.

2386 Board #305 May. 28 3:00 PM - 4:30 PM
Injury Trends In Special Olympics Athletes From The 2018 USA Games

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Purpose: We analyzed injury data from the Seattle Special Olympics USA Games 2018. Our findings and analysis may inform ways by which medical coverage at future similar events can be reinforced, prepared, and improved.

Methods: Deidentified injury data, collected by the RaceSafe app, was categorized by injury type: Musculoskeletal (MSK), Non-musculoskeletal (Non-MSK) and Minor Injury (including ice, bandaging, and massage). Individual event data was analyzed by percent of athletes injured and by injuries per 1000 athlete exposures. For each team sport, injury data was analyzed by injuries per game.

Results: The individual events with the highest percent of athletes injured were gymnastics (38.5%, 95% CI 22.4-62.0), tennis (31.5, 95% CI 21.5-44.7) and stand-up paddleboard (28.6%, 95% CI 11.6-59.4). The individual event with the lowest percent of athletes injured was golf (12.9%, 7.9-19.9). Among the gymnastics and tennis injuries, 53.3% and 58.6% were MSK, respectively. For stand-up paddleboard there were no MSK injuries with the majority being non-MSK (66.7%). Per 1000 athlete exposures, gymnastics had the highest rate of MSK injuries at 25.6 (95% CI 11.9-48.7), while stand-up paddleboard had the highest rate of both non-MSK injuries at 95.2 (95% CI 30.3-23.0) and minor injuries at 47.6 (95% CI 8.0-157.3). The team sports with the highest rate of injuries per game were softball at 1.9 (95% CI 1.6-2.4), followed by soccer at 1.7 (95% CI 1.4-2.0), and flag football at 1.6 (95% CI 1.3-1.9).

Conclusion: The Special Olympics 2018 USA Games required a well-staffed and organized medical team to meet the injury needs of its athletes. Based on our analysis, future events should provide a team with many medical personnel divided amongst the competition venues. A unique feature of the Special Olympics is the high rates of non-MSK injuries requiring medical attention, and appropriate measures should be taken to address these conditions.

2387 Board #306 May. 28 3:00 PM - 4:30 PM
The Use Of Micro-doppler Radar For Motion Analysis In NCAA Athletes

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PURPOSE: The current musculoskeletal portion of the pre-participation physical exam lacks evidence for the detection of biomechanical subtleties that predispose an athlete to injury. Previous pilot data has shown that micro-Doppler radar has the potential to provide objective data on limb and torso variations at a granular level using a handheld, portable and cost effective device. The purpose of this study was to determine if micro-Doppler radar signals can predictably and accurately detect subtle differences in human movement patterns.

METHODS: This is a cross sectional study using micro-Doppler radar technology to detect known differences in biomechanics among Division III athletes. Each participant performed 3 sets of 3 squat jumps in front of the micro-Doppler radar antenna. Each set of squat jumps was performed barefoot, with shoes and with a 2cm heel lift at both 0 degrees and turned 90 degrees to the antenna. The micro-Doppler responses were processed using short-time Fourier transform, principal component analysis and linear discriminant analysis to highlight differences among the data sets and to minimize background noise from the radar. Further computer learning classification using support vector machine, k-nearest neighbor and discriminant analysis classifier were used to determine the micro-Doppler radar accuracy for predicting movement patterns.

RESULTS: Thirty seven NCAA Division 3 Football athletes aged 18-22 were recruited and consented to perform the protocol. All micro-Doppler radar responses were recorded and processed successfully. The overall accuracy of the computer-derived models to predict which participants were wearing shoes, a heel lift or barefoot was 83%-100% for all groups regardless of whether the athlete was facing or turned to the right of the radar. **CONCLUSIONS:** This study was able to demonstrate that micro-Doppler radar technology has excellent predictability and can accurately detect subtle differences in movement. Future studies will aim to further validate data sets using comparison studies to biomechanical video analysis techniques. Ultimately the goal will be to use the micro-Doppler radar to define movement patterns that may predispose athletes to injury allowing us to determine a high risk group to direct injury prevention resources.

2388 Board #307 May. 28 2:00 PM - 3:30 PM
Comparison Of Ultrasonography To Mri In The Diagnosis Of Lower Extremity Bone Stress Injuries.

Kevin Mullins¹, Lauren Bosshardt¹, Sara Raiser², Richard Lawley³, Yaeko Fukushima¹, Isaac Syrop⁴, Jeremiah Ray⁵, Andrea Finlay⁶. ¹Stanford University, Redwood City, CA. ²Emory University, Johns Creek, GA. ³Cornerstone Orthopaedics, Superior, CO. ⁴Columbia University, Tarrytown, NY. ⁵University of California, Davis, Davis, CA. ⁶Stanford University, Stanford, CA. (Sponsor: Michael Frederickson, MD, FACSM) Email: kevinmullinsmd@gmail.com (No relevant relationships reported)

BACKGROUND: Bone-stress injuries (BSIs) are relatively common in college-level athletes and can result in substantial disability leading to prolonged leave from sport when diagnosed in more advanced stages. Early detection and intervention of BSIs in this population is critical given the demanding NCAA schedules and expectations for timely returns to full activity. Currently, the gold standard for detecting early-stage BSIs is magnetic resonance imaging (MRI), however with recent global advancements in ultrasound technology, there are new opportunities for early diagnosis of BSIs in the sports medicine clinic and training-room settings.

PURPOSE: To examine the sensitivity and specificity of ultrasound imaging (USI) in the diagnosis of BSIs, utilizing MRI as the gold standard.

STUDY DESIGN: Cohort Study (diagnosis)

METHODS: Thirty-nine elite primarily NCAA division 1 athletes (mean age, 21.64 years; standard deviation [SD], 7.24; range 18-62) underwent USI and MRI for clinical suspicion of a BSI in the lower extremity. 32 females and 7 males enrolled, with running as the most common sport (44%). An 8-point assessment system was utilized on USI for detecting BSI, and the Frederickson Criteria was used to classify MRI findings. Sensitivity, specificity, positive and negative predictive values (PPV and NPV) of USI compared to MRI were calculated.

RESULTS: Using MRI, there were 31 (79%) athletes with a positive and 8 participants with a negative BSI diagnosis. The most common bone injuries were metatarsal (51%) and tibia (33%). Average days to onset was 31.87 (SD = 34.20). Compared to MRI, USI demonstrated 0.77 sensitivity (95% confidence interval [CI], 0.59-0.90) and 0.75 specificity (95% CI, 0.35-0.97) in detecting BSI, with a PPV of 0.92 (95% CI, 0.75-0.99) and NPV of 0.46 (95% CI, 0.19-0.75). Subcutaneous edema was the most sensitive (0.81, 95% CI=0.63-0.93) USI finding but the least specific (0.25, 95% CI=0.03-0.65), while calcified bone callus was the most specific (0.88, 95% CI=0.47-1.00) but least sensitive (0.26, 95% CI=0.12-0.45).

CONCLUSION: USI is a reliable screening tool for sports medicine providers to combine with their clinical evaluation in the diagnosis of bone stress injuries. Further research is ongoing to determine the role of USI in follow-up care and return-to-play protocols.

2389 Board #308 May. 28 3:00 PM - 4:30 PM
Does Poor Recovery Predict Injury In The Division 1 Female Collegiate Lacrosse Athlete?

Jeffrey Wisinski, Paul Herickhoff, Brandon Hall, Peter Seidenberg, FACSM. ¹Penn State University, University Park, PA. (Sponsor: Peter Seidenberg, FACSM) Email: jwisinski@pennstatehealth.psu.edu (No relevant relationships reported)

BACKGROUND: Overtraining continues to be a serious issue across youth athletes at all levels. As an athlete transitions to the collegiate level, their training volume typically increases significantly. With more female athletes participating in Collegiate Lacrosse, there needs to be an ongoing awareness of athletes at increased risk for overuse and acute injuries. Examining injury incidence patterns and attempting to objectively find risk factors for the development of these injuries can provide helpful feedback to coaches, athletic trainers, and team physicians when determining athlete participation recommendations.

PURPOSE: Retrospectively analyze data related to the recovery of 31 Division 1 Collegiate Female Lacrosse athletes obtained over an entire regular season, and then determine if athletes who suffered injuries had lower recovery scores in comparison to athletes who did not suffer injuries.

METHODS: The data related to the recovery of the Collegiate Female Lacrosse athletes was obtained using a questionnaire developed through the Restwise division of Recovery Science and Technology. An overall Recovery score was calculated based on the athlete's heart rate, weight, pulse oximetry, and their responses to questions about quality and amount of sleep, energy level, presence of illness, and mood state. Athletes submitted their respective responses using the online Restwise application prior to each practice and game. Injury reports were then analyzed to determine specific dates of injuries. A logistic regression analysis was performed to determine if there was a statistically significant association between overall recovery scores as well as the specific components of overall recovery scores, and future injury.

RESULTS: 21 total injuries took place throughout the regular season. Overall recovery scores were not shown to be associated with future injury ($p = 0.518$). Previous injury ($p = 0.118$), illness ($p = 0.48$), mood ($p = 0.588$), amount of sleep ($p = 0.648$), sleep quality ($p = 0.686$), and energy state ($p = 0.211$) were also not shown to have a statistically significant relationship with future injury.

CONCLUSION: Restwise Recovery Data was not shown to have a statistically significant association with future injury in the Division 1 Female Lacrosse Athlete.

2390 Board #309 May. 28 3:00 PM - 4:30 PM

The Effect Of Social Media Use On Sleep Quality Among College Athletes

Rhonda Watkins, Dai Sugimoto, Danielle Hunt, Jeesie Oldham, Andrea Stracciolini, FACSM. *Boston Children's Hospital, Boston, MA.*

(No relevant relationships reported)

BACKGROUND: Social media use among young adults has increased significantly in recent years. Existing literature suggests that increased social media use is linked to poor sleep quality, but this is unexplored in college athletes, who pose a unique risk for poor sleep given academic, social, and sport demands. **PURPOSE:** 1) To examine the effect of social media use on sleep quality among college athletes. 2) To compare the effect of social media use on sleep quality by sex. **METHODS:** Study participants included local NCAA Division III college athletes. Across sectional study design was employed. Data was collected using social media use and PROMIS sleep disturbance questionnaires. Main outcome measures were social media volume measured in hours of social media use per day over 7 days and collected using iPhone screentime function. Sleep quality was determined using the PROMIS T-score. Statistical analysis utilized Pearson's correlation (little: $r < .25$, weak: $r = .25-.50$, moderate: $r = .50-.75$, strong: $r > .75$), t-test ($p < .05$), and effect size (small: Cohen's $d = .20$, medium: Cohen's $d = .50$, large: Cohen's $d > .80$). **RESULTS:** 87 athletes (age: 19.5 ± 1.2 years, 40 males, 47 females) completed the survey. Mean social media use was 4.6 ± 3.4 hours/day. Female athletes spent more time on social media compared to male athletes (5.0 ± 3.2 and 4.1 ± 3.5 hours/day respectively, $p = .018$, Cohen's $d = .27$). No correlation was found between increased social media time and reduced sleep quality ($r = .20$, $P = .068$). Similarly, analysis by sex revealed no correlation in sleep quality (females $r = .22$, $p = .131$, males $r = .18$, $P = .276$). College athletes who spent more time on social media than the mean of 4.6 hrs/day demonstrated worse sleep quality (51.0 ± 8.1 vs. 47.8 ± 7.6 , $p = .130$, Cohen's $d = .41$). When stratified by sex this finding held true for female athletes but not for male athletes (53.2 ± 8.5 vs. 49.1 ± 8.3 , $P = .186$, Cohen's $d = .49$, and 46.3 ± 6.6 vs. 47.6 ± 6.5 , $P = .505$, Cohen's $d = .20$, respectively). **CONCLUSION:** Female college athletes use social media more than male college athletes. Social media use appears to have a negative impact on sleep quality among female college athletes, although more research is needed to explore this. These findings may have implications for developing social media use guidelines for college athletes to improve their sleep quality.

2391 Board #310 May. 28 3:00 PM - 4:30 PM

Psychotropic Medication Use And Concussion History Among Adolescent Athletes

Mary Daley¹, Jessie Oldham¹, Corey Lanois¹, David R. Howell², Rebekah Mannix¹, Diane Sartanowicz¹, William P. Meehan¹. ¹Boston Children's Hospital, Boston, MA. ²Children's Hospital Colorado, Aurora, CO.

(No relevant relationships reported)

An estimated 5-8% of children and adolescents in the United States take prescription psychotropic medications, including antidepressants, stimulants, anxiolytics, antipsychotics, and mood stabilizers. Psychotropics are occasionally used for patients with concussion to treat both cognitive and psychological symptoms, but little is known about the association between psychotropic medication use and concussion history. **PURPOSE:** To examine the relationship between psychotropic medication use with concussion history and concussion symptom burden among adolescent athletes tested at baseline.

METHODS: Data was collected prospectively by the Massachusetts Concussion Management Coalition that contains demographics, medications, and concussion symptom scores from junior high and high school athletes in Massachusetts. Independent samples t-tests were used to investigate differences in concussion history and in symptom scores between those who were and were not on psychotropic medications at the time of baseline testing.

RESULTS: Data was collected from a total of 18,833 adolescent athletes (mean age 14.8 ± 1.7 yrs; 39.6% female). Individuals who were on psychotropics had significantly greater average number of prior lifetime concussions (0.63 ± 0.99 vs 0.34 ± 0.72 concussions; $p < 0.001$, Cohen's $d = 0.34$), and significantly higher symptom scores at baseline (8.67 ± 11.63 vs 4.81 ± 8.25 ; $p < 0.001$, Cohen's $d = 0.38$). Those with a history of depression or anxiety had a significant but smaller increase in number

of prior concussions compared with healthy controls (0.55 ± 0.91 vs 0.34 ± 0.72 concussions; $p < 0.001$, Cohen's $d = 0.26$), and a greater difference in symptom scores (12.4 ± 14.05 vs 4.54 ± 7.8 ; $p < 0.001$, Cohen's $d = 0.69$).

CONCLUSIONS: Adolescent athletes taking psychotropic medications reported a significantly greater number of prior lifetime concussions and higher concussion symptom scores at baseline. Similar trends were seen in those with a history of depression or anxiety, suggesting that these diagnoses alone may be correlated with concussion history and symptom burden regardless of medication use. Future research is warranted to further examine how psychotropic medication use alone may influence these variables, as well as how psychotropics may affect post-concussion symptoms and recovery.

2392 Board #311 May. 28 3:00 PM - 4:30 PM

Accuracy Of The Limb-lead Electrocardiogram In Identifying Conditions Associated With Sudden Cardiac Death

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(No relevant relationships reported)

The best screening strategy to prevent sudden cardiac death (SCD) in athletes remains unknown. Using the electrocardiogram (ECG) as a part of a pre-participation examination remains controversial due to the cost and rate of false positives. Screening athletes can be both time intensive and costly. Our previous study demonstrated that using a limb-lead ECG is faster than using a 12-lead ECG. However, the utility and accuracy of limb-leads alone in identifying cardiac abnormalities associated with SCD have never been studied. **PURPOSE:** To assess agreement and diagnostic accuracy in the interpretation of limb lead v. 12-lead ECG in identifying cardiac abnormalities associated with SCD.

METHODS: This study compared the interpretation accuracy of 4 physicians evaluating publicly available ECGs of the most common cardiac conditions associated with SCD in athletes. 4 Medical Sports Medicine fellows participated in the study and each interpreted a total of 100 ECGs: 50 normal ECGs (25 limb lead and 25 12-lead) and 50 abnormal ECGs (25 limb lead and 25 12-lead). The agreement between limb lead and 12-lead ECGs was assessed by Cohen's kappa coefficient and the accuracy of identifying an abnormal ECG was compared across limb lead and 12-lead ECGs using a chi-squared test. Inter-rater and intra-rater reliability were assessed by estimating the Fleiss's kappa coefficient. **RESULTS:** Preliminary data of 150 interpreted ECGs showed an accuracy of 77.8% and 82.1% in identifying abnormal from normal ECGs using 12-lead v. limb-lead, respectively ($p = 0.513$). Based on the readings of the physicians in this study, the sensitivity of limb-lead was 97.2% and 12-lead was 89.5%. The specificity of limb-lead was 69.1% and 12-lead was 64.7%. **CONCLUSIONS:** There was no significant difference in the accuracy of physicians' interpretations of limb lead ECGs compare to standard 12-lead ECGs in identifying cardiac conditions associated with SCD.

2393 Board #312 May. 28 3:00 PM - 4:30 PM

Is Dynamic Ultrasound Of Femoroacetabular Translation Increased In Female Dancers With Acetabular Dysplasia?

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BACKGROUND: Hip pain is common in dancers. A contributing factor to hip pathology in dancers may be the high prevalence of acetabular dysplasia. Dynamic ultrasound (US) of femoroacetabular translation has been shown as a reliable measure of femoroacetabular motion and may serve to assist in the evaluation of hip microinstability. Evidence regarding associations between acetabular dysplasia and femoroacetabular translation is unknown.

PURPOSE: To investigate associations between acetabular dysplasia and dynamic US femoroacetabular translation in female dancers with hip pain.

METHODS: Prospective cross-sectional study design. Dynamic US of femoroacetabular translation was performed in three positions: neutral (N), neutral with contralateral hip flexion (NF), and the apprehension position with contralateral hip flexion (EER flexed). Dysplasia was defined using radiographic measures: $LCEA < 25$ or $ACEA < 20$. Multivariable linear regression analysis was used to assess variation in femoroacetabular translation between dancers and non-dancers with and without dysplasia controlling for covariates. Independent variables included age, Beighton score, hypermobility (Beighton score ≥ 5), BMI, and femoral version angles. P -values < 0.05 were considered significant.

RESULTS: The study included 64 female dancers and 92 non-dancer athletes. Dancers were younger ($p=0.001$), had a higher Beighton score ($p=0.006$), and were more likely to be hypermobile ($p=0.005$) compared to non-dancer athletes. Dynamic US femoroacetabular translation was not different in dancers with and without dysplasia ($N, p=0.55$; NF, $p=0.78$; EER flexed, $p=0.93$). Dancers showed greater dynamic US femoroacetabular translation when compared to non-dancer athletes in both the NF position (5.0 ± 2.57 mm, 4.2 ± 2.50 mm; $p=0.04$) and EER flexed position (6.0 ± 2.53 mm, 5.2 ± 2.41 mm, respectively; $p=0.04$).

CONCLUSION: Acetabular dysplasia was not associated with increased dynamic US femoroacetabular translation in this cohort. Dancers showed increased US femoroacetabular translation compared to non-dancer athletes. This finding is likely related to increased ligamentous laxity and stretched ligaments inherent to dance training. Future research is warranted to collect data in asymptomatic dancers with and without acetabular dysplasia.

2394 Board #313 May. 28 3:00 PM - 4:30 PM
Identification Of Functional Popliteal Artery Entrapment Syndrome In Athletes Who Have Failed Compartment Release

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(No relevant relationships reported)

ACSM FPAES abstract

TLevel of evidence: IV **Objective:** To evaluate the work up and outcomes of athletes with exertional leg pain, specifically the co-existence of functional popliteal artery entrapment syndrome (FPAES) and chronic exertional compartment syndrome (CECS), in athletes who were unable to return to sport or have significant symptomatic improvement after lower leg compartment fasciotomy. **Design:** Retrospective case series **Setting:** Outpatient musculoskeletal sports clinic, outpatient vascular surgery clinic **Participants:** 36 patients aged 15-67 (average age 26.9) diagnosed with functional popliteal artery entrapment syndrome using CT-angiogram with provocative maneuvers or MRI-angiogram with provocative maneuvers. In our cohort, a moderate number of athletes (11/36 athletes, 19/59 affected limbs) were referred for evaluation by vascular surgery after already having undergone lower leg fasciotomies for chronic exertional compartment syndrome. **Interventions:** Partial debulking of anterolateral quadrant of the medial head of the gastrocnemius muscle with or without fasciotomy **Main Outcome Measures:** Return to sport/previous activities **Results:** Mean follow up was 52.3 ± 22.2 months. 78% (28/36) of the patients were able to fully return to their previous athletic competitive levels. All patients were able to resume their athletic sport at a recreational level. The patients participated in a myriad of sports and athletic activities: 14 runners, 9 soccer players, 3 unspecified, 2 lacrosse, 2 basketball, 1 triathlete, 1 jumper, 1 diver, 1 water polo, 1 rugby, 1 skier. At 6-month follow-up, there were 13% of affected limbs that had recurrent symptoms, at 12 months, only 5% had recurrent symptoms and at three years, no patients had symptoms present. **Conclusions:** Many of these patients were unable to return to participate in high levels at their respective sport even after initial fasciotomy for CECS, suggesting that FPAES was unidentified, overlooked, or possibly developed after fasciotomy. FPAES can be a co-existing diagnosis that warrants screening during the evaluation of CECS. Provocative CT-A and MRI-A protocols can help guide the diagnosis as well as location of muscle debulking to alleviate the functional entrapment that occurs in these athletes with exercise. It is important to consider and screen for this diagnosis to allow for proper treatment and return to sport.

D-74 Free Communication/Poster - Sports Medicine Fellow Clinical Cases

Thursday, May 28, 2020, 2:00 PM - 4:30 PM
 Room: CC-Exhibit Hall

2395 Board #314 May. 28 3:00 PM - 4:30 PM
19 Y/o Male Marine Experiencing Exercise-induced Laryngeal Obstruction (eilo) During Military Training.

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(No relevant relationships reported)

HISTORY: 19 year old male with a long history of shortness of breath on exertion. States that since childhood he has had inspiratory wheezing and tightness in chest with exertion, but he was told he would outgrow it. More recently, he has noted that it has worsened with maximal exertion during military training. He states that he is

unable to run all out once around the track without experiencing inspiratory difficulty with gasping. It takes about 10 minutes for him to recover. If he resumes exercise it will recur. Asthma inhalers have not helped. Episodes are associated with pain and dysphagia. **PHYSICAL EXAMINATION:** Laryngeal examination shows that there is reduced abduction of the vocal folds, with a maximum glottic space of about 6 mm. During high ventilatory output tasks there is evidence of paradoxical movement of the vocal folds, most prominently on inspiration, resulting in shortness of breath, and loud stridor on inspiration. **Cardiac:** RRR, without murmur **Lungs:** Clear to Auscultation bilaterally "at rest", Loud inspiratory stridor during "high ventilation". **MSK:** Significant muscle tension dyspnea, an inefficient breathing pattern with an upper torso / clavicular breathing, and hyperfunction of strap muscles.

DIFFERENTIAL DIAGNOSIS:- Hypertrophic Obstructive Cardiomyopathy (HOCM)- Asthma- Exercise-Induced Bronchoconstriction (EIB)- Exercise-Induced Laryngeal Obstruction (EILO)- Exercise-Induced Anaphylaxis (EIA) **TEST AND RESULTS:** Cardiopulmonary Exercise Test (CPET): negative. Spirometry with methacholine challenge: negative. Laryngeal function Study: videoendoscopy with stroboscopy revealed reduced abduction of the vocal folds. During high ventilatory provocative challenge, there was evidence of paradoxical movement of the vocal folds, most prominently on inspiration, resulting in shortness of breath, and loud stridor on inspiration. **FINAL/WORKING DIAGNOSIS: Exercise-Induced Laryngeal Obstruction (EILO)** Patient has developed poor breathing patterns with reduced bilateral vocal fold abduction. **TREATMENT AND OUTCOMES:** Breathing Retraining Therapy (4-6 sessions). Patient report significant improvement in symptoms after 2nd session, and complete resolution of symptoms following the 5th session. Remaining symptom free for 4 months.

2396 Board #315 May. 28 3:00 PM - 4:30 PM
The Two-Year Long Pubalgia

George Liras. UT Health, Houston, TX. (Sponsor: Mark Chassay, FACSM)

(No relevant relationships reported)

HISTORY: 20-year-old male collegiate basketball player with prior history of athletic pubalgia s/p repair 2 years ago. The patient was seen in our clinic for evaluation of LLQ abdominal pain that has been present for the past 2 years. During that time, he has had 2 MRIs of the Pelvis w/o contrast showing bone marrow edema and erosive changes in the pubic symphysis and the left superior pubic ramus area and was prescribed physical therapy as well as medication management. The patient also received an ultrasound guided corticosteroid injection in the area for left lower quadrant pain 8 months prior to his visit in our clinic. During the visit the patient reported a fever with a Tmax of 102F the night before, as well as fatigue, cold sweats, chills and groin pain. Of note two days prior, the patient was seen in the ER for a right sided abdominal laceration from a fall of a broken mug. A CT scan of the abdomen and pelvis showed signs of worsening of the previously seen erosive periostitis. He was also found to have an elevated WBC count with left shift.

PHYSICAL EXAM: BP: 125/ 73, T: 98.7 F, HR: 100bpm Constitutional: NAD, AOx 3 Eyes: eyelids normal, conjunctiva and sclera normal, PERRLA, EOMI. Pulmonary: the respiratory rate was normal, the lungs were clear to auscultation bilaterally. Cardiovascular: the heart and rate and rhythm were normal, normal S1, normal S2, no murmurs, rubs or gallops were present. Abdomen: abdominal laceration sutures clean, dry and intact.

DIFFERENTIAL DIAGNOSIS: 1.Osteomyelitis 2.Bone tumor 3.Abdominal Hernia **STUDIES/ LABS:-** ESR: 101 [H]-CRP: 174 [H]-ALP: 139 [H]-ALT: 81 [H]-AST: 74 [H]-WBC: 10.5 [WNL]-Hgb: 12.5 [L]-Hct: 36.1 [L]-Blood smear: Neutrophilia, Normochromic normocytic anemia-ANCA screen: Negative MRI of Pelvis w/o contrast: - Post-surgical changes from repair of left-sided sports hernia - Complex irregular cyst at the repair site - Development of new erosion along the inferior aspect of the pubic symphysis with moderate marrow edema within the pubic bodies and edema of the surrounding soft tissues.

FINAL DIAGNOSIS: Osteomyelitis of pubic bone **TREATMENT AND OUTCOMES:-** Trans-abdominal drainage of pelvic abscess -IV antibiotics (Cefazolin) and transitioned to 6 weeks of PO Keflex under the supervision of Infectious Disease specialist-Patient has recovered well-Will follow up with surgery at the 3 months post-op mark for repeat MRI.

2397 Board #316 May. 28 3:00 PM - 4:30 PM
Abdominal Pain In A Collegiate Quarterback

Allen R. Harris. Crozer Keystone Healthplex Sports Medicine Institute, Springfield, PA. (Sponsor: Thomas Kaminski, FACSM)

Email: allen.harris@crozer.org
 (No relevant relationships reported)

ACSM case Core Injury - Football Allen R. Harris, DO, Crozer Keystone Healthplex Sports Medicine Institute, Suburban Philadelphia, PA (Sponsor: Thomas Kaminski, University of Delaware, ATC, PhD, FACSM) **HISTORY:** A 21-year-old collegiate quarterback sustained a right flank/hip injury during the first quarter of a football game. He scrambled and was tripped from behind falling forward onto the heel of an offensive lineman. He experienced instant pain over his right flank and hip.

He required assistance off the field and complained of pain with breathing. He was immediately escorted to the sports medicine office on-site for examination. **PHYSICAL EXAMINATION:** On examination there was bruising over the lower right abdomen and anterior hip along with tenderness to palpation over the right lower quadrant. No rebound tenderness or guarding. There was marked tenderness over the right ASIS and iliac crest. There was tenderness over the rectus abdominus and right hip flexor. No tenderness over the right upper quadrant. He had decreased strength and range of motion with hip flexion. He did not have dysuria or hematuria. Under ultrasound guidance, the superior aspect of the right iliac crest was injected with 6cc of lidocaine/Sensorcaine in a ratio of 1:2. The patient experienced a 50% reduction in pain and did not return to the game. **DIFFERENTIAL DIAGNOSIS:** 1. Iliac crest contusion (hip pointer) 2. Core muscle injury/avulsion 3. Abdominal contusion **TESTS AND RESULTS:** ultrasound: No free fluid, hematoma or evidence of avulsion or bony disruption. X-ray right hip: No acute fracture. MRI pelvis without contrast: 1. Full-thickness detached tears of the right transversus abdominis and internal oblique muscles at their attachment to the right iliac crest. 2. Grade 1-2 strain of the overlying external oblique muscle. Grade 1 strain of the lateral portion of the right iliacus muscle. **FINAL/WORKING DIAGNOSIS:** Core muscle injury/avulsion **TREATMENT AND OUTCOMES:** 1. Aspiration of hematoma, rest and NSAIDs. 2. Surgical repair of the obliques and rectus abdominis muscles 10 days after initial injury 3. 6-week progressive physical therapy/rehabilitation plan 4. Progressed back to full activity without setback 8 weeks following injury.

2398 Board #317 May. 28 3:00 PM - 4:30 PM
An Unusual Case Of Back Pain
 James McKee. *University of Massachusetts, Worcester, MA.*
(No relevant relationships reported)

HISTORY: A 13-year-old male with a past medical history of Hermansky-Pudlak syndrome was playing soccer and was struck from behind. He presented to the ED complaining of left lateral rib pain with waxing and waning intensity for seven days. The pain was described as a deep ache combined with sharp stabbing pain with deep inspiration without radiation, exacerbated by bending, twisting, and coughing. OTC NSAIDs provided mild relief. He simultaneously also complained of low back pain of unknown lengthy duration. The back pain was a stiffness in the morning that routinely takes until noon to dissipate. ROS otherwise negative. **PHYSICAL EXAMINATION:** Neck: No midline cervical spine tenderness, step-offs, or deformity. Full ROM. Pulmonary/Chest: Effort normal, breath sounds normal. No stridor, wheezes, or rales. Lungs clear bilaterally. Patient reports stabbing pain inferior to left scapula with deep inspiration and lateral bending. No respiratory distress. Musculoskeletal: Normal ROM. No midline spinal tenderness. No tenderness over left posterior ribs. No palpable deformity. Sharp pain just inferior to scapula with inspiration, worse with movement. Straight leg raise negative bilaterally. Steady gait **DIFFERENTIAL DIAGNOSIS:** 1) Rib Contusion 2) Ankylosing Spondylitis 3) Neurogenic **TEST AND RESULTS:** XR Ribs Left: Normal CXR: Normal XR LS: Normal Vitamin D: 27 CRP: 0.4 ESR: 5 RF: <10 HLA-B27: Negative MRI Thoracic and Lumbar Spine: 1) Bone marrow edema in L5 spinous process with small amount of posterior midline subligamentous fluid collection that is likely inflammatory. 2) Congenital narrowing of the bony spinal canal. 3) Syrinx at T5 through T9, up to 2mm at T7. **FINAL/WORKING DIAGNOSIS:** Syringomyelia, spinal stenosis **TREATMENT AND OUTCOMES:** The patient underwent a period of activity modification and PT and clinically improved. Laboratory workup was negative. Lidocaine patches were ineffective. His lower back pain remains unchanged although he states he has received benefits from foam rolling. He decided against playing lacrosse for the spring season. No neurological deficits have manifested. No pulmonary issues have manifested. We continue to recommend that he participated in activities as tolerated with no restrictions.

2399 Board #318 May. 28 3:00 PM - 4:30 PM
Acute Hip Pain In A Female Adolescent Runner
 Catherine Lott. *Detroit Medical Center, Detroit, MI.*
 Email: clott16@gmail.com
(No relevant relationships reported)

HISTORY: 13-year-old female presents for evaluation of left hip pain. Initial injury occurred one day prior to presentation during cross-country practice. She states she was approximately three quarters of a mile into a run on the track when she felt/heard a pop and immediately endorsed pain along the anterior left hip. She described it as sharp in quality with immediate discomfort with ambulation. She was not able to complete the remainder of practice and given the severity and intensity of pain she was taken to the emergency department for further evaluation. While there, plain films were obtained and read as negative for acute fracture. She was given Motrin, placed on crutches and instructed on close follow-up. Since this time, she points to her ASIS and iliac crest as the source of pain with exacerbations during resisted/active hip flexion, internal rotation and weightbearing type maneuvers. She denies any lower extremity radicular symptoms, paresthesias, temperature variations or nocturnal awakenings. Denies any fevers, chills, sweats or loss of bowel/bladder function. She does report some mild hip discomfort over the preceding couple of weeks however

this was transient and self-limiting. She currently runs cross-country and participates in a travel softball team 3 days a week. **PHYSICAL EXAMINATION:** Examination of the left hip revealed no lesion/abrasion or overt deformity; normal alignment, no erythema, swelling or ecchymosis. On palpation she had point tenderness over ASIS and Iliac crest, more so at the ASIS, no crepitus or tenderness at greater trochanter or anterior groin; slight pain over the hip flexor. Patient had full ROM of the left hip but noted pain with both internal rotation and flexion. Patient had mildly decreased strength with resisted hip flexion (4/5), but strength was otherwise normal in the left lower extremity. For provocative testing she had a negative Log Roll, negative FABER; neg FADIR; negative SLR; negative Slump test; positive Trendelenburg; neg Adductor squeeze test. She had normal neurovascular exam of the left lower extremity. The contralateral leg was normal to inspection, palpation, ROM and strength and stability testing. **DIFFERENTIAL DIAGNOSIS:** 1. Sartorius Strain/Rupture 2. Iliac Crest Apophysitis 3. Iliac Crest Apophyseal Avulsion Fracture 4. Psoas Strain 5. Stress Fracture/Reaction

TEST AND RESULTS: Imaging: L hip/pelvis x-rays showed avulsion of the superior aspect of the lateral left innominate bone with the cortical fragment laterally offset. **FINAL/WORKING DIAGNOSIS:** L Iliac Crest Apophyseal Avulsion Fracture **TREATMENT AND OUTCOMES:**

After consultation with surgical colleagues it was decided to proceed with conservative management including ice/heat/NSAID therapy and non-weightbearing with crutch assistance. Patient followed up 2 weeks after the initial clinic visit with improving symptoms. She no longer required crutch assistance for ambulation. Patient was symptom free at 4-week follow up with further radiographic evidence of healing. At this time she was placed in a formal physical therapy program. Completed gradual return to play and was fully participating in running and softball at 8 weeks post injury.



2400 Board #319 May. 28 3:00 PM - 4:30 PM
Let's Talk About Stress
 Lauren Victoria Greene, Sadiq Haque, Brandon Kakos. *Detroit Medical Center, Detroit, MI.*
(No relevant relationships reported)

HISTORY: A 32 year old Female nurse presented to the sports medicine clinic with complaint of left hip pain after she was lifting a patient and twisted her left hip internally. She felt sudden sharp pain over the lateral and anterior hip that radiated into the groin. Pain was made worse with movement and improved with rest and she rated the pain as 7 out of 10 after the injury. Her symptoms continued with little improvement over a few weeks resulting in an antalgic gait favoring the left side. She rates her pain as 6 out of 10 on VAS at presentation. She tried ibuprofen with little relief, has had no imaging or treatment. She runs 3 miles 3 to 5 times per week prior to the injury. She had a history of irregular menses for many years. **PHYSICAL EXAMINATION:** Examination in the clinic revealed a slim female with no swelling or bruising over the left hip. She had tenderness to palpation over the anterior groin and greater trochanter on the left side. She had limited internal rotation of the hip and preserved external rotation. Her strength was preserved and she was neurovascularly intact. She had positive log roll, FADIR and negative FABER. She had an antalgic gait favoring the left side. **DIFFERENTIAL DIAGNOSIS:** 1. Labral Tear 2. Femoroacetabular impingement (FAI) 3. Stress fracture of the femoral neck 4. Hip flexor strain 5. Female athlete triad **TEST AND RESULTS:** Left hip x-rays: 1. Preserved joint space with mild pincer deformity suggesting FAI. No fractures or dislocations noted. MRI Arthrogram of Left Hip: 1. Significant marrow edema and contusion involving a large portion of the femoral neck with a non-displaced stress fracture involving the medial left femoral neck. 2. No labral tear noted. Left Hip Xray 1 week post operatively 1. Three compression screws in the femoral head and neck with adequate alignment and no signs of migration or loosening of the screws. **FINAL/WORKING DIAGNOSIS:** Left femoral neck non-displaced stress fracture with

workup for female athlete triad
TREATMENT AND OUTCOMES: 1. Patient made non weight bearing with crutches. 2. Patient was given options of surgical or conservative management of her compression-sided fracture and chose to pursue surgical route given the fracture extended approx. 50% across the femoral neck and her level of activity prior to the fracture. 3. Closed reduction with percutaneous pinning of the left hip. 4. Using a walker for immobilization she was made 25% weight bearing. 5. 1 week post operatively her pain was improving and she was compliant with weight bearing status. 6. 2 weeks post operatively she continues to improve, she is advanced to 50% weight bearing status using walker and starting physical therapy. She remains off of work as a nurse. 7. Plan to return to work three to four months post operatively.

2401 Board #320 May. 28 3:00 PM - 4:30 PM

Kindness For Weakness

Nicole Nash¹, James Daniels¹, Erica Miller - Spears¹, Rob Carmichael². ¹*Southern Illinois University-Quincy, IL, Quincy, IL.* ²*Culver Stockton College, Canton, MO.*

(No relevant relationships reported)

HISTORY: 21 year old African American male junior running back on the football team presenting with right shoulder and neck pain after tackling an opponent during a game. He had associated numbness and tingling extending down to the right hand. He is right hand dominant. He was seen on the field by the athletic trainers and a burner stinger was initially suspected. He was then re-evaluated on the sideline, and kept out of play due to persistence of symptoms. He denied any symptoms on the left side or in the lower extremities. He does report a history of two burner/stingers in high school. He is otherwise previously healthy with no regular medications. He later came to the training room for further evaluation.

PHYSICAL EXAMINATION: Patient had good range of motion in the neck. Spurling test was negative. Hoffman test was positive. He had global muscle weakness in the right upper extremity. Right shoulder had no swelling or bruising. He had some tenderness over the right bicep tendon. Shoulder range of motion was intact. Sulcus sign and rotator cuff testing were both negative.

DIFFERENTIAL DIAGNOSIS: Burner/Stinger - Brachial Plexus Injury, Cervical Disc Herniation, Spinal Cord Syrinx, Spear Tackler's Spine, Cervical Stenosis
TEST AND RESULTS: X-ray of the cervical spine showed no evidence of acute fracture or subluxation. MRI of the cervical spine without contrast showed a small disc protrusion at C5-C6 and a small area of focal dilation of the central canal at C6-C7 concerning for a syrinx.

FINAL/WORKING DIAGNOSIS: Spinal cord syrinx

TREATMENT AND OUTCOMES: The findings of disc herniation were presumed old, with an acute development of spinal cord syrinx. Patient was referred to an orthopedic spine surgeon who recommended no surgery for the disc and referral to neurology. Neurology started him on baclofen 5 mg twice a day and gabapentin 300 mg twice a day. He has not been cleared to return to play to avoid any further neck trauma. We will continue to monitor his symptoms. He will let us know if he develops any worsening of symptoms. He has a follow up appointment with neurology in 2 months.

2402 Board #321 May. 28 3:00 PM - 4:30 PM

Foot injury- Track & Field

Odrick R. Rosas-Virella¹, Manuel H. Garcia-Cartagena², William F. Micheo-Martinez, FACSM¹. ¹*University of Puerto Rico-School of Medicine, San Juan, PR.* ²*Ponce Health Sciences University, Ponce, PR.*

(No relevant relationships reported)

HISTORY: A 15 y/o female with no medical history, who participates in long jump, triple jump and 200-meter sprints arrived at our clinic (December 2019) with right foot pain partially treated with a pneumatic boot on October 2019. Patient states pain in her right foot, mainly in the first metatarsophalangeal (MTP) joint. Denies burning, irritation, acute trauma, past hospitalizations, surgery or toxic habit, but stated oligomenorrhea for months. Upon further questioning, patient reports having a previous sesamoid fracture of the left foot on May 2017.

PHYSICAL EXAMINATION:

Inspection: Mild edema in the first digit of the right foot
 Palpation: Point tenderness in plantar aspect of the distal part of the first MTP joint bilateral

Range of Motion: Full passive and active in lower extremities

Strength: MMT 5/5 in lower extremities

Single leg hop test positive for pain

DIFFERENTIAL DIAGNOSIS: 1- First MTP joint sprain

2- Stress fracture of sesamoids

3- Sesamoiditis

4- Flexor hallucis brevis tendinopathy

5- Osteonecrosis of hallux sesamoids

TEST AND RESULTS: Lab results: CBC, CMP, uric acid level, U/A, TSH level, A1C, OGTT, RA factor; anti-CCP; C3 and C4 levels; IgA, IgG, and IgM levels;

FT3 and FT4 levels; and Prolactin are all within normal reference ranges. Total testosterone: 119 ng/dL (normal= 5-75 ng/dL), T3 uptake: 35.77% (normal= 20.00%-34.00%), LDH level: 121U/L (normal= 125-243 U/L), and CRP: 1.6 mg/dL (normal= 0.0-1.2 mg/dL).

MRI: Fractured medial hallux sesamoid with bone marrow edema and a small first MTP joint effusion in the left foot, and a small, fragmented and sclerotic medial hallux sesamoid with lateral sesamoiditis (stress fracture) in the right foot.

Left Foot X-Ray: anteroposterior, oblique, and lateral views: Left foot sesamoid fracture had healed.

Pelvic sonogram: Prominent right ovary (3.6x2.7x3.5cm), and normal left-sided ovary with an unilocular cyst measuring 2.2x1.5x2.3cm.

FINAL/WORKING DIAGNOSIS:

Right hallux sesamoid subacute stress fractures.

Left medial hallux sesamoid healed fracture

Suspected female athlete triad.

TREATMENT AND OUTCOMES

1. Physical therapy, home exercises and relative rest from running and jumping.

2. Calcium and Vitamin D supplementation

3. F/U DEXA scan to assess female athlete triad

4. Gradual return to Sports activity

2403 Board #322 May. 28 3:00 PM - 4:30 PM

Progressive Rash In A High School Basketball Athlete

Bram Newman, Adriana Isacke. *Maine Medical Center, Portland, ME.* (Sponsor: Heather Gillespie, FACSM)

(No relevant relationships reported)

History: A 16 year old female high school basketball player presented to the athletic training room with a rash on the bilateral lower extremities. It was first noticed 1 week prior to presentation and had progressed from the feet and ankles proximally to the upper thighs. She stated that she initially had right ankle pain but at presentation felt her left knee was particularly swollen and painful. She denied any significant itching related to the rash but felt her legs were swollen and heavy. She denied any specific joint trauma and had been participating in her usual physical activities. She endorsed that she was currently recovering from an upper respiratory viral illness that occurred prior to the appearance of the rash. She had tried taking oral diphenhydramine for the rash which did not help.

Physical Examination: She was in no acute distress. Nasal congestion and cough were noted. The legs were diffusely swollen from the ankles to the proximal third of the thighs bilaterally with scattered, non-blanching and non-tender purpuric lesions. There was non-specific tenderness to palpation about the left knee without warmth. It was difficult to assess for a knee effusion as there was significant soft tissue swelling. Knee flexion range of motion was 0 to 150 degrees, pain-free and flexion and extension strength was 5/5. Ligamentous structures of the knees were intact. Sensation to light touch of the bilateral lower extremities was intact. She reported pain in the left knee with gait but was not observed as having a limp. Balance was intact.

Differential Diagnosis: 1)Septic arthritis2)Transient synovitis3)Lyme disease4) IgA Vasculitis (formerly known as Henoch-Schnlein Purpura)5)Coagulopathy6) Dermatologic hypersensitivity

Tests and Results: The patient was sent to the emergency department for further evaluation. Blood pressure was 116/69, pulse was 90, respiration rate was 19 breaths per minute with 100% oxygen saturation, and temperature was 97.5°F. A complete blood count showed normal platelets and no leukocytosis, while a basic metabolic panel showed normal renal function. A urinalysis showed trace blood and left lower extremity vascular ultrasound was negative for DVT. Musculoskeletal ultrasound did not show any intra-articular effusion in the left knee.

Final/Working Diagnosis: IgA Vasculitis (formerly known as Henoch-Schnlein Purpura) with polyarticular involvement.

Treatment and Outcomes: Our patient was managed conservatively with symptom management as needed. Although there was concern for septic arthropathy, she remained afebrile with no clinical signs of sepsis. The rash and arthralgias resolved within 4 weeks.

2404 Board #323 May. 28 3:00 PM - 4:30 PM

A RARE CASE OF WRIST PAIN IN AN ADOLESCENT TENNIS PLAYER

Marc Phillip Gruner, Jacob Sellon, Edward Laskowski. *Mayo Clinic, Rochester, MN.*

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Reported Relationships: M.P. Gruner: OOwnership/interest/stock; own stocks.

CLINICAL CASE -16 year old tennis athlete with dorsal wrist pain

HISTORY: A 16 year old female left-handed high school tennis athlete presented with a several month history of left dorsal wrist pain. She had an episode of whole arm pain, which resolved spontaneously, prior to the wrist pain, but she continued to

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experience dorsal wrist pain. She described diffuse pain about the dorsal aspect of the wrist radiating into the left hand. She denied mechanical symptoms, swelling, discoloration, or paresthesias. She also denied neck pain.

PHYSICAL EXAMINATION: Skin was grossly negative for erythema, breakdown, or concerning lesions in the left wrist/hand region. Neurologic exam: 5/5 strength in all forearm and hand muscles without atrophy, sensation was intact to light touch C5-T1, and tinel test was negative over the superficial radial nerve. Musculoskeletal wrist exam: no swelling or deformity. No focal tenderness or mass. Full active and passive range of motion of the wrist. There was no pain or laxity with distal radial ulnar joint shucking. There was no pain or laxity with distal radial ulnar joint shucking. There was no pain or laxity with distal radial ulnar joint shucking. There was no pain or laxity with distal radial ulnar joint shucking.

DIFFERENTIAL DIAGNOSIS: 1. Ganglion cyst of the wrist joint. 2. Sprain of the dorsal scaphoid-lunate ligament. 3. Symptomatic extensor digitorum brevis manus. 4. Dorsal Impaction syndrome. 5. Extensor tendinopathy.

TEST AND RESULTS: Ultrasound examination revealed an extensor digitorum brevis manus accessory muscle traversing from the deep side of the 4th dorsal extensor compartment, extending across the dorsal hand, and terminating into a tendon slip that merged with the dorsal extensor hood of the 3rd digit. The muscle was notably larger on the left side than the right. She had no evidence of tenosynovitis or other abnormalities in the dorsal wrist.

MRI of the wrist revealed a tiny ganglion cyst along the volar margin of the radioscaphoid articulation and a normal variant extensor digitorum manus brevis muscle.

FINAL/WORKING DIAGNOSIS: Symptomatic extensor digitorum brevis manus. **TREATMENT AND OUTCOMES:** 1. Immobilization. 2. Diclofenac Gel. 3. Ultrasound guided Botox injection of the extensor digitorum manus brevis muscle.

We discussed different management options and she elected to proceed with an ultrasound guided botox injection since she had minimal relief from immobilization.

2405 Board #324 May. 28 3:00 PM - 4:30 PM

Adverse To Converse

Jeevan Abraham¹, Raman Singh². ¹AMITA Resurrection Medical Center, Chicago, IL. ²Advocate Health, Aurora, IL. (Sponsor: Poonam Thaker, FACSM)

(No relevant relationships reported)

Toe Pain--- Cross-Country

HISTORY: A 12 year-old female cross country runner presented to the pediatric sports medicine clinic with 3 months of right second toe pain. Initially, the pain started after stubbing her toe. She developed a constant dull ache that was present at rest and worsened with prolonged walking and during cross country. She noted that her symptoms gradually worsened with time, and she was having no improvement with rest, icing and anti-inflammatories.

PHYSICAL EXAMINATION: Overlying skin with no rashes or lesions. Tenderness along the plantar surface of her right second metatarsophalangeal (MTP) joint. ROM was limited in both passive and active flexion and extension of the affected joint. Sensation was intact, and strength with flexion and extension of the toe was normal, however there was significant pain with testing. MT squeeze test was negative. Varus and valgus stress to MTP joint elicited no laxity, and "drawer test" of MTP joint showed mild instability.

DIFFERENTIAL DIAGNOSIS:

1. Sprain of plantar plate
2. Metatarsal fracture/stress fracture
3. Osteochondrosis of the metatarsal head
4. Metatarsalgia
5. Lisfranc injury
6. Intermetatarsal neuroma

TEST RESULTS:

X-ray R foot:

--- Flattening of the second metatarsal head.

MRI R foot without contrast:

--- Flattening/collapse of the 2nd metatarsal head/distal epiphysis with prominent marrow edema of the 2nd metatarsal head and neck. Mild MTP joint space narrowing.

FINAL/WORKING DIAGNOSIS:

Osteochondrosis of the metatarsal head (Freiberg Disease) - Stage 4

TREATMENT AND OUTCOMES:

1. Placed in short leg walking boot with protected weight-bearing, ice 1-2 times daily, Foot/Ankle Surgery consultation with discussion of conservative care vs surgical (chondral drilling and/or chondroplasty). Patient opted for conservative care.
2. At 4-week follow-up, patient's pain significantly reduced. Continued walking boot additional 4 weeks with transition into stiff-soled shoe.
3. At 8-weeks post treatment, follow-up MRI showed no progression of disease. Clinically with almost complete resolution of pain.
4. By 10 weeks, transitioned into a custom foot orthotic with added support to float 2nd MTP joint. Restrictions included low impact sports only with plan for repeat MRI at 6 months.

2406 Board #325 May. 28 3:00 PM - 4:30 PM

Bilateral Shoulder Pain - Baseball

Frances Adkins Comer, Anastasia Fischer, FACSM. *Nationwide Children's Hospital, Dublin, OH.* (Sponsor: Anastasia Fischer, FACSM)

Email: frances.comer@nationwidechildrens.org

(No relevant relationships reported)

HISTORY: A 14-year-old right handed baseball player presents with two and a half years of insidious-onset bilateral shoulder pain. The pain is generalized in both shoulders, but worse anteriorly and in the right shoulder. He has continued to play year-round at an elite level, but he had to stop pitching due to pain. His shoulders "catch" and pain is exacerbated with rapid movements. **PHYSICAL EXAM:**

Examination in clinic demonstrated tenderness of the anterior and posterior humeral head on the right and anterior humeral head on the left. Range of motion is limited in extension, internal rotation, and external rotation, and is full in flexion and abduction. Strength is full in all ranges of motion with pain in abduction, internal and external rotation. Hawkins, O'Brien's, and Crank tests are positive for pain. He is distally neurovascularly intact. **DIFFERENTIAL DIAGNOSIS:** 1. Labral tear. 2. Proximal Humeral Epiphysiolysis. 3. Synovial Osteochondromatosis. 4. Dysplasia Epiphysialis Hemimelica. **TEST AND RESULTS:** Bilateral shoulder radiograph: Abnormal rounded ossific densities anterior to the right humeral head and metaphysis. Similar pattern of ossification anterior to the left humeral head, which is less well-defined than that seen in the right shoulder. Bilateral shoulder MR without contrast: Bilateral symmetric irregularly-shaped osteochondral fragments within the anterior glenohumeral joint spaces with evidence of erosions of the humeral head. Bilateral shoulder CT without contrast: Bony irregularity along the medial, proximal aspect of both humeri with clustered ossicles adjacent to the bony irregularity. No evidence of free intra-articular bodies. **FINAL/WORKING DIAGNOSIS:** Bilateral Synovial Osteochondromatosis of the Shoulders. **TREATMENT AND OUTCOMES:** 1. Referred for a surgical consult, where non-operative treatment was recommended. 2. Started in physical therapy (PT). 3. Continued full participation in sports despite pain. 4. 10-15% improvement after 3 months of PT. 5. Currently travelling for the winter baseball season and continuing PT at a distant site.

2407 Board #326 May. 28 3:00 PM - 4:30 PM

An Unexpected Cause For Hip Pain

Adam Stefaniak. *Resurrection Medical Center, Chicago, IL.*

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(No relevant relationships reported)

Clinical Case Abstract

Right hip pain-Runner

Adam Stefaniak, DO Resurrection Sports Medicine Fellowship, Chicago, IL. (Sponsor: Poonam Thaker, MD, FACSM)

HISTORY: The patient is a 17 year old male who presented with his mother for right hip pain that started 4 months prior to evaluation. There was no known injury when the pain started. The pain was located anteriorly and in the groin. He described the pain as sharp with radiation down his femur. He also started limping recently because of worsening pain. The pain worsened with running, walking, and standing for long periods of time. He felt like his hip sometimes would get "stuck", but denied any snapping, popping or clicking. Pain improved with ibuprofen. He ran track during spring, but he denied participating in any sports or increase in activity prior to the pain starting. Denied back or knee pain. No previous injuries to that hip. Denied fevers, chills, night sweats, weight loss.

PHYSICAL EXAMINATION: Antalgic gait. Right Hip- No swelling or bruising. No pain over iliac crest, ASIS, AIIS, PSIS, greater trochanter, IT band. Hip flexion 120, external rotation 45, internal rotation 35. 4/5 hip flexion strength. 5/5 hip extension, knee extension, knee flexion, dorsiflexion, plantar flexion. Positive groin pain with FABER testing. Negative FADIR. Negative log roll. Pain with resisted straight leg test. Pain with jump testing. Negative Ober's test.

DIFFERENTIAL DIAGNOSIS: 1. Hip labral tear. 2. Stress fracture. 3. Snapping hip syndrome. 4. FAIS. 5. Muscle strain. 6. Osteitis pubis. 7. Athletic pubalgia

TESTS AND RESULTS:

Right Hip and Pelvis Xray: nMild osseous expansion with sclerotic and lucent areas involving the left pubic bone. Right Hip and Pelvis MRI without contrast: nMultiple aggressive appearing osseous lesions throughout the pelvis, proximal femurs, and lower lumbar spine, compatible with metastatic disease. CT biopsy performed of the right ischial bone lesion. CD20+ Diffuse B-cell Lymphoma

FINAL/WORKING DIAGNOSIS: Diffuse B-cell Lymphoma

TREATMENT AND OUTCOMES: 1. Referral to pediatric hematology/oncology. 2. 10 cycles of intrathecal R-COPADM chemotherapy (ANHL1131 protocol). 3. Activity as tolerated

2408 Board #327 May. 28 3:00 PM - 4:30 PM

Acute Blindness In An Athlete

Sarah Abdellatif, Kevin Lisman, Rehal Bhojani. *UT Health in Houston, Houston, TX.* (Sponsor: Mark Chassay, FACSM)
(No relevant relationships reported)

TITLE: Acute Blindness in an Athlete
PRESENTER: Sarah Abdellatif, DO
HISTORY: A 24 yo weightlifter with a past medical history of mitral valve prolapse and Raynaud’s syndrome experienced sudden right eye blindness about one month ago after training at the gym. She finished her session at the gym that day with no issues. Once patient returned home, she decided to sit down and read for a bit when she suddenly lost vision of her right eye. She had no precipitating symptoms. Patient took an aspirin and her vision returned in about thirty minutes. She states that the image was slightly pixelated when it returned. Patient had never had anything like this happen before and had not happened again after that episode.
PHYSICAL EXAMINATION: Height- 66 inches Weight- 112 pounds Blood Pressure- 132/76 HEENT- Extraocular movements intact. Pupils equal and reactive to light. Neck- JVP normal, carotid pulses are full and equal bilaterally without bruits
Cardiac- Regular rhythm and rate, S1 normal, S2 normal, so S3 or S4, no murmurs, no gallops, no rubs detected
Peripheral Pulses- Femoral, popliteal, dorsalis pedis, and posterior tibial pulses are full and equal bilaterally with no bruits auscultated.
Neuro- Cranial nerves 2-12 intact.
DIFFERENTIAL DIAGNOSIS: 1. Patent Foramen Ovale 2. Central Retinal Artery Occlusion 3. Carotid Stenosis 4. Hemiplegic Migraine 5. Multiple Sclerosis
TEST AND RESULTS: Complete 2D Echocardiogram-- The left ventricular systolic function is normal with an estimated EF 60-64%. Patent foramen ovale is seen with left to right shunting.- Qp:Qs ratio is 0.72.- There are no hemodynamically significant valvular abnormalities or insufficiencies noted on this study.
FINAL/WORKING DIAGNOSIS: Large bidirectional shunting via patent foramen ovale with possible aborted central retinal artery occlusion stroke
TREATMENT AND OUTCOMES: 1. Start aspirin and Plavix daily. 2. TEE and a cardiac CTA to include origin of great vessels and carotid arteries. 3. Check a seven day cardiac monitor. 4. Schedule for PFO closure once results return. Risks and benefits discussed, given patient’s level of activity. 5. Refer to stroke neurologist for multidisciplinary evaluation.

2409 Board #328 May. 28 3:00 PM - 4:30 PM

Mesenchymal Stem Cell Use For ACL Repair: A Case Report

Navid Javan¹, Andrew Blecher². ¹Dignity Health Northridge, Northridge, CA. ²Southern California Orthopedic Institute, Van Nuys, CA.
(No relevant relationships reported)

HISTORY: The subject of this case is a 41-year-old stuntman who was referred for non-surgical consultation for left knee pain and inability to return to work after being hit by a car 2 years prior. He had been treating his knee with rest and a hinged knee brace which had partially improved his pain. He did not report any instability but had not yet “tested” his knee. He had no injuries to this knee prior to that incident. He takes no medications and had no prior surgeries.

PHYSICAL EXAMINATION: He had no effusion, deformity or focal tenderness. He had full AROM and strength was 5/5. He had 1+ laxity on Lachman maneuver and anterior drawer testing. McMurray, varus stress, and valgus stress were all negative.

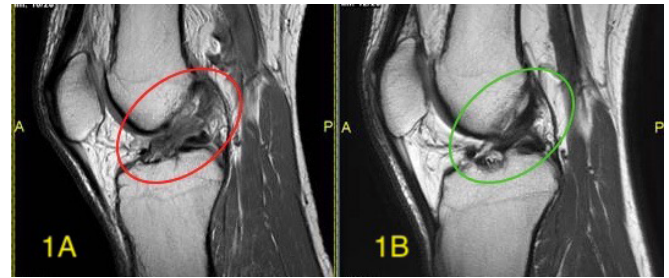
DIFFERENTIAL DIAGNOSIS: 1) ACL Sprain 2) ACL Rupture

TEST AND RESULTS:

KT1000 testing was performed and showed a 4 mm difference at the 15 lb. level and a 5 mm difference with quadriceps active displacement. MRI of the left knee demonstrated a grade 2 ACL sprain with only a few fibers left intact. MRI also demonstrated an impaction contusion injury of the medial tibial plateau and a small medial meniscal tear. (Figure 1a)

FINAL/WORKING DIAGNOSIS: Grade 2 ACL Sprain of the Left Knee

TREATMENT AND OUTCOMES: He first verified that he had not taken any NSAIDs within the previous 2 weeks and wouldn’t take any for the next 12 weeks. He received a centrifuged PRP intra-articular knee injection. The patient returned 2 days later for a mesenchymal stem cell (MSC) injection. Bone marrow aspirate was collected from the posterior iliac crest bilaterally and then processed, centrifuged and separated using the Regenxx technique which resulted in MSC, platelet lysate (PL), and a superconcentrated platelet solution (SCP). The PL and SCP was injected intra-articularly. The MSC were injected into the course of the ACL remnant under fluoroscopy. The patient was placed in a knee immobilizer and then received an intra-articular injection of SCP and PL 5 days later. He was evaluated twice over the next two weeks, being advanced to an ACL brace and PT. His ACL brace became pm 8 weeks later. At 6 months he had 90% improvement of his pain with discomfort during backwards running and deceleration but had no instability. He was cleared to return to his occupation as a stuntman. At 9 months he had an intact ACL on MRI (Figure 1B) and complete resolution of his pain.



2410 Board #329 May. 28 3:00 PM - 4:30 PM

Case Of A Pathologic Phalanx Fracture

Adam Thompson. *Crozer Keystone Health System, Springfield, PA.* (Sponsor: Thomas Kaminski, FACSM)
(No relevant relationships reported)

Phalanx Fracture

Adam M. Thompson, Crozer Keystone Health System, Springfield, PA. (Sponsor: Thomas Kaminski, ATC, PhD, David Webner, MD, Kevin DuPrey, DO)

HISTORY: A 24 year old right hand dominant male presented to urgent care with a hand injury sustained while moving a refrigerator. He was attempting to lift the refrigerator when he dropped it and it landed on his left hand. It landed on his middle and ring fingers. He developed pain and swelling primarily in the middle finger but with some in the ring finger as well.

PHYSICAL EXAM: Vital signs were within normal limits. Examination of the patient’s left hand demonstrated swelling and ecchymosis over the middle phalanx of the middle and ring fingers along with tenderness to palpation. There was equal range of motion in pronation, supination, wrist extension and wrist flexion bilaterally. There was decreased active flexion and full extension in those fingers as well - MP 0/85, PIP 0/75, DIP 0/35. Skin was warm and dry. Capillary refill was brisk.

DDX: 1. DIP/PIP ligament sprain 2. Phalanx fracture 3. Flexor tendon injury

TESTS AND RESULTS: X-ray demonstrated an angulated middle finger middle phalanx fracture with an underlying circumscribed lucent lesion with cortical thinning and some suggestion of internal matrix with somewhat limited evaluation secondary to fracture favored to represent a unicameral bone cyst or enchondroma.

FINAL/WORKING DIAGNOSIS: Left long finger middle phalanx cyst, consistent with bone cyst/enchondroma with pathologic fracture.

TREATMENT/OUTCOMES: The patient was referred to hand surgery for evaluation due to the fracture extending through the bone cyst. He underwent ORIF for pathologic fracture 7 days post injury. He was placed in a splint post-operatively. At initial follow-up he demonstrated good wound healing and significant improvement in pain. He was placed in a custom splint which he wore for six weeks. At this time he started in hand therapy to work on return to full function.

2411 Board #330 May. 28 3:00 PM - 4:30 PM

A Writer’s Block

Cindy Ong. *Kaiser Permanente, Los Angeles, CA.* (Sponsor: Aaron Rubin, FACSM)

Email: cindyong510@gmail.com

(No relevant relationships reported)

HISTORY: A 32-year-old male writer had right shoulder pain for four weeks without inciting injury and possibly slept awkwardly on his couch. The pain radiated with numbness/tingling along his right arm, forearm, and right thumb. His pain feels like “a bad sunburn.” His severe pain led to two prior emergency department visits and was provided a sling, Norco and lidocaine patch with minimal relief. He tried NSAIDs, acupuncture, cupping and physical therapy with mild relief. He finished a prednisone burst with improvement, however, with residual shoulder pain with overhead activities. He had also been recovering from a recent viral syndrome before his pain started.

PHYSICAL EXAMINATION: Neck: no tenderness over C-spine and paracervical muscles, normal ROM, strength decreased in right C5 4+/5, negative Spurling’s. Right Shoulder: mild forward slumping, tenderness over bicipital groove. ROM normal except internal rotation (IR) at L1 (left IR T6), pain at end arc flexion and abduction, Neer’s/Hawkin’s test positive. Scapula rotation asymmetric, mild dyskinesia, right scapula mildly more protracted than left. Sensation decreased on ulnar/radial C6 and C8 distribution. Radial pulse symmetric. **DIFFERENTIAL DIAGNOSIS:** 1. Neuralgia amyotrophy/brachial neuropathy/brachial neuritis (Parsonage-Turner syndrome) 2. Dorsal scapular nerve entrapment 3. Rotator cuff syndrome 4. Quadrilateral space syndrome 5. Cervical spinal stenosis. **TEST AND RESULTS:** Cervical Spine Radiographs:— Normal. MRI Cervical Spine No Contrast:— Degenerative changes, mild-moderate right neural foraminal narrowing at C3-C4 without spinal canal stenosis. Small central disc protrusion without stenosis at C6-C7. MRI Right Shoulder

No Contrast:— Mild supraspinatus and infraspinatus tendinosis, no tear. Edema

within teres minor without atrophy, possible denervation changes versus muscle strain. **FINAL/WORKING DIAGNOSIS:** Neuralgic amyotrophy. **TREATMENT AND OUTCOMES:** The patient had follow ups with sports medicine and orthopedics with gradual improvement with conservative therapy, including NSAIDs, steroids, rest and physical therapy. He tolerated more of his physical therapy exercises with nerve gliding, increasing range of motion and strengthening.

2411a Board #331 May. 28 3:00 PM - 4:30 PM Hand Injury

Marcin Jungiewicz, Kaleigh Suhs. *Advocate-Aurora Lutheran General Hospital, Park Ridge, IL.* (Sponsor: Mark Hutchinson, FACSM)
 Email: moi1791@gmail.com
 (No relevant relationships reported)

HISTORY: A 15 year old H.S. football quarterback sustained a right thumb injury while throwing a pass. His hand hit a defender's chest during follow through, jamming his thumb. He noted swelling and bruising over thenar eminence and his 2nd MCP joint. This resulted in limited ROM of the right thumb especially of abduction and opposition. **PHYSICAL EXAMINATION:** Examination of the right hand showed edema along the 1st MCP joint, thenar eminence with ecchymosis in 1st webspace extending into 2nd MCP joint. Skin was intact. Thumb was well vascularized. No tenderness over 2nd metacarpal or 2nd MCP joint. Thumb opposition and 1st MCP flexion and extension less than 20° were limited by edema and pain, IP ROM was within functional limits. Tenderness over ulnar aspect of 1st MCP joint. Pain and tenderness present during MCP extension with mild laxity with UCL stressing. Laxity at the CMC joint with some dorsal subluxation, reducible. Tenderness proximal to trapezium. Contralateral side thumb revealed also some laxity at the CMC. **DIFFERENTIAL DIAGNOSIS:** 1. Fracture of the right 1st Metacarpal bone 2. Fracture of the right thumb proximal phalanx 3. Fracture of the wrist bones 4. Right 1st MCP joint UCL sprain **TEST AND RESULTS:** X-rays of the right hand 3V: No bony or soft tissue abnormalities. MRI right hand ordered to rule out occult fracture(s), ligament tears: 1. Nondisplaced fracture of the trapezium. Diffuse bone marrow contusion in the 1st metacarpal with small avulsion fragment of the radial metacarpal at RCL attachment 2. Bone contusion of the distal dorsal capitate 3. Moderate grade sprain of UCL and RCL at the thumb MCP joint with partial tearing of proximal RCL at the avulsion fragment. 4. Diffuse low grade muscle strain with superimposed partial musculotendinous tear of flexor pollicis brevis muscle. **TREATMENT AND OUTCOMES:** 1. Wrist and thumb immobilization in Custom thumb spica splint to enable graduated ROM as tolerated and Occupational Therapy 2. Restriction from all contact sports for 6 weeks 3. Consultation with Hand Orthopedist to evaluate for surgical necessity determined patient to be appropriate for conservative treatment. Patient seen in Sports Medicine Clinic 39 days after initial injury. Returned to sports after 6 weeks of immobilization with thumb/wrist taped. Patient denied pain with activity.

2411b Board #332 May. 28 3:00 PM - 4:30 PM Chronic Shoulder Pain Secondary To Trampoline Injury

Johnel Mayberry¹, Terry Nicola, FACSM¹, Kevin Machino².
¹University of Illinois at Chicago, Chicago, IL. ²Rush University, Chicago, IL. (Sponsor: Terry Nicola, FACSM)
 Email: jaymayberry15@gmail.com
 (No relevant relationships reported)

HISTORY: 14 year old female with right shoulder pain and arm paresthesias after trampolining injury 17 months prior to visit. Her right arm was yanked down and she heard a pop. Pain initially improved but recurred during basketball tryouts 6 months later. At presentation she noted right shoulder "spasm" pain rated 2/10 at rest and worsened to 5/10 with repetitive activities. Most bothersome symptoms were aching, tingling sensation on the medial aspect of her right arm radiating into the 3rd-5th digits with hand weakness. **PHYSICAL EXAMINATION:** Right first rib was elevated with tenderness. The right middle scalene was notable for spasm with tenderness. Right scapula winging noted. Positive right lift-off test. Weakness in the right abductor pollicis brevis, 3/5 on motor testing. No sensory or other strength deficits. Radiating symptoms reproduced with right shoulder mobility. Negative Neers, Hawkin's and speed's. Positive Roo's maneuver on the right at 15 seconds. Negative Adson's test bilaterally, Negative Tinel's test at the right elbow and wrist. Negative Spurling's and Lhermitte's. **DIFFERENTIAL DIAGNOSIS:** #1-Neurogenic thoracic outlet syndrome #2-Brachial plexopathy #3-Vascular thoracic outlet syndrome **TEST AND RESULTS:** MRI Right brachial plexus - No mass or focal abnormality along right brachial plexus. Diminutive appearance of right internal jugular vein of uncertain clinical significance. MRI of cervical spine - No evidence of neural compromise. Electrodiagnostic exam - There was a 25% decrease in the right median motor amplitude compared to the left. No side to side difference in ulnar nerve studies. The

scapular stabilizers were not evaluated. Vascular Doppler Evaluation - Dampened plethysmography waveforms in the right arm in the Adson maneuver when compared to the left. **FINAL/WORKING DIAGNOSIS:** Arterial thoracic outlet syndrome **TREATMENT AND OUTCOMES:** Dry-needling of the right anterior and middle scalene muscles were performed. Physical therapy was prescribed with focus on stretching the scalenes and pectoralis muscles. She is no longer having symptoms at rest and her strength is significantly improved. She continues to have right 3rd-5th digit paresthesias with prolonged activities despite focused physical therapy and is undergoing surgical evaluation.

D-75 Clinical Poster/Reception - Clinicians' Reception with Poster Presentations

Thursday, May 28, 2020, 6:00 PM - 7:00 PM
 Room: Hotel-Nob Hill

2412 Board #1 May 28 6:00 PM - 7:00 PM Influence Of Injury Severity And Recovery Environment On Physical Activity And Function Following Lower-limb Amputation

Peter Laddow (Sponsor: James Betts, FACSM)¹, Thomas E. Nightingale², M. Polly McGuigan³. ¹UK Ministry of Defence, Loughborough, United Kingdom. ²University of British Columbia, Vancouver, BC, Canada. ³University of Bath, Bath, United Kingdom.
 (No relevant relationships reported)

Restoration of physical function and physical activity (PA) is considered a vital therapeutic component in the short-term rehabilitation and long-term recovery of individuals with traumatic lower-limb amputation(s) (LLA). Unfortunately, evidence suggests an increased prevalence of physical inactivity and reduced functional status in this population. **PURPOSE:** To determine the impact of free-living environment (rehabilitation vs. home) on PA and function in UK military personnel following traumatic LLA, compared to active non-injured controls (CON). **METHODS:** Sixteen LLA (8 unilateral (UNI), 30±5yrs; 8 bilateral (BI), 29±3yrs), nearing the end of their clinical rehabilitation care pathway, attended one 4-week residential rehabilitation admission and one 6-week recovery block at home. Thirteen physically active, age-matched males (28±5yrs) represented CON. Estimated daily ambulatory PA energy expenditure (PAEE) was estimated from an accelerometer (Actigraph GT3X+), worn on the hip of the shortest residual limb in each environment, using validated population specific prediction algorithms. Six minute walk distance (6MWD) was recorded at baseline and 10 weeks (general population 6MWD norms is >459m). **RESULTS:** Whilst at home, mean PA counts.day⁻¹ reduced by 17% (p=0.018) and 42% (p=0.001) in the UNI and BI group, respectively. UNI group demonstrated a similar capacity for PAEE to CON, both of which were greater (P<0.05) than BI (Table 1). No significant changes in 6MWD were demonstrated within groups (P>0.05), however, significant differences (P<0.05) were demonstrated between all groups at baseline (UNI, 574±66m; BI, 337±85m, CON, 705±32m). **CONCLUSION:** UNI group demonstrate a similar capacity for PA and function to active non-injured CON. To support and manage the long-term health and well-being of more severely injured BI LLA, future research should investigate strategies that promote regular engagement in PAEE, particularly when they return home.

Estimated daily physical activity in all groups. Data presented as mean±SD and Δ mean							
	Unilateral Amputation (n=8)	Bilateral Amputation (n=8)	Control (n=13)				
	Rehabilitation	Home	ΔChange	Rehabilitation	Home	ΔChange	Work
Days (>14 hours)	5 ± 1	5 ± 1	0	6 ± 1	6 ± 1	0	5 ± 1
Wear Time (minutes)	918 ± 41	916 ± 55	-2	918 ± 45	904 ± 42	-14	934 ± 40
PA Counts.day ⁻¹	645084 ± 86078	534248 ± 90125	-110836	492569 ± 72750	283357 ± 91406	-209212	707632 ± 197909
PAEE (kcal.day ⁻¹)	839 ± 88	733 ± 87	-106	410 ± 68	217 ± 85	-194	948 ± 155

THURSDAY, MAY 28, 2020

2413 Board #2 May 28 6:00 PM - 7:00 PM

Does Immobilization Period Affects The Functional Outcomes After Bankart Repair?Irem Duzgun, Taha I. Yildiz, Gazi Huri, Dilara Kara, Ceyda Sevinc, Egemen Turhan, Serdar Demirci, Leyla Eraslan, Elif Turgut, Ozgur A. Atay. *Institution of Health Sciences, Ankara, Turkey.**(No relevant relationships reported)*

There is no consensus about the absolute immobilization time period and whether the rehabilitation should start in the first or in the third week after Bankart Repair.

PURPOSE: The aim of this study was to compare the clinical outcomes of 1 and 3 weeks of absolute immobilization time after the surgery and evaluate their effects on recurrent instability. **METHOD:** Forty-two patients with arthroscopic Bankart surgery were included to the study. Patients were randomly allocated into two groups. One week of absolute immobilization was performed to the patients in group-1 (n=21, age:24.7±7.1, BMI: 25.3±3 kg/cm²) and 3 weeks of absolute immobilization was performed to the patients in group-2 (n=21, age: 22.1±6.7 years, BMI: 24.8±2.8 kg/cm²). All of the patients come to the clinic once in a week and performed supervised exercise program and the rehabilitation program was progressed. They were also prescribed home exercise program. Shoulder ROM, pain level and shoulder function were assessed, according their groups at the first or third weeks, 4, 8 and 12 weeks of post-operative period. The pain level during resting, activity and at night was assessed with VAS. Shoulder ROM was assessed with standard goniometer and shoulder function was assessed using ASES questionnaire. At the average of 30. weeks after the surgery, it was questioned whether there was a re-dislocation. The demographics of the patients on both groups were analyzed with student t test. Two-way repeated measures ANOVA was used for the statistical analyses. **RESULTS:** There were no significant the "Group*time" interactions for pain at rest and activity and flexion, abduction, external rotation, internal rotation angles (p>0.05). The main effect of time was significant at rest and activity pain and all ROM measurements (p<0.05). There was a significant "Group*Time" interaction for pain at night (p<0.05). Pain at night was higher in the group-1 at post-operative 1 and 4. weeks compared to group-2. There were no statistically significant differences between the two groups in shoulder function at post-operative 12 weeks (p>0.05) and 30 weeks (p>0.05). One patient had re-dislocation in the group-2. **CONCLUSION:** One or three weeks of absolute post-operative immobilization period does not differ in terms of functional outcomes on patients with Bankart repair.

2414 Board #3 May 28 6:00 PM - 7:00 PM

The Effect Of Injuries And Pain On Athletic Identity Across NCAA DivisionsBryanna Veroneau (Sponsor: Stephen Bailey, FACSM)¹, Bailey Tadlock¹, Shefali Christopher¹, Srikant Vallabhajosula¹, Amy Knab², Chris Harnish³, Garrett Bullock⁴. *Elon University, Elon, NC. ²Queens University of Charlotte, Charlotte, NC. ³Mary Baldwin College, Staunton, VA. ⁴University of Oxford, Oxford, United Kingdom.**(No relevant relationships reported)*

There is a high prevalence of pain and injury in collegiate athletes, which can affect playing time and performance. Previous studies have observed that surgery and concussions can affect athletic identity. Currently, there is a paucity of research investigating how current pain and injury affect athletic identity.

Purpose: To determine how current collegiate athlete pain and injury affect athletic identity and how these relationships differ across NCAA divisions. **Methods:** NCAA division 1 (D1), 2 (D2), and 3 (D3) athletes were administered a questionnaire through an encrypted database. The Athletic Identity Questionnaire (AIM) and Oslo Sports Trauma Research Center Overuse Injury Questionnaire (OSTRC) were used within the survey. AIM estimates self-perceived athletic identity while OSTRC measures level of participation, training volume, performance, and pain. Athletes were further classified by OSTRC scores into overuse and substantial overuse injuries. Multivariable and logistic regressions assessed the relationship between Aim, OSTRC scores, and overuse injury. Models were adjusted for age, gender, NCAA division, history of orthopedic surgery, and history of major injury, with unadjusted and adjusted coefficients and Odds Ratios (OR) with 95% confidence intervals (95% CI). **Results:** 252 athletes (age of 19.4 years (1.2); female: 181, male: 70; D1: 101, D2: 74, D3: 77) participated. Mean AIM scores were D1: 37.98 (7.61), D2: 37.03 (37.03), and D3: 38.86 (6.98). The OSTRC median score was 0 (IQR: 0-22). 127 (50%) athletes had an overuse injury while 47 (19%) had a substantial overuse injury. Adjusted total OSTRC score was -0.67 (95% CI: -2.4, 1.1; p=0.474). Adjusted OR for OSTRC overuse injury was 1.00 (95% CI: 0.97, 1.04; p=0.589) and substantial overuse injury was 0.95 (95% CI: 0.91, 0.99; p=0.036). Similar results were observed between gender and division subgroups. **Conclusion:** After adjusting for confounding variables, it was determined that substantial overuse injuries negatively affected athletic identity, regardless of gender or NCAA division. Sports medicine professionals need to consider the

possibility of lost athletic identity when an athlete sustains an injury. Measures should be taken to ensure that athletes continue to have meaningful contribution to sport following pain or injury.

2415 Board #4 May 28 6:00 PM - 7:00 PM

Masters Athlete Screening Study: Four-Year Cardiovascular Disease and Event IncidenceBarb N. Morrison¹, Darren E. R. Warburton², Jack Taunton, FACSM². *¹SportsCardiologyBC, Vancouver, BC, Canada. ²University of British Columbia, Vancouver, BC, Canada.**(No relevant relationships reported)*

Background: Masters athletes (≥35 yrs) are not immune to elevated cardiovascular risk and cardiac events. In the first year of Masters Athlete Screening Study, 798 masters athletes were screened; 91 (11.4%) of the cohort were found to have cardiovascular disease (CVD). Coronary artery disease (CAD) was the most common diagnosis (7.9%).

Purpose: To evaluate the incidence of CVD and adverse cardiovascular events over four years of the screening study.

Methods: Masters athletes (≥35yrs) from a variety of sports without previous history of CAD underwent yearly cardiovascular screening for four years. The screen consisted of anthropometrics, resting blood pressure, resting electrocardiogram, modified American Heart Association 14-element recommendations, cardiovascular event questionnaire, physical examination (year one), and Framingham Risk Score. Participants with an abnormal screen according to the European Association of Cardiovascular Prevention and Canadian Cardiology Society Guidelines underwent further evaluations.

Results: During the following three years of study an additional 45 cases of CVD were detected, with an incidence rate of 1.9/100 (64.7±7.3yr; 79%M), 3.0/100 (65.1±7.3yr; 62%M), and 1.5/100 (65.0±5.8yr; 80%M), for years two, three, and four, respectively. Twelve participants had a new CVD diagnoses or progression of a diagnoses. The most common diagnoses over the three years was CAD (n=15; 33.3%) and atrial arrhythmias (n=14; 31.1%). An additional 9 participants were diagnosed CVD outside of the study (atrial fibrillation n=2; moderate CAD n=2; mild CAD n=4; genotype positive hypertrophic cardiomyopathy n=1). Five out of 798 (0.6%) participants had a myocardial infarction. A single CV death occurred. Three of the individuals who had a cardiac event demonstrated a negative exercise treadmill test (ETT) (mean time 15±2.9 min) and three had a positive ETT (mean time 12±1.2 min); two of which initiated cholesterol-lowering medication after confirmation of CAD via CCTA, and one declined medication after a negative MIBI.

Conclusion: Yearly cardiovascular screening of masters athletes identified ~2 new diagnoses per 100 athletes per year (primarily CAD and atrial fibrillation). Despite yearly cardiovascular screening and high fitness, myocardial infarctions still occur.

2416 Board #5 May 28 6:00 PM - 7:00 PM

Sex Differences In Patient Reported Outcomes 6 Months Following Acl ReconstructionEmily Kidwell, Cale Jacobs, Mary Lloyd Ireland, FACSM, Darren Johnson, Brian Noehren, FACSM. *University of Kentucky, Lexington, KY.**(No relevant relationships reported)*

Evidence indicating the important role psychological factors contribute to patient reported outcome (PROs) post anterior cruciate ligament reconstruction (ACLR) has been growing over the last decade. However, it is unclear whether sex-specific differences in psychological profile exist in ACLR recovery. Determining the potential psychological differences between sexes has important implications on the development of targeted intervention strategies post ACLR. **PURPOSE:** To determine whether sex differences in PROs exist at six months following ACLR.

METHODS: Forty-one subjects (23 F, BMI 24.0 ± 3.5, Age 19.2 ± 5.9, Tegner 8.8 ± 1.2) six months post ACLR completed PRO questionnaires. Subjects were administered the ACL-Return to Sport after Injury Scale (ACL-RSI), the Knee Self-Efficacy Scale (K-SES), and the Psychological Readiness to Return to Sport Scale (I-PRRS). Independent samples t-tests were used to compare PRO responses between males and females.

RESULTS: No significant differences were observed between male and female demographic information (p > 0.05). Significant differences were observed between male and female responses. Males reported higher scores on the ACL-RSI (M: 7.63 ± 1.43, F: 5.46 ± 2.17; p = 0.004, Cohen's d = 1.21), K-SES8 (M: 8.88 ± 0.85, F: 7.53 ± 2.11; p = 0.001, Cohen's d = 0.88), and I-PRRS (M: 51.58 ± 6.22, F: 36.17 ± 13.37; p < 0.001, Cohen's d = 1.54) when compared to females.

CONCLUSIONS: These results show that, six months following ACLR, males have significantly higher knee-function self-efficacy, as assessed by K-SES. I-PRRS and ACL-RSI responses show that males are more psychologically ready to resume sports participation. These results show a discrepancy between male and female psychological response following ACLR, which should be a consideration for re-injury risk. While most patients are cleared to return to activity six to nine months

post ACLR, there is a lack of consideration for patient's psychological readiness at the time, for both sexes. If females are returning to sports before being psychologically ready, they are likely to be hesitant and less confident in game situations, contributing to injury risk. Future work is needed to determine if psychologically-focused rehabilitation programs are needed to potentially reverse the reported sex differences.

2417 Board #6 May 28 6:00 PM - 7:00 PM
Diarrhea (Infectious Disease)-Swimming And Diving

Jordan P. Hilgefert, Christina Murphy, Amy Miller, Keri Denay, FACSM. *University of Michigan, Ann Arbor, MI.*
 (No relevant relationships reported)

History: 19-year-old men's collegiate swimming athlete with PMH of anxiety & major depressive disorder presented with 3-days of nausea, vomiting & diarrhea. He reported several teammates with similar symptoms. He returned for reassessment 1 week following initial evaluation endorsing 2 days of symptom improvement followed by return of several episodes of emesis, diarrhea & fatigue.

Physical Examination:

General: Well-developed, Well-nourished, NAD

HEENT:

-Head: NC, AT

-Eyes: conjunctiva clear, EOMI, PERLL, no discharge

-Ears: hearing normal on gross assessment, TMs normal

-Nose: nares clear, no deformity

-Throat: MMM, no erythema or exudate

NECK: normal ROM, no lymphadenopathy

PULM/CHEST: CTAB, no wheezes, rales or rhonchi

CV: RRR, no MRG. CR < 2 sec

ABD: BS+, soft, non-tender, non-distended, no organomegaly

SKIN: no visualized rashes or skin lesions, skin is warm and dry

PSYCH: appropriate mood and affect

Differential Diagnosis:

- 1) Viral gastroenteritis
- 2) Bacterial gastroenteritis
- 3) Parasitic infection
- 4) Irritable bowel syndrome
- 5) Anxiety

Tests and Results: Initial CBC, BMP and TSH were remarkable only for mild thrombocytosis (447 K/mm³) and hypoglycemia (63 mg/dL). After incomplete resolution of symptoms, GI PCR panel was obtained and found to be positive for cryptosporidium.

Final Diagnosis: Cryptosporidiosis

Treatment and Outcomes:

- 1) He was treated with Nitazoxanide 500 mg PO BID x 3 days and held out of the pool for 2 weeks.
- 2) Athletes with exposure to university pools presenting with diarrhea were tested for cryptosporidium via PCR. 6 were positive and all were held out of the pool for 2 weeks.
- 3) The public health department and environmental health experts were consulted to assist with management.
- 4) Administrators from every university and local swimming clubs who shared a common pool with our athletes were notified of potential exposure to cryptosporidium. One head-to-head swimming meet was cancelled in an effort to limit potential exposure.
- 5) University pools were shut down and treated twice with a high-concentration chlorine.
- 6) Water samples were collected serially before and after treatment cycles to ensure eradication prior to re-opening the pools.

2418 Board #7 May 28 6:00 PM - 7:00 PM
Rare Case Of Avascular Necrosis In A Dodgeball Player

Steven Liu¹, Alpha Anders², Kenneth Vitale, FACSM². ¹*Eastern Virginia Medical School, Norfolk, VA.* ²*UCSD School of Medicine, San Diego, CA.*
 (No relevant relationships reported)

History:

A 27-year-old male presented with left anteromedial hip/groin pain for 2 weeks. He competes in a dodgeball league and plays occasional racquetball as well. After a dodgeball game, he noted onset of hip and groin pain, which became progressively severe, and went to a local Emergency Department. He had x-rays and were told they were normal, however he had significant pain even with weightbearing at this point. No past history of hip dysplasia, dislocation, hip surgery.

Physical Examination:

Hip flexion was 110°, internal rotation 20°, external rotation 60°, abduction 45°; significant pain with flexion, adduction, and internal rotation, and positive FABER. He was able to ambulate without assistance.

Differential Diagnosis:

- Labral tear
- Femoroacetabular impingement
- Femoral neck stress fracture
- Loose body
- Chondral defect
- Athletic pubalgia

Tests and results:

X-rays were obtained and suggested minimal left femoral head collapse, and did suggest mild right femoral head sclerosis; an MRI showed large areas of grade 2 avascular necrosis bilaterally. The left had a joint effusion, edema in addition to necrotic fatty signal in the femoral head compatible with early collapse.

Final/Working Diagnosis:

Bilateral hip avascular necrosis with early left collapse.

Treatment/Outcome:

- Internal Medicine and Rheumatology referral for serological work up.
- Referred to Orthopedic Surgeon; recommended toe-touch weightbearing, counseled on risk of progression. Alendronate was considered as with precollapse Ficat stages 0-II.
- At 8 months, left hip pain was progressing, and noted onset of right hip pain. X-rays showed visible left AVN on the entire weightbearing surface with collapse and flattening of the superior articular surface; right hip now showed subtle sclerosis.
- His only pertinent history included a brief course of oral corticosteroids when he got his wisdom teeth removed, which he did not initially disclose. This case reports an unusual etiology of an avascular necrosis after taking a short-term dose of corticosteroids. Case raises awareness to counsel health providers about collaborating to provide patients with optimal care and avoid potential serious side effects.

2419 Board #8 May 28 6:00 PM - 7:00 PM

Bilateral Hip Pain - Soccer Player

Samantha Lucrezia (Sponsor: Dilipkumar R. Patel, FACSM), Danielle Hirsch, Patrick Mularoni. *Johns Hopkins All Children's Hospital, St. Petersburg, FL.*
 (No relevant relationships reported)

History: A 16-year-old Asian male presented with 2 weeks of worsening groin pain. Pain began after a difficult soccer practice, without a specific inciting injury. Patient was evaluated by team's athletic trainer and was referred to orthopedic surgery where x-rays were negative. One week later, patient presented to local pediatric emergency center with intermittent fevers, worsening pain and inability to ambulate. He denied any recent travel outside the US or new exposures.

Physical Exam: afebrile in no acute distress with tenderness to palpation over paraspinal muscles, costovertebral processes L3-L4 and quadriceps musculature. Patient walked with antalgic gait and found to have 2/5 strength hip flexion bilaterally with 5/5 strength in all other muscle groups. Cardiac, pulmonary and abdominal exam were unremarkable. There was no lymphadenopathy present on exam.

Differential Diagnosis:

1. Ankylosing Spondylitis
2. Iliopsoas Abscess
3. Epidural abscess
4. Osteomyelitis
5. Malignancy

Test and Results:

- ESR: elevated at 94 mm/hr, CRP: elevated at 4.57 mg/dL
- CBC: mild normocytic anemia without leukocytosis or thrombocytopenia
- CK, CMP, Uric Acid, LDH within normal limits
- Blood culture: negative
- Rheumatologic studies: ANA, adolase, ANCA were negative
- Testicular US: negative

-MRI of lumbar spine and pelvis: signal enhancement within the bones of pubis symphysis with significant surrounding soft tissue edema
 -Bone biopsy: focally degenerated bone, mixed chronic inflammation, fibrosis with reactive changes. No microorganisms present on special stains

- Bone aerobic/anaerobic cultures: negative
- Quantiferon gold: POSITIVE, mycobacterium sputum PCR: POSITIVE
- Chest x-ray: negative

Final/Working Diagnosis:

Tuberculosis osteomyelitis of the pelvis

Treatment and Outcomes:

1. Treatment with ethambutol, isoniazid, pyrazinamide, and rifampin daily until cleared by infectious disease
2. Close follow up with Infectious disease clinic with monitoring labs every 2 weeks
3. Indomethacin PRN for pain
4. Range of motion and strengthening exercises for bilateral hip flexors with physical therapy
5. Regular follow up with local department of health

2420 Board #9 May 28 6:00 PM - 7:00 PM

Head Injury - Soccer

Mark Sederberg (Sponsor: Stanley Herring, FACSM), Melinda Loveless. *University of Washington, Seattle, WA.*
(No relevant relationships reported)

HISTORY:

A 16 year-old male presented to an outpatient sports medicine clinic one month after a head-to-head collision during a soccer match with concern for concussion. There was no loss of consciousness, and he continued to play the rest of the game with a mild headache. He felt normal and asymptomatic that evening and was able to complete homework. The following morning he felt tired, but was able to perform adequately at school. Over the coming weeks, he noticed progressive worsening of his cognitive symptoms and tiredness. His athletic trainer became concerned for a concussion and held him from practice. One week prior to presentation he noted midline lower lip numbness, teeth pain while chewing, hearing his pulse in his left ear, and poor sleep due to sweatiness. He also felt progressive lethargy and difficulty concentrating and missed the last three days of school due to these symptoms. His medical history was significant only for a recently diagnosed inguinal hernia.

PHYSICAL EXAMINATION:

Mild cognitive deficits in attention and memory, impaired balance on BESS, normal motor strength. Cranial nerve exam showed ptosis of the left eye, mild left facial nerve palsy, decreased hearing in the left ear, and altered sensation to light touch over the middle lower lip. There was no focal tenderness or deformity of the skull or scalp.

DIFFERENTIAL DIAGNOSIS:

Mild traumatic brain injury

Intracranial hemorrhage

Cerebral mass

Bell's palsy

TESTS AND RESULTS:

MRI Brain with and without contrast: Asymmetric enhancement of the left 7th cranial nerve, asymmetric nodular enhancement along the left 5th nerve with enhancement of muscles of mastication, diffuse bilateral pachymeningeal enhancement.

Complete Blood Count: WBC 19k, platelets 80, hematocrit 30.4

CT Chest, Abdomen, Pelvis: Large abdominal soft-tissue mass herniating through the inguinal canal, most consistent with a lymphoma

CSF Cytology: Enlarged B-cells most consistent with Burkitt lymphoma.

FINAL DIAGNOSIS:

Stage IV Burkitt lymphoma, with primary lesion in abdomen, and perimeningeal spread, causing cranial nerve V and VII palsies.

TREATMENT AND OUTCOMES:

1. Admitted for prompt initiation of chemotherapy.
2. Cranial nerve symptoms resolved with chemotherapy and steroids.
3. After multiple rounds of chemotherapy, there is no evidence of residual lymphoma.

2421 Board #10 May. 28 6:00 PM - 7:00 PM

Do Different Wet Bulb Globe Temperature Reading Cutoffs Change Outdoor Heat Injury Frequency And Severity?

Christina S. Gutta (Sponsor: Dr. Franklin Sease, FACSM)¹, Ellen E. Shanley², Vicki R. Nelson¹. ¹*Prisma Health, Greenville, SC.*
²*ATI Physical Therapy, Greenville, SC.*
(No relevant relationships reported)

PURPOSE: To evaluate differences in injury frequency and severity between two different heat participation policies in South Carolina high school and collegiate athletics.

METHODS: Retrospective cohort study of Division II collegiate & high school athletes looking at injury frequency & severity between 2 different heat participation policies. Fifty middle & high schools as well as 2 Division II colleges with a total of 16,832 athletes were investigated over 3 years. Inclusion criteria were reported heat illnesses between July 1 & November 30th for 12 outdoor sports resulting in 86 injuries that were analyzed. Chi square analysis was used to compare injury frequency & severity between no outdoor workouts with a wet bulb globe temperature (WBGT) > 90 (policy 1) versus WBGT > 92 (policy 2).

RESULTS: For policy 1 there was a mean of 31 heat illnesses/year with an average of 16 days for illness resolution. For policy 2 there was a mean of 24 heat illnesses/year but the average of 41 days for illness resolution was significantly higher (p=0.02). Grading heat illness severity was based on guidelines developed by Rauh et al. Mild to moderate injury was defined as 0-21 days for return to activity while severe injury >21 days for return to activity. With policy 1, 4.8% of heat illnesses met severe criteria while 20.8% of heat illnesses in policy 2 were severe showing an odds ratio of heat illness with policy 2 is 5.2 times higher than policy 1 (OR 5.2, 95% CI 1.1-23.7). Conversely the percentage of mild to moderate illness was statistically lower with policy 2 compared to policy 1 (p=0.022) suggesting that policy 2 resulted in more severe heat illness. Policy 1 was in place for several years with no record of EMS transport for heat illnesses however within the first season of policy 2, there

was 3 athletes transported. The average age at time of injury was 16 years old & not statistically different between policies. There was an average of 45 minutes of practice per week lost with the WBGT cutoff of 90 compared to cutoff of 92.

CONCLUSIONS: Although the total number of heat illnesses did not change between policies, there was a statistically significant increase in severity of illness & time for return to sport with raising the WBGT participation cutoff from 90 to 92. Our data suggests that a cutoff of 90 reduces the frequency of severe heat illness in athletes.

2422 Board #11 May 28 6:00 PM - 7:00 PM

International Clinical Scholar Award - Results From The Fifa Sudden Death In Football Registry (FIFA-SDR) — Sport-specific Data Of 5 Years

Florian Egger¹, Jürgen Scharhag, FACSM², Andreas Kästner³, Jiri Dvorak⁴, Philipp Bohm⁵, Tim Meyer, FACSM¹. ¹*Saarland University, Saarbrücken, Germany.* ²*University of Vienna, Vienna, Austria.* ³*University Heart Center Freiburg, Bad Krozingen, Germany.* ⁴*Schulthess Clinic, Zurich, Switzerland.* ⁵*University Heart Center of Zurich, Zurich, Switzerland.*
(No relevant relationships reported)

PURPOSE: Large population-based studies about sudden cardiac deaths (SCD) and survived sudden cardiac arrests (SCA) in athletes from the USA and Europe indicate regional differences in the underlying causes. A different ethnic and genetic mix between these regions may lead to such a heterogeneous distribution. It is of great relevance to investigate these regional patterns to possibly optimize existing screening and prevention procedures and reduce fatalities. This registry aims to investigate SCD and SCA in football (soccer) players worldwide, both at professional and recreational level.

METHODS: From 2014 to 2018 cases of SCDs and SCAs were mainly recorded by media monitoring (Meltwater®), a confidential web-based data platform and data synchronization with existing national SCD registries (n=16). Inclusion criteria were met when SCD or SCA occurred during football-specific activity or up to one hour afterwards. Death during other activities was excluded.

RESULTS: A total of 632 players (mean age 34 ± 16 years, 96% males) was reported from 70 countries; 150 players (24%) survived. Elite players represented a small portion (6%). A diagnosis by autopsy or definite medical reports could be established in 219 cases (35%). The leading causes over the age of 35 years were coronary artery disease (CAD, 74%) and ≤35 years sudden unexplained death (22%), cardiomyopathy (CM, 17%) and CAD (11%). Hypertrophic CM and coronary artery anomalies showed the highest fraction in North America with 15% and 36%, respectively. Myocarditis was most frequently reported from Europe (7%). CAD ≤ 35 years prevailed in Africa (38%) and CM (42%) in South America. Commotio cordis occurred infrequently (3%). In North America and Australia survival rates were the highest (53% and 47%, respectively). Early use of an automated external defibrillator was associated with a higher survival rate (86%) compared to manual cardiopulmonary resuscitation (35%). **CONCLUSIONS:** Differences between countries in the underlying cardiac diseases for SCA and SCD have to be taken into account to possibly improve and modify primary and secondary prevention measures in football players. The percentage of autopsied cases is difficult to increase because this reflects the law in most countries. Therefore, an expansion of national SCD registries is urgently needed.

2423 Board #12 May. 28 6:00 PM - 7:00 PM

Lisa S. Krivickas Clinician/Scholar Travel Award: The Diagnostic And Prognostic Utility Of Dual-task Tandem Gait For Pediatric Concussion

Katie A. Van Deventer, Corrine N. Seehusen, Gregory A. Walker, Julie C. Wilson. *Children's Hospital Colorado, Aurora, CO.*
(No relevant relationships reported)

Background: Tandem gait performance is part of the Sports Concussion Assessment Tool (SCAT), but its diagnostic and prognostic value has not been fully assessed in pediatric concussion. **Purpose:** To determine the diagnostic and prognostic value of single-task and dual-task tandem gait by comparing performance of subjects with concussion relative to controls, as well as subjects who developed Persistent Post Concussion Symptoms (PPCS) and those who did not (No PPCS). **Methods:** Subjects seen within 21 days of concussion and uninjured controls completed a single/dual-task tandem gait test battery and modified Balance Error Scoring System (mBESS) test. During the tandem gait test, subjects walked in a heel-toe manner along a 3m strip of fabric down and back as fast as possible. During dual-task trials, they completed a concurrent cognitive task. Outcomes included tandem gait time to completion, cognitive accuracy, and mBESS errors. Subjects with concussion were followed until symptom resolution and sub-grouped into those who developed PPCS (>28 d time to symptom resolution) vs. No PPCS. **Results:** We evaluated 29 subjects with concussion who developed PPCS (mean age=15±2 years; 62% female; tested 12±6 days post-injury), 58 subjects with concussion who did not develop PPCS (mean age=14±3 years; 36% female; tested 8±5 days post-injury), and 58 controls (mean age= 16±1 years; 42% female). Subjects with concussion performed significantly worse than

healthy controls on single-task tandem gait (24.4 ± 12.6 vs. 14.9 ± 3.6 s; $p < 0.001$; area under curve [AUC]=0.85), dual-task tandem gait (33.3 ± 14.9 vs. 20.6 ± 7.1 s; $p < 0.001$; AUC=0.84), dual-task cognitive accuracy (82.1 ± 12.5 vs. 89.1 ± 18.9 %; $p = 0.01$; AUC=0.61), and mBESS (6.5 ± 4.9 vs. 3.8 ± 3.4 errors; $p = 0.001$; AUC=0.68). The PPCS sub-group performed dual-task tandem gait significantly slower than the No PPCS group (38.8 ± 17.7 vs. 30.6 ± 12.7 s; $p = 0.016$; odds ratio=1.04), but PPCS and No PPCS groups were not significantly different on other measures. **Conclusions:** Pediatric patients with concussion have impaired performance on balance and gait measures compared to healthy controls. Dual-task tandem gait test specifically showed diagnostic value for pediatric concussion and prognostic value in differentiating subjects who developed PPCS compared to those who did not.

E-06 Thematic Poster - Buffers

Friday, May 29, 2020, 9:30 AM - 11:30 AM
Room: CC-2000

2445 **Chair:** Bryan Saunders. *University of Sao Paulo, Sao Paulo, Brazil.*
(No relevant relationships reported)

2446 Board #1 May 29 9:30 AM - 11:30 AM
The Efficacy Of Topical Sodium Bicarbonate Application On Blood Buffering Capacity And Exercise Tolerance

Rebecca L. Cross¹, Alannah McKay², Peter Peeling², Martyn Binnie³, Paul Goods², Marc Sim⁴, Jason Siegler, FACSM¹.
¹Western Sydney University, Penrith, Australia. ²University of Western Australia, Crawley, Australia. ³Western Australian Institute of Sport, Mt Claremont, Australia. ⁴Edith Cowan University, Western Australia, Australia. (Sponsor: Jason Siegler, FACSM)
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Reported Relationships: **R.L. Cross:** Industry contracted research; AMP Human.

The ingestion of sodium bicarbonate (NaHCO₃) to improve short duration, high intensity exercise performance is widely practiced in elite athletics, rowing and track cycling. However, gastrointestinal (GI) distress is a common side-effect of NaHCO₃ supplementation which has been suggested to mitigate the performance-enhancing potential of NaHCO₃ supplementation. With this in mind, a method of NaHCO₃ administration that bypasses the GI tract may be a favourable alternative to oral supplementation. **PURPOSE:** The purpose of this study was to compare the blood buffering profile and exercise responses between a commercially available topical NaHCO₃ lotion and a typical, orally ingested amount (0.3 g/kg body weight (BW) NaHCO₃). **METHODS:** 10 recreationally active participants completed two experimental trials (randomised and counterbalanced); oral NaHCO₃ (0.3g/kg BW + placebo lotion) or topical NaHCO₃ lotion (0.9036 g/kg BW + oral placebo) applied or ingested 90 min prior to a cycling task to exhaustion (repeat 30 s cycling efforts at 120% peak power output with 30 s rest). Capillary blood was collected and analysed for pH, bicarbonate (HCO₃⁻) and lactate every 10 min throughout the 90 min loading period and post-exercise at 5, 10 and 15 min. **RESULTS:** pH and [HCO₃⁻] were significantly elevated from baseline after 10 min in the oral NaHCO₃ condition and throughout recovery compared to the topical lotion ($p < 0.001$). No differences in cycling performance (e.g. cumulative time) were observed between the oral NaHCO₃ condition (363±80s) and topical NaHCO₃ lotion condition (349 ± 119 s; $p = 0.697$). **CONCLUSION:** Topical NaHCO₃ lotion (0.9036 g/kg BW) did not significantly increase blood buffering capacity, suggesting that concentrations used in the present study have limited transdermal absorption capacity into the wider circulation.

2447 Board #2 May 29 9:30 AM - 11:30 AM
Effects Of Chronic Bicarbonate Supplementation On Kicking Performance In Highly Trained Taekwondo Athletes

Gloria Velasquez¹, Oscar Cajbon², Manuel Alvarez², Tanuj Wadhi³, Luis del Valle¹. ¹Confederación Deportiva Autónoma de Guatemala, CDAG/Comité Olímpico Guatemalteco, COG, Guatemala, Guatemala. ²Federación Nacional de Taekwondo de Guatemala, Guatemala, Guatemala. ³University of Tampa, Tampa, FL.
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(No relevant relationships reported)

It has previously been observed that a competitive full-contact Taekwondo combat simulation produced progressively increasing blood lactate concentrations up to 12.3 mmol·L⁻¹ by the third round, resulting in an increment of hydrogen ions (H⁺) which causes fatigue and performance impairment. Chronic bicarbonate (BI) ingestion has been shown to act as an extracellular buffer agent of H⁺, improving performance during intense exercise. **PURPOSE:** Determine the effect of chronic BI supplementation on kicking performance in highly trained athletes during a taekwondo intermittent kick field test (TIKT). **METHODS:** A single-blinded, randomized, crossover study was conducted over 6 weeks on 14 athletes from the Guatemalan national taekwondo team (ages: 17.2±3 yrs). Athletes performed TIKT in pairs, with heart rate monitors and electronic chest protectors. During TIKT, athletes strived for the maximal number of kicks (NK), alternating with their partner for 10s, interspersed with 10s of active

recovery, all during 4 rounds of 2 min x 1 min of rest. Five days before the trials, athletes took 0.3g/kg of either BI or placebo (PL) (maltodextrin + NaCl) divided in 3 doses taken 90, 60 and 30 min before a training session and before TIKT. **RESULTS:** For kicking performance, there was a significant main condition effect ($p \leq 0.05$) in which BI increased NK compared to control (CL) (estimated differences (ED): 16.1). The same was true for the theoretical score, BI vs CL (ED: 32). Although there was a greater NK with BI, there were no significant differences ($p \geq 0.05$) between BI vs PL (ED: 7.5). There was a main condition effect ($p \leq 0.05$) in which BI and PL produced lower mean heart rate compared to CL (BI, ED: 10.9 and PL, ED: 9.8). Post TIKT lactate values were similar ($p \geq 0.05$) in both BI and PL. There were no significant differences between groups ($p \geq 0.05$) in kicking effectiveness (combat score divided by theoretical score times 100). **CONCLUSION:** Our data indicate that kicking performance was enhanced in highly trained taekwondo athletes when chronically supplementing BI by increasing number of kicks but not effectiveness during a TIKT. Furthermore, from a practical point, while not significant, the improvement in other variables with BI (especially the combat score), could potentially be the difference between standing on the podium or not.

2448 Board #3 May 29 9:30 AM - 11:30 AM
Changes In Cognition During A 24-h Simulated Military Operation. Role Of Classical Monocytes And Beta-alanine.

Adam J. Wells¹, Alyssa N. Varanoske¹, Nicholas A. Coker¹, Gregory J. Kozlowski¹, Yftach Gepner², Cheyanne L. Frosti¹, David Boffey¹, Idan Harat¹, Jay R. Hoffman, FACSM³.
¹University of Central Florida, Orlando, FL. ²Tel Aviv University, Tel Aviv, Israel. ³Ariel University, Ariel, Israel.
(Sponsor: Jay Hoffman, FACSM)
(No relevant relationships reported)

Cognitive dysfunction during sustained military operations (SUSOP's) may be related to the recruitment and infiltration of classical monocytes into the brain. Beta-alanine (BA) supplementation may attenuate cognitive dysfunction and improve resilience to stress exposure, which may be relevant during a SUSOP. **PURPOSE:** To examine the effect of BA on serum monocyte chemoattractant protein-1 (MCP1), C-C chemokine receptor 2 (CCR2), macrophage-1-antigen (CD11b) and cognition (COG), and to examine the relationships between these variables during a SUSOP. **METHODS:** Nineteen recreationally active men ingested 12g·day⁻¹ BA ($n = 10$) or placebo (PL; $n = 9$) for 14-days prior to completing a simulated 24-h SUSOP. MCP1 was assessed via multiplex assay. Classical monocyte CCR2 and CD11b expression were assessed via flow cytometry. Throughput (TP) scores were extracted from seven cognitive subtests administered via Automated Neuropsychological Assessment Metric (ANAM) software. The relative weight of each ANAM subtest was determined by dividing its outer weight by the standard deviation of all TP scores for that subtest. TP scores were multiplied by their relative weights, and the values summed to provide a value for COG. Assessments occurred at baseline (0H), 12-hours (12H), 18-hours (18H) and 24-hours (24H). A two-way mixed ANOVA was used to assess differences between BA and PL. The statistical significance of pathway (β) coefficients derived from partial least squares structural equation modeling were used to evaluate relationships between MCP1, CCR2, CD11b and COG. **RESULTS:** MCP1 was significantly greater at 12H, 18H and 24H relative to 0H ($p < 0.001$). CCR2 expression was significantly lower at 12H ($p = 0.031$), 18H and 24H ($p < 0.001$), while CD11b expression was significantly greater at 12H ($p = 0.039$) and 24H ($p = 0.003$) relative to 0H. COG was significantly lower at 18H and 24H compared to 0H and 12H ($p \leq 0.001$). No significant differences were noted between BA and PL for any variable ($p > 0.05$). MCP1 had a direct negative relationship with cognition ($\beta = -0.395, p = 0.002$). CCR2 and CD11b were not directly related to cognition ($p > 0.50$). **CONCLUSIONS:** Greater serum MCP1 concentrations were associated with increased cognitive dysfunction during the SUSOP. BA did not affect MCP1, CCR2, CD11b or COG compared to placebo.

2449 Board #4 May 29 9:30 AM - 11:30 AM
Effect Of Beta-alanine Supplementation On Transporters Gene Expression And Long Distance Runner Performance.

Gabriel S. Franco, Bruno A. F. de Oliveira, Flávia C. Ferreira, Natalia Y. Noronha, Ana Paula Pinto, Camila F. C. Brandao, Carla B. Nonino. *University of São Paulo, Ribeirão Preto, Brazil.*
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(No relevant relationships reported)

Purpose: To evaluate the effect of beta-alanine supplementation in carnitine transporters gene expression (*TauT* and *PATI*) and physical performance in athletes (long-distance runners). **Methods:** This double-blind randomized study enrolled sixteen males athletes (37 ± 8 years) divided into two groups: Placebo group (PLA), received starch (6 capsules/day) and Beta Alanine group (BA), received beta-alanine

(4.8 g per day fractionated into 6 capsules/day) for 4 weeks. Before intervention, anthropometry (weight and height), body composition (seven skinfold protocol), food intake (24-hour recall) and maximal treadmill test (Vo2Max) data were evaluated. Before and after intervention, the athletes were submitted to physical performance test (5-km race time trial), venous blood was collected for analysis of *TauT* and *PAT1* gene expression (*RT-qPCR*) and ear lobe capillary blood was collected for lactate and glucose analysis before (T_0) and post-test (T_1), three (T_3), five (T_5) and seven (T_7) minutes after the end of the test. Data are expressed as mean \pm standard deviation. Statistical analysis was performed using normality test (Shapiro-Wilk), t-tests (paired and independent), and repeated measures analysis of variance (ANOVA). Significance was accepted at p value lower than 0.05. **Results:** In the beginning of the study BA group presented higher body fat than PLA group (11.5 ± 2.8 vs. $8.7 \pm 2.2\%$, $p=0.04$). No differences in others parameters was observed. After supplementation, there was an increase in *PAT1* expression in BA group when compared to PLA group (1.17 ± 0.47 vs. 0.77 ± 0.18 , $p=0.04$). No changes were observed for *TauT* expression (0.68 ± 0.33 vs. 0.39 ± 0.17 , $p=0.08$). No statistical differences were found in performance 5km tests time in BA group (1107 ± 95 vs. 1093 ± 86 seconds) and PLA group (1128 ± 72 vs. 1123 ± 72 seconds). However, there was 14 seconds decrease in the BA group. There was an increase in lactate and blood glucose between T_0 and the other times in both groups. **Conclusion:** Beta-alanine supplementation for four weeks increases *PAT1* gene expression. No statistical significance in performance improvement in 5-km test performance was observed. However, the 14 seconds time improvement in performance, suggests that some competitive athletes could benefit from supplement intervention.

No relationships reported.

2450 Board #5 May 29 9:30 AM - 11:30 AM
Does Acute Beta-alanine Supplementation Improve Performance, Rating Of Perceived Exertion And Heart Rate During Hiking?

Bryson Carrier. *University of Nevada, Las Vegas, Las Vegas, NV.* (Sponsor: James Navalta, FACSM)
 (No relevant relationships reported)

Beta-Alanine (BA) is a common performance supplement and is thought to work by increasing the muscle buffering capacity by increasing carnosine levels, thereby decreasing muscle fatigue. The performance benefits of chronic BA supplementation has been well established while the acute effects are less resolved. It has been hypothesized that BA has a stimulatory effect, a common justification of its use in pre-workout supplements, though this has yet to be established in the published literature. **PURPOSE:** To determine if acute supplementation with BA improves performance, decreases ratings of perceived exertion, or stimulates the sympathetic nervous system during a short hike. **METHODS:** 11 subjects (2 female, 9 male, 26.18 ± 8.17 yrs [mean \pm stdev], 78.68 ± 11.95 kg, 176.18 ± 10.67 cm) participated in a double-blind crossover study, taking either a homogeneous solution of 6.4g BA and crystal light (placebo) or the placebo (PLA) in 8oz of water. After the solution was consumed, a 45-min interim was observed to ensure proper metabolism of the supplement. The participants then completed a 0.81 km (0.5 mile) hike on the Lightning Switch trail (Cedar City, UT, elevation gain = 66m, 217 ft) as fast as possible, without running. RPE and HR were recorded at the start and end of the hike, using the Borg 6-20 scale for RPE. The participants completed the alternate supplementation on the following day. A random number generator was utilized to assign which day participants would receive BA or the PLA. Data analysis was completed looking at performance under each supplement condition using a 2 tailed paired t-test for time and bottle. HR and RPE analysis was completed utilizing a 2x2 repeated measures ANOVA. Significance was accepted at an alpha of 0.05. **RESULTS:** There was no difference found in performance between supplement conditions (BA hiking time = 8.39 ± 1.34 , PLA Hiking Time = 8.58 ± 1.57 , $p=0.26$). For all dependent variables, no interaction was observed (HR $p=0.27$; RPE $p=0.63$; Time $p=0.26$). For HR and RPE, there was a main effect in regards to time (HR Pre = 80.73 ± 15.17 , HR Post = 150.86 ± 22.13 , $p<0.001$; RPE Pre = 6.68 ± 0.99 , RPE Post = 14.27 ± 1.98 , $p<0.001$); **CONCLUSION:** Changes in response variables (HR, RPE) are expected due to the exercise. Acute BA supplementation 45-min prior to hiking does not have an effect on performance, RPE or HR.

2451 Board #6 May 29 9:30 AM - 11:30 AM

Acute Beta-alanine Supplementation And Pain Perception Before And After Hiking

James W. Navalta, FACSM¹, Graham R. McGinnis¹, Jacob W. Manning², Robert W. Salatto¹, Bryson Carrier¹, Dustin W. Davis¹, Jacquelyn V.L. Sertic¹, Peyton C. Cater¹, Brenna Barrios¹, Elias M. Malek¹, Caitlin K. Reynolds¹, Mark DeBeliso, FACSM². ¹University of Nevada, Las Vegas, Las Vegas, NV. ²Southern Utah University, Cedar City, UT.
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Beta alanine (B-ALA) is a non-essential amino acid thought to increase muscle buffering capacity and decrease muscle fatigue. Supplementation with B-ALA is known to commonly cause paresthesia in some individuals, an unpleasant sensory symptom. It is unknown whether B-ALA supplementation affects pain perception in a natural environment or hiking performance. **PURPOSE:** The aim of this study was to determine if supplemented B-ALA affected participants' perceived pain before and after a bout of hiking. **METHODS:** Participants (N = 11) completed a double-blind crossover study. B-ALA (6.2 g) or placebo (PLA) was administered, followed by 45-min of seated immersion in nature. Participants completed the McGill Pain Questionnaire short form and then completed a 0.81 km (0.5 mile) hike on the Lightning Switch trail (Cedar City, UT) as fast as possible (elevation gain = 66m, 217 ft) before filling out the questionnaire again. Participants completed the alternate supplementation on a separate day. Data was analyzed using a 2 x 2 repeated measures ANOVA with significance accepted at $p<0.05$. **RESULTS:** No interaction was noted for total pain score (PLA pre = 0.6 ± 1.0 , post = 2.8 ± 3.0 ; B-ALA pre = 2.6 ± 3.1 , post = 3.2 ± 4.2 ; $p = 0.08$) or treatment main effect ($p = 0.07$). No interaction was present for the sensory component of pain (PLA pre = 0.4 ± 0.8 , post = 1.7 ± 2.0 ; B-ALA pre = 2.0 ± 2.1 , post = 2.2 ± 2.9 ; $p = 0.13$) but a main effect for treatment was observed ($p = 0.02$). Hiking performance was not different between treatment days (PLA = 8.4 ± 1.3 min, B-ALA = 8.6 ± 1.6 min, $p = 0.27$). **CONCLUSION:** While acute B-ALA increases the sensory perception of pain when administered in a natural environment, it does not affect hiking performance.

2452 Board #7 May 29 9:30 AM - 11:30 AM

Chronic Muscle Inactivity Does Not Affect Muscle Carnosine Loading Induced By Beta-Alanine Supplementation

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 (No relevant relationships reported)

PURPOSE: to study the impact of the extremes of muscle activity and inactivity on muscle carnosine content (M_{car}) and M_{car} loading in response to beta-alanine supplementation. **METHODS:** 16 trained male with spinal cord injury (SCI) (ASIA scale: AIS A or AIS B) were divided into 2 groups: beta-alanine (BA) (N = 11) and placebo (PL) (N = 5). Muscle biopsies samples were obtained from active deltoid and paralysed vastus lateralis at baseline and after 28 days of beta-alanine supplementation ($6.4 \text{ g} \cdot \text{day}^{-1}$). Unpaired t-tests were applied to compare M_{car} at baseline and the absolute pre-post change in vastus lateralis and deltoid. Mixed model was used to compare M_{car} values within- and between-subjects. **RESULTS:** (mean \pm SD): Baseline M_{car} concentration in vastus lateralis was significantly higher than in deltoid (32.0 ± 12 vs. $20.5 \pm 6.1 \text{ mmol} \cdot \text{kg}^{-1}$ dry muscle; $p=0.02$). Absolute changes in M_{car} was significantly higher in the BA group in comparison with PL for both vastus lateralis (BA: $17.6 \pm 10.4 \text{ mmol} \cdot \text{kg}^{-1}$ dry muscle; PL: $2.5 \pm 2.3 \text{ mmol} \cdot \text{kg}^{-1}$ dry muscle; $p=0.002$) and deltoid (BA: $15.7 \pm 6.8 \text{ mmol} \cdot \text{kg}^{-1}$ dry muscle; PL: $1.4 \pm 2.7 \text{ mmol} \cdot \text{kg}^{-1}$ dry muscle; $p<0.001$). Absolute changes in M_{car} following BA supplementation between inactive vastus lateralis and active deltoid was not different (vastus lateralis: 17.6 ± 10.4 ; deltoid: $15.7 \pm 6.8 \text{ mmol} \cdot \text{kg}^{-1}$ dry muscle; $p=0.6$). **CONCLUSION:** chronic muscle inactivity due to paralysis in SCI does not affect M_{car} at baseline and does not affect M_{car} loading in response to BA supplementation. These results suggest that muscle activity or training status does not influence M_{car} synthesis capacity in response to beta-alanine supplementation. Supported by CEPID-Redoxoma (São Paulo Research Foundation FAPESP: Proc. 2013/07937-8, and CAPES- PROEX 1888/2016), and FAPESP thematic grant (13/14746-4).

2453 Board #8 May 29 9:30 AM - 11:30 AM

The Efficacy Of Individualizing Sodium Bicarbonate Supplementation Strategies On Elite-level Rowing Performance

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A recent review has addressed a number of practical issues associated with traditional sodium bicarbonate (NaHCO₃) supplementation approaches, identifying ingestion timing as critical to maximising the potential of this ergogenic medium. Furthermore, contemporary empirical studies have also suggested that adjusting the start of exercise to commensurate with an individual's peak blood buffering response may result in better outcomes in terms of GI distress and exercise performance, however this concept has yet to be investigated in international level athletes. **PURPOSE:** The following study addressed the question of whether or not ingestion timing is critical to time-trial performance (2,000 m rowing time-trial) in elite-level rowers including Pan American, World Champion and Olympic team members) adhering to their own individualised pre-race strategies (e.g. nutrition, warm-up, etc.). **METHODS:** Twenty three (n = 23) elite rowers across two research centres (Canadian Sport Institute Pacific and the New South Wales Institute of Sport) completed three trials (one NaHCO₃ loading profile to determine the individual's time-to-peak blood buffering capacity followed by two randomized experimental trials (Consensus Standard (CON): 2,000 m rowing time trial (TT) performed 60 min post 0.3 g·kgBW⁻¹ NaHCO₃ ingestion; and Individualised Peak (IP): 2,000 m rowing TT performed at the rower's individual peak bicarbonate concentration [HCO₃⁻] (determined from the profiling trial) after ingesting 0.3 g·kgBW⁻¹ NaHCO₃)). **RESULTS:** Significant interaction effects and post hoc comparisons revealed differences between CON and IP at pre-warm up for HCO₃⁻ (mean difference of 2.9 ± 0.4 mmol·L⁻¹ (95% CI 2.0 to 3.8 mmol·L⁻¹); p = 0.02) but not at pre-TT. Performance times were significantly different between CON (369.0 ± 10.3 s) and IP (367 ± 10.5 s) (mean difference 1.5 ± 2.4 s (95% CI 0.5 to 2.6 s); p = 0.007), however given the effect size this difference was likely trivial. **CONCLUSIONS:** The findings of the present study do not support the recent claims that targeting the onset of exercise to commence with an individual's peak blood buffering capacity after NaHCO₃ supplementation is essential to maximise the ergogenicity of this supplement.

E-07 Thematic Poster - Microbiome and Immunity Across the Healthspan

Friday, May 29, 2020, 9:30 AM - 11:30 AM
 Room: CC-2011

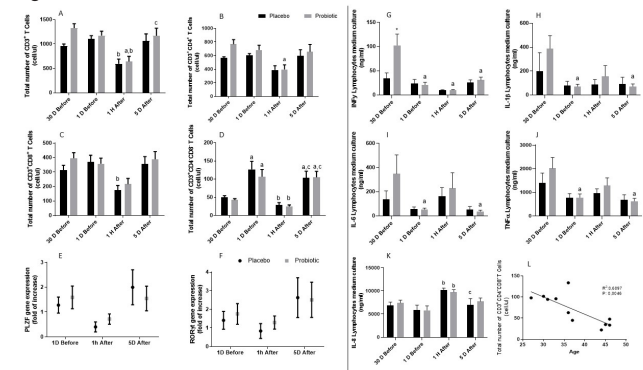
2454 **Chair:** Melody D. Phillips, FACSM. *Texas Christian University, Fort Worth, TX.*
 (No relevant relationships reported)

2455 Board #1 May 29 9:30 AM - 11:30 AM
Probiotic Supplementation In Marathonists: The Effects On T-cell Population

Helena A. Batatinha¹, Edgar Silva², Geovana Leite¹, Ayane Resende¹, Jose Antonio Albuquerque¹, Ronaldo Dos Santos², Antonio Lancha, jr¹, Fabio Lira³, Jose Rosa Neto¹. ¹The University of Sao Paulo, Sao Paulo, Brazil. ²The Federal University of Sao Paulo, Sao Paulo, Brazil. ³The University of the state of Sao Paulo, Sao Paulo, Brazil.
 (No relevant relationships reported)

High-intensity and volume exercise has been associated with decreased immune cells function enhancing viral infections susceptibility. Probiotic supplementation emerges as a strategy to treat metabolic and inflammatory diseases, playing an immune stimulatory role. **PROPOUSE:** We hypothesized that 30 days of probiotic supplementation could strengthen the immune system of marathonists. **METHODS:** 27 male marathonists were double-blind randomized in probiotic (*Bifidum Lactise* (10x10⁹) and *Lactobacillus Acidofilus* (10x10⁹) + 5g maltodextrin/ sachet) and placebo group (5g maltodextrin/ sachet) each athlete took 1 sachet/day for 30 days pre-race. Blood samples were collected 30 days before the race, 1 day before, 1 hour after and 5 days after.

Lymphocytes population were evaluated by immunophenotyping. **RESULTS:** CD3⁺ T cells decreased to both group 1h after and restored to probiotic group at 5 days after (Fig A). CD8⁺ T cells were significant decreased only to placebo group at 1h after (Fig C). CD3⁺CD4⁺CD8⁺ T cells were increased to both groups at 1 day before, decreased after the run and increased again at 5 days after (Fig D), they also presented a negative correlation with age (Fig L), which could be an indicative of MAIT cells. Promyelocytic leukemia zinc finger protein (PLZF) mRNA, the transcription factor higher expressed in MAIT cells, showed similar response as CD3⁺CD4⁺CD8⁺ T cells and RORγt mRNA followed the same pattern (Fig E and F). Probiotic group presented higher IFNγ, IL-1β, IL-6 and TNFα production, under PMA stimulation 30 days before, however it was not maintained among the other times. IL-8 increased to both groups at 1 hour and decreased only in placebo group at 5 days after (Fig G-K). Neither placebo nor probiotic group presented URTI and difference to symptoms incidence or severity. **CONCLUSION:** In conclusion probiotic supplementation have minor impact on lymphocytes, however the marathon race modulates an important class of double negative T cells.



2456 Board #2 May 29 9:30 AM - 11:30 AM

Mucosal-Associated Invariant T Cell Response To Acute Exercise In Overweight Older Women

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Mucosal Associated Invariant T (MAIT) cells have properties of both innate and adaptive immunity and are dysregulated in overweight/obese (OW) populations. MAIT cell proportion and number increase after acute exercise in healthy young men, but the effect of acute exercise on MAIT cells in OW women is unknown. **PURPOSE:** To investigate MAIT cell frequency and function after acute exercise, in OW, older women compared to lean controls. **METHODS:** Sedentary, OW women (n=15, 64 y ± 4, 32.9 kg/m² ± 3.69, 21.7 ml/kg/min ± 3.40) completed 25 min of walking at 70-80% heart rate reserve and 2 sets of 8 resistance training exercises. Immune cells were isolated at rest, 0h and 1h post exercise. Cells were stimulated with PMA/ionomycin. Cell frequency and intracellular cytokine expression were determined using flow cytometry. A reference group of lean women (n=8, 64y ± 7, 21.5 kg/m² ± 2.0, 29.8 (ml/kg/min) ± 5.06) provided a resting blood sample. **RESULTS:** Lymphocyte number increased at 0h by 44% ± 41 (p < 0.001) before returning to resting levels at 1h. Compared to lean women, OW women had greater MAIT cell counts (OW 97 ± 99 cells/uL, Lean 27 ± 18, p=0.048) but lower MAIT cell frequencies at baseline (OW 0.4% ± 0.9, Lean 4.1 ± 2.1%, p<0.001). TNFα expression in stimulated MAIT cells was also lower in OW women (OW 79% ± 16%, Lean 98% ± 5% p<0.001). Following acute exercise, there was no change in MAIT cell frequency or absolute number in OW women. TNFα expression increased by 14% ± 34% (p=0.006) at 0h in the OW group. There were no differences in IFNγ expression between groups or with acute exercise. **CONCLUSIONS:** Obesity appears to attenuate the MAIT cell function and increase counts in OW women. Lower baseline TNFα expression suggests these cells have a reduced capacity to respond to stimulation with greater resting MAIT counts potentially being a compensatory response. Acute exercise did not alter MAIT cell counts or frequencies. However, TNFα expression increased with acute exercise, suggesting that exercise may increase MAIT cell sensitivity to mitogenic stimulation. This temporary increase in cell functionality may offset some of the detrimental effects of obesity on MAIT cells but the long-term training effects still need to be determined.

FRIDAY, MAY 29, 2020

2457 Board #3 May 29 9:30 AM - 11:30 AM
Cellular Immune Response To Acute Endurance Vs. Resistance Exercise—A Randomized Crossover Study

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(No relevant relationships reported)

Exercise-induced alterations of circulating immune cells are well investigated in both healthy and clinical populations. In healthy individuals these alterations are mainly used to depict immunological recovery, while in clinical context the mobilization of immune cells is suspected to improve the course of various diseases (e.g. neoplastic diseases). Therefore, exercise might serve as add-on therapy to conventional therapeutic approaches. Since direct comparisons of the cellular immune response to different exercise types remain sparse, we compared two exercise sessions of clinical application in healthy subjects, to provide basic knowledge of potential differences. **PURPOSE:** To compare the cellular immune response to an acute bout of endurance exercise (EE) and resistance exercise (RE). **METHODS:** 24 healthy men conducted an acute EE (cycling at 60 % of peak power output) and RE session (5 exercises, 4 x 8-10 repetitions at 70 % of 1-repetition maximum) lasting 50 min on separate days. Blood was drawn before (t_0), after (t_1) and 1h after exercise cessation (t_2). Outcomes included counts of leukocytes (LEUK), neutrophils (NEUT), lymphocytes (LYM), LYM subsets (T, B, NK cells) as well as NK cell subsets (CD56^{dim}, CD56^{bright}). Baseline-adjusted ANCOVAs were performed. **RESULTS:** Compared to RE, values of EE were significantly higher at t_1 for LEUK (mean difference between groups (Δ_g) 1.53, $p \leq .001$), LYM (Δ_g 1.04, $p \leq .001$), NEUT (Δ_g 0.19, $p \leq .001$), T cells (Δ_g 0.49, $p \leq .001$), NK cells (Δ_g 0.45, $p \leq .001$), CD56^{dim} (Δ_g 0.4, $p \leq .001$) and CD56^{bright} (Δ_g 0.05, $p \leq .001$). Regarding LYM subsets, EE caused a significant increase from t_0 to t_1 in T cells (mean difference between time points (Δ_t) 0.59, $p \leq .001$) and B cells (Δ_t 0.05, $p = .001$), while NK cells increased after both, EE (Δ_t 0.58, $p \leq .001$) and RE (Δ_t 0.16, $p = .019$). **CONCLUSION:** An acute bout of EE is superior to RE in mobilizing immune cells. While the cellular immune response of T and B cells seems to be reserved to EE, RE does represent an appropriate stimulus for NK cell mobilization. Thereby, our results indicate that especially in neoplastic diseases where NK cell mobilization is crucial, RE might represent a suitable alternative to EE as potential add-on therapy to conventional therapeutic approaches. However, validation of our results in diseased populations is warranted.

2458 Board #4 May 29 9:30 AM - 11:30 AM
T-cell Response To Exercise Training Among Women At Heightened Risk Of Breast Cancer.

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Aging causes changes in the peripheral T-cell compartment that may increase susceptibility to cancer and lower immune responses. Fitness is associated with lower frequencies of highly differentiated T-cells, increased naïve T-cells, and elevations in myokines such as IL-7 that contribute to naïve T-cell output, indicating that exercise may help preserve immunity. **PURPOSE:** Examine the impact of exercise training on the differentiation status of CD4+ and CD8+ T-cells, recent thymic emigrants (RTE), and plasma levels of IL-7 in older women with an elevated risk of breast cancer (obesity status, postmenopausal, elevated Gail and/or lifetime risk score or history of non-invasive breast cancer).

METHODS: 44 women (VO_{2max} = 19.58±3.37 ml/kg/min) were randomized to: high-intensity interval training (HIIT; n=16; 63.73±6.86yrs); moderate continuous exercise (MCE; n=14; 64.62±12.21yrs); or control (CNT; n=14; 63.35±6.99yrs). Participants completed clinically supervised treadmill exercise 3x/week for 12 weeks using heart rate training. Naïve (NA), central memory (CM), effector memory (EM) and CD45RA+ effector memory (EMRA) CD4+ and CD8+ T-cells, and RTE (CD4NA or CD8NA CD31+CD103+) in blood were quantified before and after training. Fold changes (cells/ul) were calculated by (post-pre)/pre and compared across groups via ANOVA with $p < .05$ considered significant.

RESULTS: 11, 10, and 11 participants completed the HIIT, MCE, and CNT training, respectively. Compared to HIIT, MCE increased total lymphocytes (-0.05±0.13 vs. 0.12±0.12), CD4 (-0.29±0.24 vs. 0.21±0.30), CD4 CM (-0.23±0.20 vs. 0.36±0.27), CD4NA (-0.33±0.32 vs. 0.31±0.39), and CD8EM (-0.16±0.31 vs. 0.32±0.31). The change in number of CD4CM was higher in MCE compared to CNT (0.36±0.27 vs. -0.24±0.42). No changes were found for IL-7 or RTEs.

CONCLUSION: Immune responses to exercise training in women with an elevated risk of breast cancer are likely to vary depending on the intensity of exercise. Future research should focus on investigating the potential that exercise may have on T-cell phenotypes and their relation to breast cancer risk.

Funded by NCI R25 CA057730, the MD Anderson Cancer Center/Energy Balance Assessment Supplemental Funding, MD Anderson Cancer Center, Center for Energy Balance in Cancer Prevention and Survivorship, UA T32CA009213.

2459 Board #5 May 29 9:30 AM - 11:30 AM
Comparison Of The Gut Microbiota Composition Between Obese And Non-obese Young Children Using 16s Gene Sequencing

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(No relevant relationships reported)

PURPOSE: The gut microbiota regulates metabolic function and energy balance, and an altered microbial ecology contributes to the development of several metabolic diseases including obesity. To examine the association between obesity and the human gut microbiota composition in Japanese children, fecal concentrations of Bacteroidetes, Firmicutes, Actinobacteria, Proteobacteria and Firmicutes/Bacteroidetes ratio were analyzed in 42 young children.

METHODS: The subjects were 42 young children (6 obese, 36 non-obese) aged 4.5-6.5 years. Obesity was determined upon an obesity index score ((real weight - standard weight) / standard weight×100) of more than +15%. To extract enterobacterial DNA, 0.2 g of feces was used to crush cells, centrifuge several times, and collect precipitates to prepare a DNA solution. Next, RNAase treatment was performed on the DNA solution to prepare a PCR solution. Submit the amplified DNA to the next-generation sequencer team of the Faculty of Applied Biological Sciences, Gifu University, and perform metagenomic analysis using the Illumina MiSeq(TM)II system by quantitative RT-PCR targeting bacterial 16S rRNA. It was. The items to be detected were phylum classification, bifidobacteria, lactic acid bacteria, and F/B ratio. **RESULTS:** The fecal concentrations of Bacteroidetes, Firmicutes, Actinobacteria and Proteobacteria in 42 young children were 31.9±9.4%, 58.6±10.5%, 7.0±4.8% and 1.7±1.4%. The obtained data indicate that obese children have a significantly higher level of Firmicutes (Effects size=1.08) and lower level of Bacteroidetes (Effects size=1.13) compared to non-obese children ($p < .05$). The Firmicutes to Bacteroidetes ratio was higher in obese children compared with non-obese subjects ($p < .05$, Effects size=0.74). However, the gut microbiota diversity, bifidobacteria and lactic acid bacteria were not different between the obese and non-obese groups.

CONCLUSIONS: Gut microbial properties differ between obese and non-obese subjects in Japan, suggesting that gut microbiota composition is related to obesity.

2460 Board #6 May 29 9:30 AM - 11:30 AM
Exercise Preconditioning-induced Attenuation Of Acute Colitis Is Associated With Gut Microbiota Symbiosis In Wild Type Mice

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(No relevant relationships reported)

PURPOSE: To investigate the therapeutic effect of exercise preconditioning against acute colitis induced by high-fat diet (HF) plus mild dextran sulfate sodium (DSS) treatment in wild type mice.

METHODS: C57BL/6 male mice aged at 6 weeks were assigned to standard chow (SC, n=10) or HF (n=10) or HF plus DSS (HF+DSS, n=10) or exercise preconditioning (EX) with HF+DSS (EX+HF+DSS, n=10), and the mice were subjected to 15 weeks of dietary treatments, with 12 weeks of a moderate treadmill running (50 minutes per session and 5 days per week) and 2 cycles of 5-day DSS (2% w/v) administration included. Measured parameters included clinical symptoms of acute colitis, pro- and anti-inflammatory and chemotactic cytokines, gut barrier proteins, and immunity cells. Gut microbiota was explored by 16S ribosomal RNA amplification sequencing in fecal samples.

RESULTS: Chronic exposure to HF resulted in colitis symptoms (significant weight gain, enlargement of the spleen, and shortening of colon length) and histological changes in the colon, decreased gut barrier proteins (zonula occludens-1 and heat shock protein 70), infiltration of immunity cells (neutrophils and monocytes in the colon and blood), increased expression of toll-like receptor 4 in the colon, and increased pro-inflammatory and chemotactic cytokines (interleukin-6, growth-regulated oncogene- α , and monocyte chemoattractant protein-1) and decreased anti-inflammatory cytokine (adiponectin) in the colon and blood, and those pathologic

markers of acute colitis were exacerbated by DSS treatment. Exercise preconditioning alleviated the severity of HF+DSS-induced acute colitis and caused symbiotic modifications in gut microbiota, as shown by a lesser abundance of *Bacteroides vulgatus* ($p=0.050$) and a greater abundance of *Akkermansia muciniphila* ($p=0.050$). **CONCLUSIONS:** The current findings suggest that exercise preconditioning alleviates the severity of HF+DSS-induced colitis in conjunction with gut microbiota symbiosis in wild-type mice, implying a preventive/therapeutic potential of promotion of physical fitness via regular exercise against this experimentally-induced acute colitis. This study was supported by the National Research Foundation Grant funded by the Korean Government (NRF-2018R1D1A1B07048153 and 2019R111A1A01052817).

2461 Board #7 May 29 9:30 AM - 11:30 AM
Frequency And Mode Of Physical Activity Influence Gut Microbial Composition In Overweight And Obese Adults

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Chronic diseases are linked to adverse phylogenetic and functional alterations in the gut microbiota. Physical activity (PA) regimens may provide a low-cost and practical means to improve "gut health" in individuals at-risk of developing chronic disease. Endurance exercise has been shown to alter gut microbial composition in heavier sedentary individuals but it is not known how other PA modes impact the gut microbiota. It is hypothesized that PA mode and frequency may underlie differences in the gut microbiota in heavier adults.

PURPOSE: To examine the relationship between PA measures and gut microbial richness and evenness and composition in overweight and obese adults. **METHODS:** Adults ($n=38$), 28-55 years old with BMI 27-36 kg·m⁻² were asked about their frequency of aerobic, strength, and stretching exercise during one week. Participants were measured for their age-predicted $\dot{V}O_2$ max using a modified Bruce protocol on a treadmill. DNA was extracted from self-collected fecal samples for Illumina MiSeq amplicon sequencing of 16S rRNA V4. Sequencing reads were processed according to MOTHUR standard operating procedures, with operational taxonomic unit assignment at the 97% similarity threshold. General linear models were used to test effect of PA measures on alpha diversity indices. Distance-based redundancy analyses were used to evaluate community composition in relation to PA measures.

RESULTS: Shannon and Simpson indices did not differ by estimated $\dot{V}O_2$ max nor by PA frequency and mode ($p > 0.05$). Frequency and mode of PA explained more variability in the gut microbial community (11.6%) than estimated $\dot{V}O_2$ max (1.9%). Community patterns were not explained by estimated $\dot{V}O_2$ max ($p = 0.81$). However, PA frequency and mode did explain community patterns with the frequency of strength training during the week showing a greater impact ($p < 0.01$) than aerobic ($p = 0.66$) and stretching exercise ($p = 0.72$).

CONCLUSIONS: PA frequency and mode exhibit greater impacts on the gut microbial community structure than cardiorespiratory fitness in overweight and obese adults. In particular, the incorporation of strength exercise may have a larger impact on the gut microbial community than previously thought. Supported by Montana State University Research Initiative 51040-MUSRI2015-03 and USDA-NIFA 2017-67018-26367.

2462 Board #8 May 29 9:30 AM - 11:30 AM
Exercise Training Restores Age-impaired Nrf2 Signaling And Redox Capacity

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Purpose Nuclear erythroid-2-p45-related factor 2 (Nrf2) is an inducible transcription factor and the master regulator of antioxidant defenses. We have previously shown that older men have blunted Nrf2 signaling in response to a single exercise stimulus, compared to young. The present RCT tested the hypothesis that moderate exercise training would improve Nrf2 signaling in older, inactive individuals and this would translate to greater redox capacity against non-exercise oxidative stress challenge.

Methods Young (18-28y, $n=21$) and older ($\geq 60y$, $n=24$) men and women were randomized to an 8-week aerobic exercise intervention (EX) or a non-exercise control group (CON). EX performed supervised aerobic exercise 3d/wk for 45-min/d. $\dot{V}O_2$ peak was measured on a cycle ergometer. Nrf2 nuclear localization and GCLC protein were measured in response to acute exercise (30-min cycling at 70% $\dot{V}O_2$ peak) in peripheral blood mononuclear cells at 7 time points (Pre, +10m, +30m, +1h, +4h,

+8h, +24h). Plasma F_2 isoprostanes were measured in response to forearm ischemia-reperfusion (I/R trial) as a marker of redox capacity. All measures were performed pre- and post-intervention

Results EX improved $\dot{V}O_2$ peak by 15%, while CON did not change ($p < 0.001$), with no differences between age-groups or sexes. Nrf2 signaling response to acute exercise increased in EX compared to CON ($p < 0.001$), in both young and older, in support of aerobic exercise restoring Nrf2 signaling in previously inactive individuals. GCLC protein content was increased in EX with no change in CON ($p = 0.03$). Interestingly, CON had higher basal levels of nuclear Nrf2 after the intervention but did not respond to the acute stimulus indicating impaired signaling responses. Redox capacity was improved in EX compared to CON ($p < 0.05$) as shown by lower F_2 -isoP responses to the I/R trial. Furthermore, there was a significant association between improvements in $\dot{V}O_2$ peak and improvements in the I/R response ($r = -0.46$, $p < 0.01$).

Conclusion To our knowledge, this is the first study to show increased Nrf2 activation in healthy humans, in response to an exercise intervention. These data support our hypothesis and demonstrate that older individuals can improve their cell signaling in response to exercise and systemic response to a non-exercise oxidative challenge.

E-08 Thematic Poster - Sleep and Physical Activity: Health and Behavioral Outcomes

Friday, May 29, 2020, 9:30 AM - 11:30 AM
 Room: CC-2007

2463 Chair: Matthew Buman. *Arizona State University, Phoenix, AZ.*
 (No relevant relationships reported)

2464 Board #1 May 29 9:30 AM - 11:30 AM
Physical Activity And Sleep Quality In Community-dwelling Older Adults

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 (No relevant relationships reported)

Increasing life expectancy has implications for the health system. There is strong evidence that health is dependent on peoples' lifestyle. Sufficient and regular physical activity as well as a good sleep quality are major factors for improved health. Despite health benefits, the majority of older adults do not meet evidence-based physical activity recommendations. Moreover, the prevalence of sleep disorders in this age group is high. **PURPOSE:** To determine the association between physical activity and sleep quality in community-dwelling older adults (>65 years). **METHODS:** This cross-sectional study is based on 64 community-dwelling older adults (82.1 ± 6.4 years (MD ± SD); females 42). Barthel-Index was used for physical disability rating. The average amount of physical activity was assessed by means of accelerometer (MyWellnessKey), measured on 4 out of 7 consecutive days. Self-reported sleep quality, duration and bed rest time were obtained using the Pittsburgh Sleep Quality Index (PSQI). Bivariate correlations (Spearman-Rho) were used to explore relationships between physical activity and sleep quality. In order to analyze differences between subgroups (≥ 7 , 6-7, 5-6, <5 hours of sleep; Barthel Index <90 vs. ≥ 90 pts) univariate ANOVAs were applied; in case of significance followed by Tukey-HSD post-hoc analyses. **RESULTS:** Physical activity levels among community-dwelling older adults ranged from 561.2 to 5335.7 moves per week. No linear association between physical activity and sleep quality was found ($p > .05$). In subgroup analyses ($n = 41$, Barthel Index ≥ 90 pts, free of pre-existing conditions) physical activity levels (2251.6 ± 1119.1, 2516.4 ± 644.5, 3528.7 ± 1461.9, 2019.2 ± 1105.2 moves per week) differed significantly ($p = .037$) between groups of different sleep duration. The association between physical activity and sleep quality was confined to older adults reporting ≥ 7 hours of sleep and older adults reporting 5-6 hours of sleep ($p = .049$). **CONCLUSION:** Present data indicate comparable low to very low physical activity levels in community-dwelling older adults. There is no accordance between higher activity levels and better sleep quality in the investigated cohort per se. However, a sleep duration of 5-6 hours seems to be associated with 7.6 hours bed rest time and a higher level of physical activity.

2465 Board #2 May 29 9:30 AM - 11:30 AM

Associations Of Sleep, Physical Activity, And Sedentary Behavior Across Pregnancy TrimestersKara M. Whitaker¹, Christopher E. Kline², Janet Catov², Bethany Barone Gibbs². ¹University of Iowa, Iowa City, IA. ²University of Pittsburgh, Pittsburgh, PA.

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(No relevant relationships reported)

PURPOSE: Sleep and physical activity are altered in pregnancy and may affect pregnancy health; however, whether these behaviors influence each other is not well understood. In this study, we describe self-reported sleep parameters across pregnancy trimesters and examine associations with objectively measured moderate-to-vigorous physical activity (MVPA) and sedentary behavior (SB). **METHODS:** Women were recruited from Iowa City, IA and Pittsburgh, PA to assess sleep, MVPA, and SB in each trimester of pregnancy. Sleep was measured using the Pittsburgh Sleep Quality Index. MVPA and SB were estimated using a waist-worn ActiGraph GT3X and thigh-worn activPAL3 micro, respectively; data were considered valid with ≥ 4 days of ≥ 10 hours of wear. Mixed effects models were used to examine changes in sleep parameters (global sleep score, poor sleep quality, sleep efficiency, sleep duration) across trimesters. Associations of MVPA and SB trajectories with sleep parameters were also examined using mixed effects models. **RESULTS:** Women (n=120) averaged 31.1 ± 4.7 years of age with a pre-pregnancy BMI of 26.8 ± 6.7 kg/m². As seen in the Table, differences were found for all sleep parameters across pregnancy trimesters, with adverse changes occurring in the third trimester compared to the first and second trimesters. MVPA trajectory was not associated with any of the sleep parameters. Women in the high SB trajectory had greater sleep efficiency ($\beta=4.78\%$, 95% CI: 0.07, 9.49) and women in the moderate and high SB trajectories also had longer sleep duration ($\beta=0.79$ hours, 95% CI: 0.23, 1.35; $\beta=0.80$ hours, 95% CI: 0.26, 1.33, respectively), compared to those in the low SB trajectory. **CONCLUSIONS:** Few studies have examined self-reported sleep measures across pregnancy trimesters. Findings indicate that sleep quality, efficiency, and duration are adversely affected in the third trimester. Contrary to our hypotheses, high SB but not MVPA was favorably associated with sleep parameters.

Table: Sleep across pregnancy trimesters and associations of moderate-to-vigorous intensity physical activity (MVPA) and sedentary behavior (SB) trajectories with sleep

Trimester	PSQI Global Sleep Score*	Poor Sleep Quality ^b	Sleep Efficiency %	Sleep Duration Hours
	Mean \pm SD	n(%)	Mean \pm SD	Mean \pm SD
First (n=120)	6.1 \pm 3.0	58 (48.7)	83.9 \pm 13.4	7.1 \pm 1.4
Second (n=116)	6.0 \pm 3.3	56 (49.6)	85.0 \pm 12.4	7.1 \pm 1.5
Third (n=114)	7.3 \pm 3.4	75 (66.4)	80.8 \pm 12.6	6.5 \pm 1.2
p-value	<0.001	0.006	0.006	<0.001
Trajectories ^c	β (95% CI)	OR (95% CI)	β (95% CI)	β (95% CI)
MVPA				
Low (n=35)	0.65 (-0.70, 2.00)	-0.62 (-1.51, 0.27)	-0.54 (-5.47, 4.39)	-0.40 (-0.97, 0.17)
Medium (n=59)	-0.08 (-1.32, 1.15)	-0.17 (-1.00, 0.63)	-0.10 (-4.41, 4.60)	-0.36 (-0.89, 0.16)
High (n=26)	Ref.	Ref.	Ref.	Ref.
SB				
Low (n=25)	Ref.	Ref.	Ref.	Ref.
Medium (n=43)	-0.16 (-1.53, 1.22)	0.24 (-0.66, 1.13)	2.37 (-2.53, 7.27)	0.79 (0.23, 1.35)
High (n=52)	-0.28 (-1.60, 1.05)	-0.35 (-1.22, 0.53)	4.78 (0.07, 9.49)	0.80 (0.26, 1.33)

*Pittsburgh Sleep Quality Index; possible score range 0-21, higher scores indicate poorer sleep quality.

^bDefined as PSQI global sleep score ≥ 5 .

^cPossible score range 0-100%, higher scores indicate better sleep efficiency.

^dMVPA and SB trajectories constructed using growth mixture modeling; models adjusted for age, race, education, and pre-pregnancy BMI.

2466 Board #3 May 29 9:30 AM - 11:30 AM

Physical Activity And Sleep Quality Differ In LGBTQ Compared To Non-LGBTQ College Students

Ginny M. Frederick, Isaura M. Castillo-Hernandez, Ewan R. Williams, Anneliese A. Singh, Ellen M. Evans, FACSM. University of Georgia, Athens, GA. (Sponsor: Ellen M. Evans, FACSM)

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(No relevant relationships reported)

PURPOSE: Disparities in health outcomes exist for members of the lesbian, gay, bisexual, transgender, and queer (LGBTQ) community across the lifespan. Regarding sleep quality (SQ) specifically, obtaining adequate restorative sleep is a challenge for many individuals, especially college students. Although it is well established that habitual physical activity (PA) is associated with improved SQ in many cohorts, the relationship between PA and SQ among LGBTQ college students remains unstudied. This study aimed to compare PA and SQ, and their associations, in LGBTQ and non-LGBTQ college students. **METHODS:** Self-identified LGBTQ (n = 84; 20.6 ± 2.2 yo) and non-LGBTQ college students (n = 456; 20.8 ± 2.0 yo) completed online surveys: a) Pittsburgh Sleep Quality Index (PSQI) and b) International Physical Activity Questionnaire (IPAQ)

with subsequent MET-min/wk and days of resistance training (RT) being calculated. T-tests were used to compare SQ and PA levels of LGBTQ and non-LGBTQ students. Bivariate correlations explored relationships between SQ and PA within groups. **RESULTS:** LGBTQ students reported less aerobic PA (2226.1 ± 1478.9 vs. 2641.9 ± 1643.5 MET-min/wk) and less frequent RT (1.3 vs 1.9 days/wk) than non-LGBTQ students (all p \leq 0.05). Global PSQI scores indicated poor SQ for both LGBTQ and non-LGBTQ students (6.85 and 5.79, respectively); however, LGBTQ students reported 16.7% higher scores indicating poorer SQ (p \leq 0.05). Among LGBTQ students, higher aerobic PA was associated with improved SQ (r = -0.24, p \leq 0.05) whereas no association was observed in non-LGBTQ students (r = -0.05, p = 0.25). No associations between RT and SQ were observed in either group (both p \geq 0.05). **CONCLUSIONS:** Disparities exist between LGBTQ and non-LGBTQ college students regarding self-reported PA and SQ. Although causality cannot be determined, our findings suggest that increasing PA could improve SQ, particularly among LGBTQ college students. Future research should explore the utility of PA to enhance SQ using more robust methodologies toward the end of informing effective health promotion programming.

2467 Board #4 May 29 9:30 AM - 11:30 AM

The Combined Associations Of Physical Activity And Sleep With Depressive Symptoms In Women With Young Children.

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PURPOSE: To examine the combined associations of PA and sleep with depressive symptoms in women with young children. **METHODS:** We analyzed data from the National Health and Nutrition Examination Survey (2007-2014). We included women with children < 5 years of age, not pregnant, with complete data on physical activity, sleep, and depressive symptoms (n=1,222). The primary exposures were self-reported physical activity (some vs. none) and sleep duration (> 6 vs. < 6 hours/night). The primary outcome was moderate-to-severe depression (referred to as "depression" going forward). Multivariable logistic regression was used to compare odds of depression by engagement in PA and sleep individually or in combination. No PA and short sleep duration (< 6 hours/night) was the reference group. **RESULTS:** Participants had a mean age of 31.2 yrs and their youngest child had a mean age of 2.33 yrs. Approximately 48%, 82%, and 40% performed some PA, slept > 6 hours/night, and both respectively. Depression was prevalent in 10% of the sample. Engaging in some PA and sleeping > 6 hours/night were associated with an unadjusted 0.41 (95% CI 0.26 to 0.64) and 0.40 (95% CI 0.25 to 0.64) odds of depression. The combined associations of engaging in some PA and sleeping > 6 hours/night were more strongly associated with depression (OR = 0.16, 95% CI 0.09 to 0.29) than either behavior alone. This relationship persisted after adjustment for education, race/ethnicity, marital status, obesity, poverty status, and the child's age (OR = 0.19, 95% CI 0.10 to 0.38). **CONCLUSIONS:** PA and sleep, considered separately and in combination, were associated with fewer depressive symptoms in women with young children. The combination of adequate PA and sleep may have greater mental health benefits than either behavior alone. Future studies should examine the effects of promoting PA and sleep on postpartum depression in women.

2466 Board #3 May 29 9:30 AM - 11:30 AM

Physical Activity And Sleep Quality Differ In LGBTQ Compared To Non-LGBTQ College Students

Ginny M. Frederick, Isaura M. Castillo-Hernandez, Ewan R. Williams, Anneliese A. Singh, Ellen M. Evans, FACSM. University of Georgia, Athens, GA. (Sponsor: Ellen M. Evans, FACSM)

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(No relevant relationships reported)

PURPOSE: Disparities in health outcomes exist for members of the lesbian, gay, bisexual, transgender, and queer (LGBTQ) community across the lifespan. Regarding sleep quality (SQ) specifically, obtaining adequate restorative sleep is a challenge for many individuals, especially college students. Although it is well established that habitual physical activity (PA) is associated with improved SQ in many cohorts, the relationship between PA and SQ among LGBTQ college students remains unstudied. This study aimed to compare PA and SQ, and their associations, in LGBTQ and non-LGBTQ college students. **METHODS:** Self-identified LGBTQ (n = 84; 20.6 ± 2.2 yo) and non-LGBTQ college students (n = 456; 20.8 ± 2.0 yo) completed online surveys: a) Pittsburgh Sleep Quality Index (PSQI) and b) International Physical Activity Questionnaire (IPAQ)

2468 Board #5 May 29 9:30 AM - 11:30 AM

Impact Of Increased Sleep Duration On Physical Activity And Mood In Adolescents

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PURPOSE: The majority of adolescents are chronically sleep deprived and exhibit low levels of physical activity. Greater physical activity has been associated with improved sleep in teens; however, the effect of a sleep extension intervention on physical activity has not been assessed. The purpose of this study is to determine if increasing a high-school student's sleep opportunity to 10h per night for one week leads to greater physical activity and improvements in mood. **METHODS:** Ten high school students (14-17y) exhibiting habitual short sleep (< 7.5 h/night) were enrolled in the study. During orientation and follow-up visits, participants completed the Profile of Mood States. For one week between orientation and follow-up visits, participants were prescribed a bedtime and wake time, provided with time management and sleep hygiene strategies, and received payment contingent upon adherence to the assigned sleep schedule. During this week, sleep and physical activity were measured daily using the Phillips Respironics Actiwatch Spectrum Plus worn on

the wrist 24h per day and Actigraph GT3x worn on the hip during waking hours for at least 8h a day, respectively. Data were analyzed using repeated-measures ANOVA (SPSS 26.0).

RESULTS: Eight participants completed the study (50% female). Prior to the sleep intervention, participants self-reported sleeping 420.6 min (7.0h) per night. During the intervention, participants increased sleep duration to 502.8 min (8.4h) per night. Mood was significantly improved (total mood disturbance: $p=0.01$, confusion: $p=0.04$, fatigue-inertia: $p=0.01$, vigor-activity: $p=0.03$). Time spent in sedentary and light physical activity did not significantly change during the intervention; however there was a non-significant ($p=0.16$) increase in the proportion of time spent in moderate-to-vigorous activity from the first-2 days (6.5%) to the last-2 days (8.5%) of the intervention. When asked if they perceived any changes in physical activity, the majority of participants ($n=7$) reported that they became less sedentary because they did not have time to engage in sedentary activities (e.g., watching television).

CONCLUSIONS: Increasing sleep duration is a promising approach to increasing physical activity and improving the physical and mental health of adolescents.

2469 Board #6 May 29 9:30 AM - 11:30 AM

Poor Sleep Quality Increases Sedentary Time In A College Student Cohort

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Quality sleep is essential for health and quality of life, and can impact academic performance. Prior research has shown a reduced sleep time in college students. A relationship has been shown between sleep quality and physical activity (PA), but has not been examined extensively in a college cohort, nor has sedentary behavior been factored in.

PURPOSE: To examine the effect of sleep quality on sedentary and PA behavior in college students. **METHODS:** Eighty-one female ($n = 53$) and male ($n = 28$) college students (age = 20.2 ± 1.5 yr; BMI = 25.1 ± 4.7 ; % body fat = 31.8 ± 10.2) underwent 7-day objective PA and sleep assessment via ActiGraph accelerometer. Poor sleep quality was defined as total sleep time (TST) < 6 hours or sleep efficiency (SE; TST / Total time in bed) $< 85\%$. One-way ANOVA was utilized to assess mean differences in PA and sedentary behavior between poor sleep (PS) and normal sleep (NS). **RESULTS:** Based on weekly averages, 22 subjects had poor sleep quality by TST criteria, and 43 subjects had poor sleep quality by SE criteria. Based on TST, PS resulted in greater number of sedentary bouts per day (20.6 ± 2.8) vs. NS (18.5 ± 3.8 , $P = 0.02$), fewer minutes per sedentary break per day (45.2 ± 9.1 and 53.5 ± 14.5 , for PS and NS, respectively, $P = 0.02$), and greater average sedentary minutes per day (701.4 ± 79.4 and 645.1 ± 106.6 for PS and NS, respectively, $P = 0.03$). Average moderate-to-vigorous PA minutes (MVPA) did not differ between PS (65.0 ± 30.0) and NS (57.6 ± 23.9 , $P = 0.25$), nor did any other PA variable. Based on SE, the PS (65.3 ± 27.2) had greater MVPA minutes compared to NS (53.2 ± 22.7 , $P = 0.04$). No other PA variable differed. There was no difference in body composition between groups when analyzing by TST or SE criteria. **CONCLUSION:** Poor sleep quality, defined as less than 6 hours of TST, appears to have a greater impact on sedentary behavior than PA behavior in a college student population. When sleep quality is poor, college students experience a greater amount of sedentary behavior, while PA variables did not change. This may be a result of the college lifestyle, where walking on campus to classes and other PA is needed regardless of daytime sleepiness as a result of poor sleep. This is one of the first studies to show a relationship between sleep quality and sedentary time in a college-age population.

2470 Board #7 May 29 9:30 AM - 11:30 AM

Lifestyle Characteristics As Predictors Of Adolescent Sleep Duration: Evidence From A National Survey

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(No relevant relationships reported)

Chronic sleep deprivation is frequent among adolescents with only about a quarter of high school students in the United States reporting getting the 8 to 10 hours of sleep per night that is recommended for their age group. While some behaviors associated with adolescent sleep duration have been established, most studies have only examined a small subset of risk factors and have not utilized a nationally representative sample of adolescents.

PURPOSE: The purpose of this study was to examine patterns of adolescent sleep from a large sample of high school students throughout the U.S using data from the 2017 National Youth Risk Behavior Survey (YRBS) and to identify lifestyle factors that associate with meeting sleep recommendations.

METHODS: A multi-stage cluster sampling procedure was employed to yield a representative sample of US adolescents recruited from the 9th through 12th

grade. The number of sampled adolescents was 18,324 with 7,640 students submitting questionnaires with usable data for this study. Backward selection and weighted logistic regression models were employed to examine the predictive utility of independent health behaviors associating with adolescents meeting sleep recommendations, adjusting for age and BMI percentile. The final model included physical activity, alcohol use, and screen time as salient predictors of sleep duration. **RESULTS:** A total of 1,948 (25.5%) adolescents reported sleeping 8 hours or more per night. Meeting physical activity guidelines (OR = 1.18, 95% CI: 1.02-1.38, $p = 0.03$) associated with higher odds of meeting sleep recommendations. Using a computer more than two hours per day (OR = 0.62, 95% CI: 0.54 - 0.71, $p < 0.01$) and consuming alcohol (OR = 0.66, 95% CI: 0.54 - 0.71, $p < 0.01$) independently associated with lower odds of meeting sleep recommendations. These associations held after controlling for age and BMI percentile.

CONCLUSION: The majority of adolescents in the United States do not meet current sleep recommendations for their age group and multiple health behaviors associate with the odds of meeting these recommendations. Programs that aim to promote sleep hygiene among adolescents should focus on multiple lifestyle behaviors in an effort to improve sleep duration among youth.

2471 Board #8 May 29 9:30 AM - 11:30 AM

Relationship Between The 24-hour Movement Guidelines And Fundamental Motor Skills In Preschoolers

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The 24-hour movement guidelines recognize the collective influence of child physical activity (PA), sleep, and screen-time on development. An important part of child development is fundamental motor skills (FMS), as higher FMS competency in preschool is related to greater PA in adolescence. It is unknown whether meeting preschool movement guidelines are associated with FMS. **PURPOSE:** To examine the association among 24-hour movement guidelines and FMS in preschoolers. **METHODS:** Children ages 3-4 years of age were recruited from childcare centers. Parents reported child age, sex, race, and time spent viewing screens (hours/day). Child PA and sleep were measured using accelerometry. The 24-hour movement guidelines were examined (≤ 1 hour/day of screen-time, ≥ 3 hours/day total PA of which ≥ 1 hour/day is moderate-to-vigorous, and 10-13 hours/day of sleep). To measure FMS, trained researchers administered the Test of Gross Motor Development - Third Edition (TGMD-3). Raw score of the two subscales (Locomotor and Ball skills) and total TGMD-3 score were used for analysis. Linear regression was used to assess individual and number of guidelines met with total, locomotor, and ball skill scores. Crude models and models adjusting for age, sex, and race were conducted. **RESULTS:** Of the 112 participants, 86 provided complete measures (76%). Preschoolers were 3.4 ± 0.5 years old, 53% were male, 52% were White, and the sample was below average in the age-and-sex adjusted total score percentile (41 ± 21). Most children met the PA guideline (94%) and sleep guideline (87%), but few met the ST guideline (12%) or all three guidelines (10%). In crude models, those who met the PA guideline had a higher total ($p=0.04$) and ball skills scores ($p=0.01$), and those who met the ST guideline had a lower ball skills score ($p=0.04$). However, these associations were not significant in adjusted models ($p>0.05$). No other relationships between individual or number of guidelines and FMS scores were found. **CONCLUSIONS:** In this sample, there was no relationship between movement guidelines and FMS when adjusting for other factors. Promotion of adequate movement behaviors and FMS is still warranted for later child health.

E-09 Thematic Poster - Soccer

Friday, May 29, 2020, 9:30 AM - 11:30 AM
Room: CC-2010

2472 Chair: Robert A. Huggins. *University of Connecticut, Manchester, CT.*
(No relevant relationships reported)

2473 Board #1 May 29 9:30 AM - 11:30 AM
Analyses Between Field-test Outcome And Match-related Physical Performance In Elite Youth Soccer Players

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BACKGROUND: How field-test results are associated with match-related physical performance is understudied, especially in elite youth soccer players. **PURPOSE:** To investigate relationship between field-test outcome and physical performance during official soccer matches in elite youth soccer players. **METHODS:** During pre-season, elite youth soccer players (n = 27; age = 17.1±0.9 years; height = 177.9±7.4 cm; weight = 71.0±5.5 kg) performed field tests including running acceleration on 5 m (AC5) and 10 m (AC10), maximal speed running (MSR), Agility 505 with turning on dominant (A505D) and non-dominant leg (A505N), and Yo-Yo test level 1 (Yo-Yo). Following the field-test, the same players wore GPS devices (GPSports Canberra, Australia) in 12 official soccer matches. The GPS can measure total distance covered (TDC), distance covered in different speed zones (Z1-Z6), high-metabolic load distance (HMLD), maximum speed (MS), acceleration (ACC) and deceleration (DCC) in different effort zones (EZ1-EZ3). Pearson correlation analysis and canonical correlation were used to find an association, and paired sampled test was employed to compare 1st and 2nd half differences. **RESULTS:** Results revealed significant, moderate correlation between AC5 and ACCEZ3 in 2nd half (r=.450, p=.02), AC10 vs ACCEZ1 in 1st, 2nd half and full match (r=.453, r=.390, r=.444), S10 vs ACCEZ2 in 1st half (r=.382, p=.049), AC10 vs ACCEZ3 in 2nd half (r=.543, p=.003). Yo-Yo test outcome was strongly correlated with TDC in match (r=.871, p=.000) and TDC in both halves (1st: r=.871, p=.000, 2nd: r=.723, p=.000). Significant correlation was found between Yo-Yo and HMLD (r=.758, p=.000) and HMLD for both halves (1st: r=.695, p=.000, 2nd: r=.707, p=.000). Canonical correlation (R_c) between field test variables and match performing was .940 (R_c²=.884). The highest canonical loading were: TDC (-.971), HMLD (-.818), YoYo (-.972). The highest cross loadings variables were: TDC (-.913), HMLD (-.769), and YoYo (-.914). **CONCLUSIONS:** Our study identified several pre-season field tests that were associated with match-related physical performance. An intermittent exercise capacity was the strongest predictor for physical match performance in youth elite soccer players. Supported by GACR19-12150S, UNCE HUM32

2474 Board #2 May 29 9:30 AM - 11:30 AM

The Influence Of Match Congestion, Load And Wellness On Injury Risk In Collegiate Women's Soccer

Robert A. Huggins¹, Ryan M. Curtis², Courtney L. Benjamin¹, Yasuki Sekiguchi¹, Erin B. Wasserman³, Shawn M. Arent⁴, Catie L. Dann⁵, Nathan P. Lemoine⁶, Tori Powell⁷, Jessica Prencipe⁸, Rajat K. Jain⁹, Bridget McFadden⁴, Hannah Roudebush⁶, Alora Sullivan¹⁰, Douglas J. Casa, FACSM¹. ¹Korey Stringer Institute, University of Connecticut, Storrs, CT. ²San Antonio Spurs, San Antonio, TX. ³University of North Carolina at Chapel Hill, Chapel Hill, NC. ⁴University of South Carolina, Columbia, SC. ⁵University of Connecticut, Storrs, CT. ⁶Louisiana State University, Baton Rouge, LA. ⁷University of Oregon, Eugene, OR. ⁸Clemson University, Clemson, SC. ⁹Northwestern University, Evanston, IL. ¹⁰Florida State University, Tallahassee, FL. (Sponsor: Douglas J. Casa, FACSM)
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The impact of match congestion, training load (TL), perceived stress, fatigue and soreness on the odds of injury remains unclear. **PURPOSE:** To examine the influence of: 1) days rest between matches on injury rate (IR) and odds of injury and; 2) TL on injury, perceived stress, fatigue and soreness. **METHODS:** A prospective multi-site study tracked daily exposures, TL (distance and duration), injury and perceptual data from six Division I NCAA women's soccer teams in one season. Overall and non-contact (NC) IRs expressed per 1000 athlete exposures (AEs), and odds ratios (OR) were determined by days before and after matches. Associations between injury and changes in both TL and perception were analyzed using a multilevel logistic regression. **RESULTS:** 139 players experienced 94 injuries in 137 matches and 107 injuries in 363 practices. Overall match and practice IRs (per 1000AEs [95%CI]) were 39.0 [31.1, 46.9] and 17.1 [13.9, 20.3], respectively. While insignificant (p > 0.21), match IRs were highest 2 days between matches (IR= 50.9 [26.7, 75.1]). Players were at increased odds of being injured in a match with 1 to 5 days since the last match vs. 6+ days (OR [95%CI] = 1.79 [1.02, 3.17]). Practice IRs were highest in the pre-season (IR = 28.8 [17.0, 40.5]). Players were at increased odds of sustaining a NC overuse injury with 1-5 days between matches vs. 6+ days (OR=7.85 (1.06, 57.94); p=0.04). Similarly, 1-3 days' rest had 2.24 (1.03, 4.88) times higher rates on NC overuse IR than 4+ days' rest (p=0.05). Acute NC IR was increased with 1 to 3 days rest vs. 4+ days rest (OR= 3.01 [1.11, 8.14]; p=0.03). Players were at increased odds (p < 0.001) of feeling fatigue (> 5) (OR= 4.71 [1.82, 12.17]) and soreness (> 5) (OR= 7.68 (2.67, 22.10)) on match day with 2 days vs. 7+ days since the last match. For each additional 3000m covered on a day, odds of overall injury, soreness and fatigue increased (41%, 32% and 31% respectively). **CONCLUSION:** Days between matches and acute TL increases on a given day had a negative impact on odds of injury and perception. The odds of getting injured in a match were greater with 1 to 5 days vs. 6+ days between matches. These data may be used to inform and guide the NCAA in determining optimal scheduling and recovery.

2475 Board #3 May 29 9:30 AM - 11:30 AM

Biomarkers Differ Between And Within Starters And Non-Starters Throughout A Collegiate Soccer Season

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PURPOSE: To observe differences in blood biomarkers (oxygen (O₂) transport, immune, cardiovascular (CV) health and hematology) between starters (S) and non-starters (NS) over a full NCAA Division I collegiate men's soccer season. **METHODS:** Biomarkers (n = 30) related to O₂ transport (n = 9), immune function (n = 12), and CV and lipid profiles (n = 9) were collected at the start of pre-season (PS), in-season at weeks (W)1, 4, 8 and 12 in soccer players (n = 20, mean ± SD; age = 21 ± 1, height = 180 ± 6 cm, body mass = 78.19 ± 6.3 kg, body fat = 12.0 ± 2.6%, VO_{2max} = 51.5 ± 5.1 ml·kg⁻¹·min⁻¹). A 2 x 5 (group x time) repeated measures ANOVA was used to identify differences between S (n = 10) and NS (n = 10). In the presence of a significant interaction effect (p<0.05), post-hoc one-way ANOVAs and paired tests were used to identify group and time differences with uncorrected alpha level set at p<0.05. **RESULTS:** A significant interaction effect (group x time) was found for 9 biomarkers (hematocrit [HCT], hemoglobin [HGB], red blood cells [RBC], total cholesterol [Total Chol], LDL cholesterol [LDL], Chol:HDL ratio, non-HDL cholesterol [non-HDL], direct LDL [dLDL] and apolipoprotein B [ApoB]). S demonstrated significant increases in RBC (W1) and Chol:HDL (W8), while NS demonstrated significant increases in HCT and HGB (W4); Chol:HDL (W4, 12). Within-group significant

differences were found between PS and W1 for NS (HCT, HGB, RBC, Total Chol, LDL, Chol:HD, Non-HDL, ApoB) and for S (Chol:HDL, non-HDL, dLDL). HCT, HGB, RBC, LDL, Non-HDL, Direct LDL and Apo B were different in NS from W1 to W4, while only Apo B was different in S. From PS to W12, Total Chol, LDL, and non-HDL were significantly different for NS while HCT, HGB, Chol:HDL, and non-HDL were different in S.

CONCLUSIONS: Our findings indicate that there are differences between and within S and NS for many biomarkers related to O₂ transport, immune, CV health and hematology throughout a collegiate men's soccer season. Thus, future analyses should account for playing status as a covariate. From a clinical perspective, while all biomarkers were within normal reference ranges, sports medicine personnel should account for playing status and inter-individual differences when tracking or diagnosing athletes who demonstrate signs of clinical pathologies associated with these biomarkers.

2476 Board #4 May 29 9:30 AM - 11:30 AM
Variability Of Heart Rates During Small Sided Games In Female College Soccer Players

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Soccer is one of the most popular sports in the world that include small sided games (SSGs) as a match specific type of training. Much is known about the physiological demands of official match-play (OM), however less is known about which practice elements most closely mimic OM situations. **PURPOSE:** To assess differences in HR and soccer performance during SSGs in female college soccer players in comparison to a full competitive match. **METHODS:** Twenty female collegiate soccer players (mean \pm SD; age = 20 \pm 1 yrs, height = 169 \pm 6cm, weight = 64 \pm 6kg) were recruited to participate in this study. A commercially available team monitoring system was used to measure HR and determine time spent in various zones based on %HRmax. Player touches (contacting the ball) were based on video analysis of each session. Field size (120m x 75m) for the SSGs were kept constant, but the intensity of the games were influenced by the number of players involved (6 vs 6, 7 vs 7, 8 vs 8, 9 vs 9 and 11 vs 11). **RESULTS:** A one-way repeated measures ANOVA showed there was a significant main effect of average HR on SSGs, $F(4, 64) = 11.248$; $p < 0.01$. The average %HRmax responses increased in concert with the increased number of players in SSGs (6 vs 6 = 73 \pm 6%, 7 vs 7 = 75 \pm 10%, 8 vs 8 = 81 \pm 7%, 9 vs 9 = 83 \pm 5%, and 11 vs 11 = 83 \pm 6%). A one-way repeated measures ANOVA showed there was a statistically significant main effect of group size on the number of touches, $F(4, 64) = 12.67$, $p < 0.001$. The number of touches were inversely related to the number of players (11 vs 11 = 46 \pm 16, 9 vs 9 = 61 \pm 15, 8 vs 8 = 66 \pm 22, 7 vs 7 = 78 \pm 22, and 6 vs 6 = 86 \pm 28). A two-way Mixed Model ANOVA showed there was no significant main effect of position (DEF, MID, STK) on time spent in heart rate zones, $F(2, 72) = 1.38$, $p > 0.05$. **CONCLUSION:** Changes in SSGs game format affect the players. Using SSGs can allow coaches to more closely alter physiological and technical demands differently. The greater touches with fewer players may enhance technical ability. However, fewer players in SSGs are also associated with a lower %HRmax. The 9 vs 9 SSGs formats provide players with the opportunity to spend sufficient proportion of time spent in high intensity HR zones that are specific to OM.

2477 Board #5 May 29 9:30 AM - 11:30 AM
Relationship Between Sleep Quantity And Quality And Performance Variables In Female Collegiate Soccer Players.

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Support for sport-specific benefits of sleep quantity and quality are limited, particularly in female collegiate athletes. **PURPOSE:** To evaluate the relationship between sleep quantity and quality and soccer-specific performance variables in an elite group of female soccer players. **METHODS:** Eight NCAA college-aged competitive Division I women's soccer players (18-23 yrs) participated in the study. Global Positioning Systems (GPS), heart rate monitoring, and video analysis technologies were used during four matches along with 24-hour actigraphy; actigraphy was also used to measure sleep quantity and quality. The night prior to the match was used for data analyses of sleep quantity and quality. A multivariate analysis of variance (MANOVA) was utilized to determine whether the vectors of the means in groups of variables were significant. Paired t-tests were used to analyze if differences in variables of performance existed after the "best" and "worst" nights of sleep for quantity and quality. Significance was set at $p < 0.05$. **RESULTS:** Mean sleep quantity and quality for the "best" (575.0 \pm 38.4 minutes, 91.9 \pm 2.6% of time in bed spent sleeping) and

"worst" (416 \pm 57.6 minutes, 76.2 \pm 12.1% of time in bed spent sleeping) nights were significantly different. The MANOVAs were not significantly different for the physiological and physical variables for quantity and quality of sleep. No differences in performance variables were observed after "best" and "worst" quantity sleep matches. However, percent time spent exercising above 85% of the maximal heart rate (HRmax) was significantly lower after the "best" quality night of sleep (30.2 \pm 13.5 vs. 47.9 \pm 24.3%), even though overall heart rate exertion was higher after the "best" night of sleep (518.5 \pm 193.1 vs. 387.6 \pm 148.9 AU). High metabolic load distance (distance running at speeds greater than 19 km/hr) and distance accelerating or decelerating quickly (>2 m/s²) was lower (11.8 \pm 3.6 vs. 16.3 \pm 6.0 yds/min) and the number of decelerations was higher after the "best" quality night (69.7 \pm 28.1 vs. 50.6 \pm 25.9). **CONCLUSION:** While quantity of sleep did not influence performance related outcomes, quality of sleep may be important for reducing the time spent exercising $>$ 85% HRmax and reducing incidence of high orthopedic stresses.

2478 Board #6 May 29 9:30 AM - 11:30 AM
Pre-season Hip/groin Strength Is Associated With Subsequent Injury In Professional Male Soccer Players

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(No relevant relationships reported)

PURPOSE:

Hip and groin injuries are a significant cause of time lost from training and competition in elite soccer (football). The aim of this study was to explore the association between pre-season assessments of 1) isometric hip adductor and abductor strength using a novel field-test; and 2) the Copenhagen Hip and Groin Outcome Score (HAGOS), and subsequent hip/groin injury in professional male football players. **METHODS:** In total, n=204 elite male football players from ten professional Hyundai A-League and English Championship League clubs underwent assessments of hip adductor and abductor strength and completed the HAGOS in the 2017-18 pre-season. In-season hip/groin injuries were reported by team medical staff. Data reduction was conducted using principal component analysis. The principal component for HAGOS and three principal components for strength and imbalance measures were entered with age and prior hip/groin injury into a multivariable logistic regression model to determine their association with prospectively occurring hip/groin injury. **RESULTS:** Twenty-four players suffered at least one hip/groin injury throughout the 2017-18 competitive season. The principal component for between-limb abduction imbalance (peak strength in the preferred [kicking] limb - non-preferred limb) (OR = 0.58, 95% CI = 0.38 to 0.90, $p = 0.011$), the principal component for peak adduction and abduction strength (OR = 0.71, 95% CI = 0.50 to 1.00, $p = 0.045$), and the principal component for HAGOS (OR = 0.77, 95% CI = 0.62 to 0.96, $p = 0.022$), were independently associated with a reduced risk of future hip/groin injury. Receiver operator curve analysis of the whole model revealed an area under the curve of 0.76, which indicates a fair combined sensitivity and specificity of the included variables but an inability to correctly identify all subsequently injured players. **CONCLUSIONS:** In this cohort, a hip abduction imbalance favouring the preferred kicking limb, higher levels of hip adductor and abductor strength, and better HAGOS values, were all associated with a reduced likelihood of future hip/groin injury.

2479 Board #7 May 29 9:30 AM - 11:30 AM
Peripheral Perception In Soccer: Effects Of Sports-specific Dual Task Training

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In soccer, abilities such as peripheral perception seem to be of special importance. However, the extent to which these skills can be improved through practical and sports-specific training interventions has not been conclusively clarified. **PURPOSE:** To examine the effect of an 8-week sports-specific training intervention under dual-task conditions on the peripheral perception of young, highly talented soccer players. **METHODS:** 34 highly talented male soccer players (12.7 \pm .5 yrs) were assigned to an intervention group (IG: 15 subjects) and a control group (CG: 19 subjects). Computer-based measurements were conducted for pretest (T0) and posttest (T1). Outcome parameters were reaction time (RT) for left-sided (RTL) and right-sided (RTR) peripherally perceived stimuli. The sports-specific perceptual cognitive training (8 weeks, 20 min weekly) consisted of juggling training and two soccer-specific double tasks ("juggling and peripheral passing", "foveal focus and peripheral reaction"). **RESULTS:** The two-way ANOVA showed a significant interaction effect for RTR between the groups (IG, KG) and the measurement times (T0, T1) ($F(1, 32) = 9.63$, $p = .004$, $\eta^2 = .23$). For left-sided stimuli (RTL) ANOVA did not show a significant interaction effect (time x group) ($F(1, 32) = .49$, $p = .49$, $\eta^2 = .02$). A significant

interaction effect (time x group) could be determined for RT ($F(1,32) = 4.85, p = .035, \eta^2 = .13$). **CONCLUSIONS:** The intervention showed a significant effect on right-sided peripheral reaction time of highly talented soccer players. The analysis of the left-sided reaction time showed no significant interaction effect. Based on demands for sports-specific transfer tasks, the shown training intervention represents a practical approach to improve perceptual-cognitive skills. In future analyzes, neurophysiological parameters (e.g. changes in activity in the motor cortex) should be recorded in order to determine the importance of dual tasks for the development of perceptual-cognitive abilities of young highly talented soccer players and to understand underlying mechanisms.

2480 Board #8 May 29 9:30 AM - 11:30 AM
The Accuracy Of Female Collegiate Soccer Players In Self-Detecting Ventilatory Threshold During Maximal Exercise Testing

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(No relevant relationships reported)

INTRODUCTION: Ventilatory threshold (VT) is the point at which minute ventilation (V_E) increases nonlinearly with increasing exercise intensity. Several previous studies have shown that subjects are able to recognize their VT by noticing changes in their breathing during exercise bouts. High importance can be placed on knowing VT, as positive training adaptations for sport occur when the intensity is at or above this threshold. There are no previous studies examining team sport athletes detecting VT. **PURPOSE:** Determine whether female collegiate soccer players can accurately perceive the changes in ventilation associated with their VT during maximal exercise testing. **METHODS:** Volunteers were recruited from a women's collegiate soccer team ($n=17$, age = 19 ± 1.56 yrs.) to participate in the study. All subjects performed a modified maximal treadmill protocol with breath-by-breath gas analysis throughout the test. All subjects were given instructions from a script asking them to indicate when they noticed a significant change in their breathing, and this was recorded as their perceived ventilatory threshold (PVT). Actual VT was recorded and calculated from the maximal exercise test results. Pearson product correlation and independent samples t-tests were used to test the relationships and mean differences between oxygen consumption (VO_2), ventilatory frequency (VF), minute ventilation (V_E), and tidal volume (V_T) at PVT and VT. Significance was set at $p < 0.05$. **RESULTS:** Data was collected for 13 subjects. Positive correlations were found between actual VT and PVT on physiological variables with TV having a very strong relationship ($r=.932$), VO_2 a strong relationship ($r=.714$), and VF ($r=.684$) and VE ($r=.49$) with moderate relationships. On average, subjects perceived their VT after surpassing their actual VT. There were no statistically significant differences for mean difference on average between VO_2 , $\%VO_{2max}$, VF, V_E , and V_T at PVT versus VT. **CONCLUSION:** In respect to the current study, female collegiate soccer players may be able to detect the changes in their breathing associated with VT, which could be useful in prescribing exercise for this population. Coaching professionals could use PVT as a reliable mark for players to train above their VT to produce desired training effects.

E-10 Thematic Poster - Weight Lifting
Biomechanics

Friday, May 29, 2020, 9:30 AM - 11:30 AM
 Room: CC-2009

2481 **Chair:** Clare E. Milner, FACSM. *Drexel University, Philadelphia, PA.*
 (No relevant relationships reported)

2482 Board #1 May 29 9:30 AM - 11:30 AM
Sagittal And Frontal Plane Joint Moments Of The Sumo Deadlift During Shod And Barefoot Conditions

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Sumo style deadlifting has recently become more prevalent. Barefoot-style lifting has also become increasingly popular with claims such as increased force production and improved "grounding" of the foot. However, the biomechanics of sumo deadlifting while barefoot have not been examined. **PURPOSE:** To examine the effects on the hip, knee, and ankle joint moments during a sumo deadlift when comparing shod and barefoot conditions. **METHODS:** Ten subjects (27.3 ± 3.5 yrs, 1.74 ± 0.13 m, 77.97 ± 17.34 kg) with minimum six months of deadlift experience (7.6 ± 4.6 yrs), who were free from lower extremity injury, performed 1 repetition maximum (1RM; 137.7 ± 43.0 kg) testing on day 1. This testing was performed in self-selected footwear. On day 2, a minimum of 72 hours later, subjects lifted 70% of their 1RM during a 3-dimensional analysis. Subjects performed one set of five continuous repetitions of a sumo deadlift in shod and barefoot conditions in randomized order. Five minutes of rest was given between sets. Marker data were collected using Qualisys Track Manager, sampling at 240Hz. Force data were collected using Bertec force plates, sampling at 1200Hz. Raw marker and force data were imported into Visual3D. Marker and force data were filtered using a fourth-order lowpass Butterworth filter at 8Hz. Peak internal sagittal and frontal plane joint moments of the hip, knee, and ankle were calculated during the concentric phase of each repetition. Peak vertical ground reaction force was measured during the concentric phase. **RESULTS:** No significant differences were detected in peak hip extension moment ($p=0.855$), hip abduction ($p=0.288$), knee extension ($p=0.607$), knee abduction ($p=0.926$), ankle plantarflexion ($p=0.376$), ankle eversion ($p=0.739$), or peak vertical ground reaction force ($p=0.558$). **CONCLUSIONS:** There is no evidence to suggest that the barefoot lifting style increases performance capabilities when lifting the same weight as in the shod condition. Additionally, there is no evidence to suggest that there is any increased risk in excess frontal plane joint moments during barefoot lifting. Future research should examine the 1RM capabilities in both shod and barefoot conditions to determine if differences exist during maximal compared to submaximal efforts.

2483 Board #2 May 29 9:30 AM - 11:30 AM
Electromyography Of The Quadriceps And Hamstrings During The Conventional Deadlift In Two Shoe Conditions

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Electromyography of the Quadriceps and Hamstrings During the Conventional Deadlift in Two Shoe Conditions

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Introduction: The conventional deadlift is a widely used strength exercise and barefoot lifting has become a more prominent style of training. Currently there is a lack of research comparing electromyography (EMG) activity between shoe and barefoot styles of training. The purpose of the study was to compare the difference in vastus medialis and biceps femoris muscle activity during the concentric phase of the conventional deadlift. **Methods:** Seven subjects with a mean weight 80.3 ± 17.4 (kg) and height 1.8 ± 0.1 (m) participated in the study with at least six continuous months of deadlifting experience, 1-2 days/week of strength training, no surgeries and no

lower back/lower extremity injuries within the past six months. Day one consisted of 1RM testing based on NSCA guidelines. On day two subjects were fitted with two EMG sensors (biceps femoris, vastus medialis) and a maximal voluntary isometric contraction was performed. The subjects then completed two sets of five randomized repetitions (with shoes and barefoot) at 70% of their 1RM. Raw data were imported to visual 3D. EMG data were bandpass filtered (20Hz-450Hz), full-wave rectified, linear enveloped, and smoothed using a moving RMS (window size of 25 frames). A paired-samples t-test ($p < 0.05$) was used to compare muscle activity of the biceps femoris and vastus medialis. **Results:** The percentage of vastus medialis recruitment was significantly greater ($p = 0.005$) in the shoe ($53.5 \pm 26.9\%$) vs. barefoot condition ($46.7 \pm 24.1\%$). Additionally, there was a significant difference in percentage of biceps femoris recruitment ($p = 0.037$) between the shoe ($43.8 \pm 25.0\%$) condition and barefoot ($45.2 \pm 33.1\%$) condition. **Conclusion:** Using a barefoot approach in the conventional deadlift appears to have an effect on percent peak muscle activation of the biceps femoris and vastus medialis muscles. Early evidence may suggest that barefoot lifting styles increase hamstring activation while decreasing quadriceps activation.

2484 Board #3 May 29 9:30 AM - 11:30 AM
The Effects Of Fatigue On Lumbo-Pelvic Coordination During The Deadlift

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Repetitive lifting with submaximal loads has gained popularity as a mean for increasing strength and endurance. Given that repetitive lifting is a known occupational risk factor for low back injury, it is important to develop an objective criterion for determination of number of lifting repetitions that maximize the benefits of lifting, while minimizing the potential risk for low back injuries. **Purpose:** To determine whether measures of lumbo-pelvic coordination (LPC) during repetitive low-handle hexagonal bar deadlift (LHBD) get impaired before lifter exhaustion. **Methods:** Eight weight-trained males performed repetitions-to-fatigue of LHBD with a load of 68 kg. Rotations of the thorax and pelvis in the sagittal plane, measured using a motion capture system, were used to characterize LPC according to Needham, et al. 2015. Subsequently, the differences in LPC over the early portion of the lifting phase between the first and last 10% of total lifting repetitions were compared using paired to-tests. **Results:** Peak pelvic and trunk flexion angles and lumbar range of rotation from respective values of $53.9^\circ \pm 4.8^\circ$, $64.9^\circ \pm 6.6^\circ$, and $28.8^\circ \pm 3.2^\circ$ during the first 10% of lifting cycles increased to $57.2^\circ \pm 4.1^\circ$ ($p = 0.02$) $69.4^\circ \pm 6.7^\circ$ ($p = 0.05$), and $32.9^\circ \pm 5.2^\circ$ ($p = 0.04$) during the last 10%. Pelvic and trunk rotations over the early portion of the lifting phase were in-phase (anti-phase) $40.0\% \pm 8.8\%$ ($21.3\% \pm 2.8\%$) of the time during the first 10% of lifting cycles that increased, $p = 0.04$, (decreased, $p = 0.01$) to $47.9\% \pm 4.8\%$ ($12.4\% \pm 4.9\%$) during the last 10% of lifting cycles. **Conclusion:** Significant changes in neuromuscular control of LPC were observed before participants stop lifting due to fatigue. Such alterations in LPC changes mechanical loads experienced in the spinal tissues, hence, affecting risk of injury. However, more research is needed to understand the impact of such impairments in LPC on spinal loads and risk of injury.

2485 Board #4 May 29 9:30 AM - 11:30 AM
Comparison Of Shoe Vs No Shoe On Sagittal Plane Deadlift Biomechanics

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Deadlifts are often an integral part of training programs to build posterior chain strength and power, but current research has not examined the performance outcomes when performed with and without shoes from a biomechanical perspective. **PURPOSE:** To examine the differences in lower extremity sagittal plane joint kinetics and peak vertical ground reaction force (vGRF) of a conventional barbell deadlift with and without shoes. **METHODS:** Ten subjects (age: 27.9 ± 3.8 years) who deadlift twice a week for the past 6 months, were free from injury, and had no history of lower extremity surgery were recruited. Subjects first performed a one repetition max (1RM) test in self-selected footwear according to NSCA guidelines. At least 72 hours later subjects returned for a 3-dimensional analysis of their deadlift at 70% of their 1RM. Subjects performed 1 set of 5 continuous reps of a conventional deadlift in both shoe and barefoot conditions in a randomized order. A 5-minute rest was given between each condition. Visual3D was used to process raw marker and force data, calculate peak sagittal joint moments of the ankle, knee, and hip and to find peak vertical ground reaction force during the concentric phase. A one-way repeated measures MANOVA

was performed to statistically test differences between shoe and no shoe conditions in the dependent variables. **RESULTS:** Average 1RM for males and females was 437.5 ± 83.4 lbs. and 224.2 ± 37.6 lbs., respectively. No significant differences were found in internal hip extension moments ($p = 0.444$, $S = 2.99$ Nm/kg, $B = 3.05$ Nm/kg), knee extension moments ($p = 0.151$, $S = 0.92$ Nm/kg, $B = 0.81$ Nm/kg), ankle plantar flexion moments ($p = 0.113$, $S = 1.07$ Nm/kg, $B = 1.01$ Nm/kg), and peak vGRF ($p = 0.295$, $S = 1044.9$ N, $B = 1035.2$ N) between shoe and barefoot conditions. **CONCLUSION:** Anecdotal claims suggest performing a deadlift barefoot enhances stability and increases connection to the ground which would lead to improvement in deadlift performance. The lack of difference seen in sagittal plane kinetics and peak vGRF suggest that deadlift performance is unaffected by footwear choice. Future research should investigate if similar results would be attained when subjects' deadlift performance is tested at various percentages of the 1RM.

2486 Board #5 May 29 9:30 AM - 11:30 AM
The Influence Of Normalization Technique On Between-muscle Activation During A Back-squat: Methodological Considerations

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Abstract

Background/Objective: Currently, no gold standard electromyography (EMG) normalizing technique exists when conducting between-muscle comparisons of muscle activity during isotonic resistance training exercises. The aim of this study was to assess if between-muscle activation during the back-squat differed among electromyography (EMG) normalization techniques when normalizing to: (1) 1 repetition maximum (1RM), (2) maximal voluntary isometric contraction (MVIC), and (3) the first of a set of three repetitions (Rep1%) in trained female lifters. **Methods:** Thirteen participants completed a back-squat 1RM, MVIC of the rectus-femoris (RF) and gluteus-maximus (GM), and three repetitions of the back-squat at 80% 1RM. For the 1RM and MVIC normalization techniques, the average of the peak RMS signal of both muscles during the three submaximal reps were normalized to the peak 1RM and MVIC signals. The Rep1% averaged the peak RMS signals of both muscles during the 2nd and 3rd submaximal repetitions normalized to the peak signal during the 1st repetition. **Results:** The RF-GM between-muscle EMG (Δ EMG) differed among normalization techniques ($p < 0.001$, $\eta_p^2 = 0.48$). **Post-hoc** pairwise comparisons indicated MVIC normalization elicited different Δ EMG with large effects compared to both 1RM ($p = 0.037$; $d = 1.2$) and Rep1% ($p = 0.004$; $d = 1.9$) techniques, but the 1RM and Rep1% did not produce different Δ EMG ($p = 0.27$; $d = 0.8$). **Conclusion:** Our findings suggest EMG normalization technique influences the magnitude and direction of between-muscle activation during common lifting exercises, and we recommend normalizing isotonic movements to dynamic normalization methods such as a 1RM or Rep1%.
 Key Words: Electromyography; Methodology; Signal processing; Lower extremity; Training; Exercise

2487 Board #6 May 29 9:30 AM - 11:30 AM
Impact Of Vibration On Rectus Femoris During Track Athletes Bodyweight Squats In Female Collegiate Track Athletes

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Whole-body vibration (WBV) exposes the entire body to mechanical oscillations when one is standing on a vibrating platform. In recent years, researchers have studied the extent to which these oscillations effect the body. Previous studies have investigated muscle activity in the general population during static exercises with WBV, but there has been little research that has focused on the effects of WBV during dynamic movements in athletes. **PURPOSE:** The purpose of the study was to investigate the effects of WBV on rectus femoris muscle activity during a whole-body squat (WBS) exercise in NCAA Division 1 female track and field athletes. **METHODS:** Fifteen NCAA Division 1 track and field female athletes (Height = 165.20 ± 7.85 cm; Weight = 61.11 ± 9.46 kg; BF% = 18.80 ± 4.92 %; Age = 19.80 ± 1.57 years) were assessed for adequate squat form using the FMS deep squat protocol. Subjects then completed a dynamic warm-up before a wired EMG sensor was placed over the rectus femoris muscle belly of the right leg. Subjects completed two trials consisting of 10 repetitions of WBS with and without WBV, in a counterbalanced order. Root mean squared (RMS) values were collected using the EMG sensor during WBS trials. RMS values for WBS during each trial were analyzed using a Dependent t-Test with an alpha level of $p \leq 0.05$. **RESULTS:** Mean values for RMS were 74.92 ± 22.81 μ V for WBV trials, and 53.11 ± 24.46 μ V for ground squat trials. The values for RMS were significantly

($p < 0.001$) greater for the WBV trials. **CONCLUSIONS:** Significantly higher RMS values occurred for the WBV trials which may indicate that more motor units were recruited in the rectus femoris when the athlete was performing WBS and experiencing WBV. Future research may be required to determine if the current study's results may apply to collegiate male track and field athletes.

2488 Board #7 May 29 9:30 AM - 11:30 AM
Muscle Excitation During Single Leg Rotational Squat In Individuals With And Without Previous Hamstrings Injury

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PURPOSE: To compare lower extremity muscle excitation patterns between individuals with and without a previous hamstrings injury when performing a single leg rotational squat (SLRS). **METHODS:** Eight recreationally active individuals with a history of hamstrings injury within 5 years (4 males, 4 females; age=21.25±1.58 years; height=1.76±0.07m; mass=78.21±12.96kg; Hamstring Outcome Score=88.28±7.5%), were matched to 8 individuals with no history of hamstrings injury (4 males, 4 females; age=22.12±1.55 years; height=1.76±0.08m; mass=76.29±13.62kg; Hamstring Outcome Score=97.19±2.81%). Wireless EMG surface electrodes were placed bilaterally on the rectus femoris, vastus medialis oblique, biceps femoris, medial hamstrings, and gluteus medius. EMG data was sampled at 2000Hz. Participants completed five trials of a SLRS moving to four counts of a 72bpm metronome. Four phases were defined: 1) down phase from standing to squat, 2) rotating towards maximum excursion marker, 3) rotating away from maximum excursion back to straight-ahead squat, and 4) standing up from squat. EMG signals were passed through a 4th order, zero lag, Butterworth high-pass filter with cut-off at 10Hz, low-pass filter with cut-off at 350Hz, and full wave rectified. Mean EMG of each muscle during each phase was normalized to the maximum EMG of the entire task, and analyzed as %EMG. Between group differences were assessed using separate one-way ANOVAs for each muscle and phase. Alpha level was set at $p < 0.05$. **RESULTS:** %EMG of the medial hamstrings during phase two was significantly higher in the healthy group as compared to the hamstring group (Healthy: 8.66 ± 2.83%, Hamstring: 5.943 ± 1.74%; $p = 0.037$, effect size = 1.15). No other significant differences were observed ($P > 0.05$). **CONCLUSION:** Muscle excitation patterns of the rectus femoris, vastus medialis oblique, biceps femoris, and gluteus medius of individuals with a previous hamstrings injury appear similar to those with no history of hamstrings injury when performing a SLRS. Differences in excitation of the medial hamstrings during the rotation to maximum excursion could indicate a difference in movement strategy between the groups when performing the phase that requires the highest demand of dynamic stability.

2489 Board #8 May 29 9:30 AM - 11:30 AM
Effect Of Unilateral Anterior Knee Pain On 3d Net Support Moments During Split Squats

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 (No relevant relationships reported)

Anterior knee pain (AKP) is common in the active population.¹ and biomechanical differences exist between individuals with and without AKP.² Individuals with AKP portray changes in coordination,³ kinematics, and muscle function^{1,2} though, the 3D net joint moment (NJM) and relative joint contributions (RJC) of the lower extremity joints during squat tasks is not well-documented. **PURPOSE:** Quantify differences in NJM and RJC during split squats between individuals with and without AKP. **METHODS:** Data from 15 active young adults with unilateral nonspecific AKP (≥ 3 months), and 15 controls (C) was collected with a 9-camera motion capture system (500 Hz) and two force platforms (2000Hz). Ten continuous split-squats were performed with each leg leading (AKP: injured and non-injured). The hip, knee, and ankle moments of the lead and trail legs were extracted at the bottom of the movement. NJM was calculated as described by Paterson⁴. Paired statistics were used for between-leg differences and between-group analyses were performed using an ANCOVA, with the squat depth as a covariate. The alpha level was 0.05 and Cohen's D indicated effect size. **RESULTS:** No difference existed in squat depth. No differences existed between limbs in the C group so the data were pooled.

There was less NJM in the injured limb and more in the non-injured limb when the injured limb was leading compared to controls (Figure 1). When in the trail position, the injured limb produced less NJM than the uninjured. The RJC from the lead hip was lower for the AKP, while their contribution from the knee was higher. **CONCLUSION:** The total NJM suggested an increased reliance of the non-injured leg during split-squats, which likely offloads the injured leg. The RJC from the lead hip was less in the injured group (C: 50%, AKP: 46/44%), while the knee was higher (C: 30%, AKP: 34/38%). This was unexpected and highlights demands for further research.

¹ Graci V 2015. ² Nakagawa TH 2012.

³ Cunningham TJ 2014. ⁴ Peterson TJ 2018

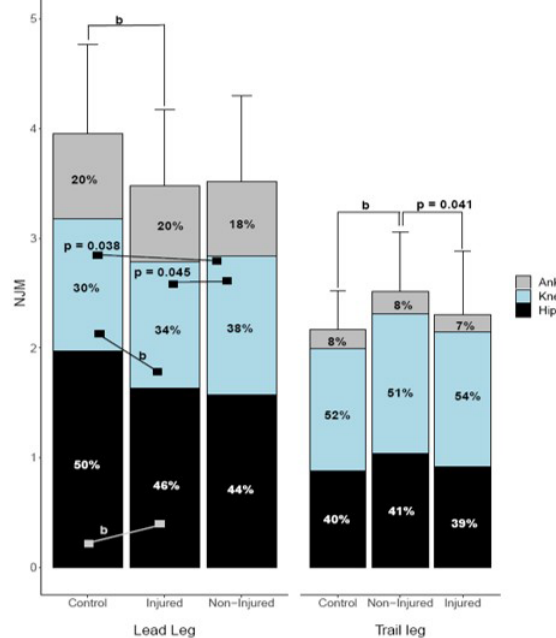


Figure 1. 3D NJM for C and AKP groups during the split-squat and relative joint contributions (%). b denotes $d > 0.5$.

E-11 Free Communication/Slide - Care of the Disabled Athlete

Friday, May 29, 2020, 9:30 AM - 11:15 AM
 Room: CC-2005

2490 Chair: Yetsa A. Tuakli-Wosornu. Yale School of Public Health, New Haven, CT.
 (No relevant relationships reported)

2491 May 29 9:30 AM - 9:45 AM
Influence Of Injury Severity And Recovery Environment On Physical Activity And Function Following Lower-limb Amputation

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Restoration of physical function and physical activity (PA) is considered a vital therapeutic component in the short-term rehabilitation and long-term recovery of individuals with traumatic lower-limb amputation(s) (LLA). Unfortunately, evidence suggests an increased prevalence of physical inactivity and reduced functional status in this population. **PURPOSE:** To determine the impact of free-living environment (rehabilitation vs. home) on PA and function in UK military personnel following

traumatic LLA, compared to active non-injured controls (CON). **METHODS:** Sixteen LLA (8 unilateral (UNI), 30±5yrs; 8 bilateral (BI), 29±3yrs), nearing the end of their clinical rehabilitation care pathway, attended one 4-week residential rehabilitation admission and one 6-week recovery block at home. Thirteen physically active, age-matched males (28±5yrs) represented CON. Estimated daily ambulatory PA energy expenditure (PAEE) was estimated from an accelerometer (Actigraph GT3X+), worn on the hip of the shortest residual limb in each environment, using validated population specific prediction algorithms. Six minute walk distance (6MWD) was recorded at baseline and 10 weeks (general population 6MWD norms is >459m). **RESULTS:** Whilst at home, mean PA counts.day⁻¹ reduced by 17% (p=0.018) and 42% (p=0.001) in the UNI and BI group, respectively. UNI group demonstrated a similar capacity for PAEE to CON, both of which were greater (P<0.05) than BI (Table 1). No significant changes in 6MWD were demonstrated within groups (P>0.05), however, significant differences (P<0.05) were demonstrated between all groups at baseline (UNI, 574±66m; BI, 337±85m, CON, 705±32m). **CONCLUSION:** UNI group demonstrate a similar capacity for PA and function to active non-injured CON. To support and manage the long-term health and well-being of more severely injured BI LLA, future research should investigate strategies that promote regular engagement in PAEE, particularly when they return home.

Estimated daily physical activity in all groups. Data presented as mean±SD and Δ mean							
	Unilateral Amputation (n=8)			Bilateral Amputation (n=8)			Control (n=13)
	Rehabilitation	Home	ΔChange	Rehabilitation	Home	ΔChange	Work
Days (>14 hours)	5 ± 1	5 ± 1	0	6 ± 1	6 ± 1	0	5 ± 1
Wear Time (minutes)	918 ± 41	916 ± 55	-2	918 ± 45	904 ± 42	-14	934 ± 40
PA Counts.day ⁻¹	645084 ± 86078	534248 ± 90125	-110836	492569 ± 72750	283357 ± 91406	-209212	707632 ± 197909
PAEE (kcal.day ⁻¹)	839 ± 88	733 ± 87	-106	410 ± 68	217 ± 85	-194	948 ± 155

2492 May 29 9:45 AM - 10:00 AM
Cross-sectional Evaluation Of Musculoskeletal Outcomes & Physical Activity Levels In Patients With Aggrecan Deficiency

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 Reported Relationships: **P.J. Gubanich:** Industry contracted research; Novo Nordisk.

PURPOSE: Aggrecan is a key proteoglycan found in the extracellular matrix of articular and physal cartilage and provides resistance to compression and deformity. Aggrecan deficiency is a recently described autosomal dominantly inherited condition due to mutations in the *ACAN* gene. Individuals with aggrecan deficiency experience premature growth cessation, short stature, and advanced skeletal maturation. Proteoglycan loss has been associated with osteoarthritis and degenerative joint disease. This study examines the joint manifestations of a cohort of prepubertal patients and affected family members with Aggrecan deficiency. **METHODS:** Proband (ACAN mutation, bone age ≥ chronological age, normal IGF-I) and affected relatives underwent baseline joint evaluation including history and physical exam, quality of life, physical activity (Marx), joint specific outcomes (Pedi-IKDC, Oswestry), and radiographic assessment (knee x-ray and MRI). **RESULTS:** Twenty subjects (9 male, 11 female, ages 2.4-62.6 years) were enrolled in the study. The average Pedi-IKDC of the pediatric subjects (mean age 6.5+/-3.2 years, range 2.4-12.5 years) was 95.5+/-8.9 compared to 74.9+/-20.1 for adult subjects (mean age 42.9+/-10.6 years, range 25.4-62.6 years), (p=0.02). The average Marx activity score was 12.2+/-2.2 for pediatric subjects compared to 2.6+/-4.4 for the adults (p<0.001). Two pediatric subjects reported a history of knee pain while none reported back or other musculoskeletal concerns. Additionally, two pediatric subjects were identified with osteochondral defects on MRI while 2 others displayed variant MRI findings. Of the 9 adults, 67% reported knee pain (4 patellar dislocations), 88% displayed osteoarthritis on knee x-ray, 67% reported other joint concerns, and 56% reported back pain. Seven orthopedic surgeries were reported. **CONCLUSIONS:** Patients with ACAN deficiency appear to be at high risk of premature joint complications as evidenced by (1) the high rate of knee, back, and joint complaints, (2) increased requirement for surgical intervention, and (3) low physical activity scores. Early surveillance of joint

complaints, lifestyle counseling and therapeutic interventions to improve joint health and maintain physical activity should be considered to optimize patient outcomes and quality of life.

2493 May 29 10:00 AM - 10:15 AM
Reduced Muscle Sympathetic Nerve Activity Response To A Cold Pressor Test In Multiple Sclerosis

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Multiple sclerosis (MS) is a neurodegenerative autoimmune disease characterized by demyelination in central nervous system leading to potential impairments in the autonomic control of cardiovascular function. We have previously demonstrated individuals with MS exhibit a diminished ability to increase blood pressure in response to a hypotensive stimulus compared with healthy controls likely due to impaired sympathetic modulation of the vasculature. **Purpose:** The aim of the current investigation was to test the hypothesis that muscle sympathetic nerve activity (MSNA) responses to a cold pressor test (CPT) are reduced in individuals with MS compared to healthy controls. **Methods:** Four patients with relapsing-remitting MS (2 females/2 males, EDSS < 4) and 4 sex-, age- and mass-matched controls were instrumented for MSNA (peroneal nerve), mean arterial blood pressure (MAP; Finometer), and heart rate (HR). Subjects were exposed to a CPT by immersing a hand in ice water for 2 min. Mean cardiovascular and MSNA responses (burst frequency) at baseline and at 30 sec intervals during the CPT were compared between groups. **Results:** Heart rate (P<0.001) and MAP (P<0.001) responses increased from baseline throughout the CPT but no group differences were observed (P=0.10 and P=0.78, respectively). At baseline, MSNA was similar between groups (MS: 2 ± 2 vs. CON: 14 ± 9 bursts/min; P=0.239). However, individuals with MS had blunted MSNA responses to CPT compared to healthy controls at 60 seconds (MS: 18 ± 14 vs. CON: 42 ± 10 bursts/min; P=0.033), at 90 seconds (MS: 16 ± 12 vs. CON: 44 ± 10 bursts/min; P=.017) and 120 seconds (MS: 13 ± 12 vs. CON: 43 ± 13 bursts/min; P=.012). **Conclusion:** Individuals with MS appear to have an attenuated muscle sympathetic response to CPT. However, MAP appears to respond similarly to healthy controls potentially through other compensatory mechanisms.

2494 May 29 10:15 AM - 10:30 AM
The Adoption Of Spinal Cord Injury Policies In The Secondary School Setting

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Development of written policies and procedures (P&P) may enhance adequate preparation and management of spinal cord injuries (SCI). **PURPOSE:** To evaluate the current adoption of SCI P&P in the secondary school setting as reported by athletic trainers (ATs). **METHODS:** Using a cross-sectional design, ATs employed in a secondary school (n=3315) were emailed invitations to participate in an online questionnaire about sport safety best practices, which included three questions related to SCI P&P (Table 1). The questions were framed using the Precaution-Adoption Process Model (PAPM), which is a health behavior model aimed at identifying an individual's readiness to act with answers including unaware, unengaged, undecided, decided not to act, decided to act, acting and to maintaining a SCI P&P. Additional questions related to the management of SCI were also asked. Frequencies were tabulated and prevalence ratios with 95% confidence intervals (CI) are presented. **RESULTS:** Of the 389 ATs who responded (response rate = 8.5%) (male= 52.1%, age=41±10 years), a majority reported "maintaining" for all questions (Q1 (Comprehensive SCI plan)= 82.8%, Q2 (Equipment Removal)=79.1%, Q3 (Healthcare professional practice)=64.8%, Table 1). The proportion of ATs reporting being "unaware" was higher in Q2 compared to Q1 (7.2% vs 4.8%; (PR=1.78, 95% CI= 1.11, 2.87)). Further, the ATs reporting "acting" or "maintaining" in Q2 was higher than Q3 (80.6% vs 65.8%; PR=1.22, 95% CI=1.12, 1.33). Approximately half (56.6%) reported they coordinate SCI policy with emergency medical services (EMS). A majority reported they do not document practicing equipment removal (62.2%). **CONCLUSION:** Overall, the PAPM appears to be able to classify ATs readiness to act for the adoption of a SCI P&P, though there was a low proportion in many of the stages. Interventions may be needed to improve the practicing and documentation of equipment removal skills along with collaborative efforts between ATs and EMS.

Question <i>My school has policies and procedures...</i>	Un-aware we needed this	Un-aware if we have	Un-engaged	Un-decided	Decided not to act	Decided to Act	Acting	Maintaining
Q1. Comprehensive plans for immediate care of a potential severe head or cervical spine injury are in place (n=389)	6 (1.5)	13 (3.3)	11 (2.8)	14 (3.6)	10 (2.6)	8 (2.1)	5 (1.3)	322 (82.8)
Q2. Emergency equipment to remove face mask, helmet, and shoulder pads are onsite and in working order (n=387)	14 (3.6)	14 (3.6)	14 (3.6)	11 (2.8)	12 (3.1)	10 (2.6)	6 (1.6)	306 (79.1)
Q3. Policies are in place for healthcare professionals to practice and maintain equipment removal skills regularly (n=384)	25 (6.5)	15 (3.9)	26 (6.8)	21 (5.5)	23 (6.0)	21 (5.5)	4 (1.0)	249 (64.8)

2495 May 29 10:30 AM - 10:45 AM

Injury Incidence In Competitive Wheelchair Tennis Athletes

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(No relevant relationships reported)

There is great interest in tennis sports science and in the wheelchair tennis community on the overall injury incidence in competitive wheelchair tennis players. There are biomechanical differences between the wheelchair tennis and the able-bodied tennis serve that have been published. In addition, wheelchair tennis players are required to propel their wheelchair around the court during match play, which exposes the upper extremities and trunk to additional movements during tennis play. Currently, there is a paucity of data published on the injury incidence in competitive wheelchair tennis athletes. **PURPOSE:** To provide a prospective evaluation of the injury incidence in wheelchair tennis players during their competitive schedule. **METHODS:** The study is a prospective cohort study of competitive wheelchair tennis players during their seasons. 81 subjects were enrolled at 5 different tennis tournaments over a two year period. Subjects completed an injury history and a training log at the beginning of the study. 39 subjects volunteered for a physical exam at the start of the study. Once enrolled in the study, the subjects were monitored for injuries through weekly email communication. **RESULTS:** The injury incidence is calculated to be 1.88 injuries per 100 athletic exposures. Of the reported injuries, 2 occurred during match play, 3 occurred during training, and 8 were reported while not playing tennis. There were no statistically significant findings associating physical exam findings and future injury. **CONCLUSIONS:** An injury incidence in competitive wheelchair tennis athletes obtained while competing and training prospectively contributes to the body of evidence to guide further research to evaluate the mechanism of injuries and develop injury risk reduction strategies in a unique population of high performance athletes. Future injury risk reduction strategies should include a focus on potential causes of non-tennis related injuries in competitive wheelchair tennis players.

2496 May 29 10:45 AM - 11:00 AM

Longitudinal Changes In Sensorimotor And Mobility Function In People With Progressive Multiple Sclerosis

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PURPOSE: To determine whether changes in sensorimotor function and mobility are apparent between people with relapsing-remitting (RRMS) and progressive multiple sclerosis (PMS) after 1 year of baseline testing. **METHODS:** The percent change relative to baseline (i.e., % change = (visit 2 - visit 1)/visit 1*100), for measures of sensorimotor function and mobility was calculated for 25 RRMS (22

women, 53.2±10.3 yrs) and 26 PMS (16 women, 60.3±8.7 yrs). Sensorimotor function measures included lower-extremity cutaneous vibration sensitivity, proprioception, and central motor drive. Mobility measures included the 25-Foot Walk Test at preferred and brisk speeds (25FWTpref, 25FWTbrisk), and the Timed-Up-And-Go (TUG). One-sample t-tests and pairwise comparisons were used to determine whether within- and between-group performance changed, respectively, relative to baseline. **RESULTS:** One-sample t-tests revealed that RRMS became less sensitive to vibration at the hallux (p=0.014, [5.4, 43.9]), improved 25FWTbrisk performance (p=0.018, [-17.5, -1.8]), and tended to improve performance during the 25FWTpref (p=0.076, [-13.8, 0.7]) and TUG (p=0.053 [-14.8, 0.1]). Results for PMS demonstrated moderately decreased sensation to vibration at all but 1 site on the foot (Hallux: p=0.066, [-1.7, 49.8], Heel: p=0.084, [-2.9, 43.4]) and worsened performance for the 25FWTpref (p=0.090, [-1.4, 17.6]). Neither RRMS nor PMS demonstrated changes in lower-extremity proprioception or central motor drive measures for either one-sample t-tests or pairwise comparisons. Pairwise comparisons between the groups showed a larger % change (improved performance) from baseline to visit 2 in RRMS compared to PMS for all mobility tests (25FWTpref: p=0.015, [-26.2, -3.0], 25FWTbrisk: p=0.009, [-24.3, -3.7], TUG: p=0.048, [-26.5, -0.1]). **CONCLUSION:** Relative to RRMS, people with progressive forms of MS may increase the amount of time it takes to complete the 25FWT. Increased mobility impairment in PMS over a one year period may be explained by decreased sensation, especially related to cutaneous sensitivity at the plantar surface of the foot, which could impact perception of body orientation and foot-ground contact during the stance phase of gait, and thereby impair mobility performance by walking more cautiously at slower speeds.

2497 May 29 11:00 AM - 11:15 AM

The Medical Demands On The Multidisciplinary Team Of Team UK At The 2018 Invictus Games

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(No relevant relationships reported)

73 military personnel competed at the 2018 Invictus Games in Sydney, Australia as part of Team UK. The medical support team consisted of two doctors, two nurses and two physiotherapists. **PURPOSE:** To describe the epidemiology of injury and illness of Team UK competitors at the 2018 Invictus Games and the medical demand on the multidisciplinary team (MDT) by role (doctor, nurse & physiotherapist). **METHODS:** Electronic medical notes of the 56 males and 27 females (mean age: 37.18 S.D. 7.67) Team UK athletes were recorded via PPS software platform (Rushcliff, UK 2018). All medical interactions were retrospectively analysed using Excel (Microsoft, USA 2019) by: presenting complaint, MDT role, time, venue, anatomical region, treatment and outcomes. **RESULTS:** Team UK comprised of 60 veterans and 13 serving military personnel. Self-declaration of baseline illness/impairment returned 8 spinal cord injuries, 23 limb deficiencies, 23 musculoskeletal, 6 traumatic brain injuries, 14 neurological and 23 psychological illnesses. In total 198 interactions occurred over the 14 days: 69 doctor interactions, 21 nursing interactions and 108 physiotherapist interactions. Of these 107 were new interactions and 91 follow-ups/re-presentations. Of new interactions 59 (55.1%) were musculoskeletal in origin, 15 (14.0%) were illness, 14 (13.1%) were wound care, 3 (2.8%) were emergency care, 1 (0.8%) was psychological support and 15 (14.0%) were classified as other. The most common anatomical regions were shoulder, lumbar spine and cervical spine. Three acute emergencies required hospital admission: a suspected spinal cord injury, a suspected stroke and a respiratory arrest. 7 interactions led to visits to the local medical centre and three resulted in a quarantine. The highest incidence of interactions occurred within the 6 day competition period: 123 (62.2%) vs. 75 (37.9%) on the 8 days pre/post-competition. The highest incidences by day were the second, the first and last day of competition. 82 (41.4%) interactions occurred outside of competition venues (e.g. transport/hotel). Only 13 (17.8%) athletes had no medical interactions. **CONCLUSION:** These results can be used to inform injury prevention programmes and the composition of future MDTs. The data presented will allow for comparative data to be collected at future Invictus Games.

E-12 Free Communication/Slide - Mental Health

Friday, May 29, 2020, 9:30 AM - 11:30 AM
Room: CC-3020

2498 Chair: Laura D. Ellingson-Sayen, FACSM. *Western Oregon, Ames, IA.*
(No relevant relationships reported)

2499 May 29 9:30 AM - 9:45 AM

The Effect Of A 9-month Exercise Program On Physical And Mental Functioning Of Dementia Patients

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Dementia has become a critical health problem with negative impacts on the quality of life. It is widely accepted that exercise has beneficial effects on both physical and mental performance of the elderly people.

PURPOSE: This study examined the effect of an exercise training program on physical and mental abilities of nursing home patients in early and middle stages of dementia.

METHODS: Thirty eight patients with early to middle dementia (31 females and 7 males, age: 80.8±6.9 yrs, body mass: 67.84±6.93 kg, height: 164±7 cm) volunteered to participate in the study. They were randomly assigned to either the intervention group (IG), which received a 50-min structured exercise program 3 days/week, or the control group (CG), which followed the usual care, for an experimental period of 9 months. The study was conducted in an elderly care unit, and functional and cognitive parameters were evaluated in both groups before and after the completion of the intervention period.

RESULTS: Compared to pre exercise values, significant improvements ($p < 0.05$) were found in Time Up and Go test (TUG: 15.1±4.6 vs 12.7±4.4 sec), Berg Balance Scale score (BBS: 42.9±3.8 vs 46.3±5.2), Chair-Stand test (CST: 9.5±1.6 vs 18.06±3.8 reps) and Geriatric Depression Scale (GDS: 5.8±2.9 vs 3.8±3.2) in IG, while no change (TUG: 16.8±4.5 vs 18.6±5.9 sec; BBS: 49.1±5.4 vs 40.7±11.1; GDS: 2.9±2.4 vs 6.2±3.6) or deterioration (CST: 14.2±3.1 vs 10.0±3.01 reps; 6-min walk test-6MWT: 312.6±100.9 vs 231.9±131.5 m; Functional Rating Scale for Symptoms of Dementia-FRSSD: 4.6±2.6 vs 9.2±3.3; $p < 0.05$) was observed in CG at the end of the experimental period. Significant improvements ($p < 0.05$) were revealed in IG compared to CG regarding CTS, 6MWT (428.8±93.9 vs 231.9±131.5 m), FRSSD (4.2±3.8 vs 9.2±3.3) and GDS, while no differences ($p > 0.05$) were found between groups in Handgrip (11.94±6 vs 11.35±5.6 kg) and Mini-Mental State Exam (21.8±4.7 vs 19.5±6.07) at the end of the experimental period.

CONCLUSIONS: A 9-month exercise training program leads to significant improvements in physical and mental functioning of nursing home patients in early and middle stages of dementia. Further studies are needed to reveal the optimum characteristics of the exercise training so as to maximize its benefits in physical and mental performance of patients in various stages of dementia.

2500 May 29 9:45 AM - 10:00 AM

Aerobic Interval Training Integrated In Collaborative Care Of Outpatients With Schizophrenia: One-year Outcomes

Mathias F. Brobakken, Mona Nygård, Ismail Cüneyt Güzey, Gunnar Morken, Solveig K. Reitan, Jørn Heggelund, Einar Vedul-Kjelsaas, Eivind Wang. *Norwegian University of Science and Technology, Trondheim, Norway.*
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Although aerobic interval training (AIT) is recognised to attenuate the risk of cardiovascular disease (CVD) and premature mortality, it appears that it rarely arrives at patients' doorsteps. **PURPOSE:** This study investigated 1-year outcomes when AIT was integrated with municipal and specialised health service in collaborative care of outpatients with schizophrenia. **METHODS:** Forty-eight outpatients (28 men, 35±10 (SD) years; 20 women, 35±12 years) with schizophrenia spectrum disorders (ICD-10) were randomised to either a collaborative care group provided transportation and training supervision and walking/running 4x4-minutes at ~90% of peak heart rate (HR_{peak}) 2 d-wk⁻¹ (TG), or a control group (CG) given 2 introductory AIT sessions

and advised to continue training. **RESULTS:** Directly assessed peak oxygen uptake ($\dot{V}O_{2peak}$) increased in the TG (3-months: 2.7±3.1 mL·kg⁻¹·min⁻¹; 6-months: 3.2±3.0 mL·kg⁻¹·min⁻¹; 1-year: 3.3±3.1 mL·kg⁻¹·min⁻¹; all $p < 0.001$; different from CG: $p < 0.05$ -0.001). In contrast, $\dot{V}O_{2peak}$ remained unchanged (3/6-months) and decreased (1-year: -1.8±3.8 mL·kg⁻¹·min⁻¹, $p < 0.05$) in the CG. One-year cardiac effects revealed increased HR_{peak} (3±7 b·min⁻¹, $p < 0.05$; different from CG: $p < 0.01$) in the TG and decreased HR_{peak} (-3±7 b·min⁻¹, $p < 0.05$) in the CG, while peak stroke volume tended to be higher (0.87±2.15 mL·b⁻¹, $p = 0.12$) in the TG compared to the CG. Conventional risk factors (body weight, waist circumference, blood pressure and lipids/glucose) were unaltered. One-year regular AIT rates were 15/25 (TG; different from CG: $p < 0.0001$) and 0/23 (CG), respectively. **CONCLUSIONS:** AIT was successfully integrated in long-term collaborative care of outpatients with schizophrenia, advocating this model for aerobic capacity improvement and CVD risk reduction in future treatment.

2501 May 29 10:00 AM - 10:15 AM

Effects Of PTSD And MDD Comorbidity On Psychological Changes During Surf Therapy Sessions

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PTSD is more likely to be accompanied by another psychological disorder (most commonly depression) than to occur alone, and those with this comorbidity exhibit more severe psychological outcomes compared to those with a single disorder. Exercise-based interventions that occur in the natural environment, such as surf therapy, have preliminarily been shown to improve psychological outcomes in service members/veterans with PTSD or major depressive disorder (MDD); however, previous research has not yet examined the effectiveness of these programs for those with both disorders. **PURPOSE:** This study compared changes in depression/anxiety and positive affect during surf therapy sessions between active duty service members with comorbid PTSD and MDD and those with either disorder alone. **METHODS:** Probable PTSD and MDD diagnoses were determined using *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* criteria applied to baseline self-report measures. Study outcomes were assessed using validated self-reports (Patient Health Questionnaire-4 and Positive Affect Schedule) completed before and after each of 6 weekly surf therapy sessions. Longitudinal repeated measures data was analyzed using multilevel modeling. **RESULTS:** From pre-to-post session, both the comorbid and single disorder groups reported significant improvements in symptoms of depression/anxiety and positive affect ($ps < .001$). However, those with comorbid PTSD and MDD experienced significantly greater reductions in depression/anxiety ($\beta = -1.22$, $p = .028$) and significantly greater improvements in positive affect ($\beta = 3.94$, $p = .046$) compared with the single disorder group. **CONCLUSIONS:** Surf therapy appears to have global effects on psychological symptom reduction, and may be a useful adjunctive intervention for the treatment of comorbid PTSD and MDD in both clinical and community health settings.
Supported by the U.S. Navy Bureau of Medicine and Surgery under work unit no. N1600.

2502 May 29 10:15 AM - 10:30 AM

Does Body-mind Exercise Has Less Effect Than High-intensity Interval Training?

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Objective: High-intensity interval training (HIIT) has recently attracted considerable interest as a time-efficient approach to improving physical and psychological health. The aim of this study was to compare the physical and psychological effect of substance abusers by HIIT or body-mind exercise. **Methods:** 120 Methamphetamine (Meth) dependent individuals from a compulsory rehabilitation center in Shanghai were randomly assigned to HIIT group (experimental group) and body-mind exercise group (control group). The subjects in the experimental group received HIIT training including rope jumping, running, weight lifting and basketball game, 1 hour a day, 3 times a week. The control group received Tai Chi practice, the duration of each session and the repetitions per week were the same as those of the experimental group. Subjects in both groups took part in 6 months intervention. The outcomes of Amphetamine Withdrawal Symptom Questionnaire (AWQ), blood pressure (BP), vital capacity (VC) and fitness test were measured at the

baseline, 3 months, 6 months. Data analysis was applied with SPSS 22.0, a two-way repeated measures analysis of variance (ANOVA) was applied to test whether the treatments were different after 6 months.

Results: At the baseline, there were no significant differences between the two groups regarding to age, years of drug use, scores of AWS, BP, VC and fitness. The significant changes were found after 6 months. The score of AWQ in experimental group was 8.84 ± 0.78 and in control group was 12.04 ± 0.76 , $p = 0.004$. The blood pressure, vital capacity, hand grip, one-leg-stand with eyes close, reaction time were found significantly improved after 6 months intervention in both groups. However, there was no significant differences between the two groups.

Conclusion: HIIT and body-mind exercise have similar effect for Meth dependent individuals except the score of AWQ, the result suggests that the body-mind exercise might be a safer and optional choice for whom don't want to engage in vigorous exercise.

2503 May 29 10:30 AM - 10:45 AM

Aerobic Exercise Acutely Reverses Negative Mood Occurring In The Mid-luteal Phase Of The Menstrual Cycle

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Purpose: Over 80% of women report a more negative mood state during the luteal phase compared to the follicular phase of their menstrual cycle. Mood is acutely improved following aerobic exercise. Thus, aerobic exercise may be capable of normalizing mood during the luteal phase of the menstrual cycle. We tested the hypothesis that prior aerobic exercise would eliminate differences in mood state between the mid-luteal and mid-follicular phases of the menstrual cycle.

Methods: 12 recreationally active eumenorrheic women (25 ± 6 y) completed ~30 min of aerobic exercise, which consisted of 10 min of steady state aerobic exercise and an 8 km cycle time trial, during the mid-follicular and mid-luteal phases of the menstrual cycle. Participants completed a Profile of Mood State Questionnaire (POMS) pre-exercise and 20 min post-exercise. The POMS provided indices of confusion, tension, depression, vigor, fatigue and anger, from which total mood disturbance (TMD) was calculated (higher scores = more negative mood). Data are presented as T-scores (a.u.).

Results: Pre-exercise tension (42 ± 10 vs. 39 ± 7 , $P < 0.01$) and anger (41 ± 4 vs. 39 ± 4 , $P = 0.04$) were elevated and vigor (35 ± 11 vs. 42 ± 11 , $P < 0.01$) and TMD (174 ± 26 vs. 162 ± 31 , $P < 0.01$) were lower in the mid-luteal vs. the mid-follicular phase. Confusion and depression did not differ between phases pre-exercise ($P \geq 0.56$). Fatigue did not differ between phases at any time ($P \geq 0.57$) nor change from pre- to post-exercise ($P \geq 0.15$). Confusion, tension, depression, and vigor decreased from pre- to post-exercise in the mid-luteal and mid-follicular phases ($P < 0.01$), but there were no differences between phases at post-exercise ($P \geq 0.06$). Anger decreased from pre- to post-exercise in the mid-luteal (38 ± 1 , $P < 0.01$) but not the mid-follicular phase (37 ± 1 , $P = 0.08$), which eliminated differences between phases post-exercise ($P = 0.57$). TMD decreased from pre- to post-exercise in both phases ($P < 0.01$) and there were no differences between the mid-luteal (142 ± 17) and mid-follicular (136 ± 16) phases post-exercise ($P = 0.16$).

Conclusion: Women experience a more negative mood state during the mid-luteal compared to the mid-follicular phase. Aerobic exercise acutely normalizes these differences in mood state by eliminating menstrual cycle dependent differences in vigor, anger, and tension.

2504 May 29 10:45 AM - 11:00 AM

The Effects Of Ecologically-Valid Resistance Exercise Training Among Young Adults With Analogue Generalized Anxiety Disorder

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PURPOSE: This randomized controlled trial examined the effects of eight weeks of ecologically-valid resistance exercise training (RET) compared to wait-list control among 27 young adults (26.6 ± 4.5 y; 18 female) with analogue Generalized Anxiety Disorder (AGAD; Psychiatric Diagnostic Screening Questionnaire GAD subscale ≥ 6 and Penn State Worry Questionnaire ≥ 45).

METHODS: Fully supervised, ecologically-valid, one-on-one RET sessions designed according to World Health Organization (WHO) and American College of Sports Medicine (ACSM) guidelines, consisting of 2 sets of 8-12 repetitions of

eight exercises, were delivered twice weekly, after a 3 week familiarization. Rating of perceived exertion (RPE) and muscle soreness (1-10) were assessed after each exercise. The primary outcome, remission based on change in AGAD status, was assessed post-intervention, and quantified with number needed to treat (NNT).

Worry and anxiety symptoms were assessed at baseline, week 1, week 4, and post-intervention. Independent samples *t*-tests examined baseline differences between conditions. Paired sample *t*-tests examined changes in 5RM strength. RM-ANOVAs examined differences between RET and wait-list across time. Significant interactions were decomposed with simple effects analysis. Hedges' *d* effect sizes (95%CI) quantified the magnitude of the difference in change between groups across time.

RESULTS: There were no baseline differences between conditions. Attendance was 81%, and compliance was 77% (average RPE = 14.41 ± 1.58 , muscle soreness = 4.40 ± 1.70). Participants significantly increased strength ($F = 6.86$, $p < 0.001$, $d = 1.24$). RET improved AGAD status (NNT = 3, 95%CI: 2 - 17). A significant condition-time interaction was found for worry ($F_{(3,66)} = 3.12$, $p \leq 0.043$, $d = 0.93$ [0.13 - 1.73]), and anxiety symptoms ($F_{(3,66)} = 2.91$, $p \leq 0.046$, $d = 0.71$ [-0.08 - 1.49]). RET significantly reduced worry (mean difference = -6.49 , $p \leq 0.045$) and anxiety symptoms (mean difference = -10.50 , $p \leq 0.001$).

CONCLUSIONS: Ecologically-valid RET, designed according to WHO and ACSM guidelines, improved AGAD status, and elicited large magnitude reductions in worry and anxiety symptoms among young adults with AGAD. This is the first ecologically-valid RET intervention among young adults with clinically relevant anxiety pathology.

2505 May 29 11:00 AM - 11:15 AM

Neural Responsiveness To Reward And Cognitive Control Following An Eight-week Aerobic Exercise Trial For Depression

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(No relevant relationships reported)

Major Depressive Disorder (MDD) is a common affective disorder that affects nearly 20% of adults and is a leading cause of global disability and disease. Despite demonstrated efficacy of aerobic exercise for depression, there is a poor understanding of clinical and neurobiological mechanisms. Two candidate mechanisms of depression that may be modifiable through aerobic exercise are reward processing and cognitive control deficits. **PURPOSE:** The primary aim was to examine the effects of an 8-week aerobic exercise (AE) program on event-related potential (ERP) indices of reward processing (RewP) and cognitive control (ERN), and symptoms of depression among individuals with MDD. Secondary aims were to determine whether changes in reward (RewP) or cognitive control (ERN) were related to changes in depressive symptoms and whether baseline RewP or ERN could predict the likelihood of an antidepressant response. **METHODS:** Individuals with MDD ($N = 51$; 75% female) were stratified by depressive symptoms and randomized to either moderate-intensity AE ($n = 26$) or light-intensity stretching ($n = 25$) that was completed 3 times per week for 45 min. Depressive symptoms, aerobic fitness, and ERPs were assessed pre and post intervention. **RESULTS:** Compared to stretching, the AE condition resulted in pre-to-post reductions in depressive symptoms ($p < .01$; $\eta_p^2 = 0.17$), while both conditions experienced pre-to-post increases in aerobic fitness ($p < .01$, $\eta_p^2 = 0.14$). Although no mean-level treatment changes in RewP or ERN were observed, there was a relationship between pre-to-post change in ERN and change in depressive symptoms ($r = -0.41$, $p < .01$), indicating a decrease in ERN was related to larger pre-to-post reductions in depressive symptoms. At baseline, a larger ERN was predictive of greater pre-to-post change in depressive symptoms, ($p < .05$, OR = 1.27), while there was a trend for baseline RewP as a predictor of treatment response ($p = .07$, OR = 1.24). **CONCLUSION:** These findings provide support for the antidepressant effects of AE and highlight ERN as a potential neurobiological marker that predicts and tracks the antidepressant response. Future research incorporating predictors of response and examining neurobiological mechanisms may help advance understanding of the effects of exercise as a treatment for depression.

2506 May 29 11:15 AM - 11:30 AM

Walking Away Depression And Anxiety: Results From The Irish Longitudinal Study On Ageing

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Walking is an accessible physical activity that is promoted as a best buy for public health. However, few prospective studies have examined the association between walking and depression, and none have investigated Generalized Anxiety Disorder (GAD).

PURPOSE: This study examined associations between walking and incident depression and incident GAD among community-dwelling adults aged ≥50 years in the Republic of Ireland.

METHODS: Participants completed the short form International Physical Activity Questionnaire at baseline and Center for Epidemiological Studies Depression Scale (CES-D) and CIDI-short form at two-year follow-up. Walking doses were categorised based on reported minutes of walking in the prior seven days (None=0 minutes/week; Low=1-209 minutes/week; Moderate=210-419 minutes/week; High=420+ minutes/week). Logistic regression, weighted relative to age, sex, and education and adjusted for age, sex, waist circumference, social class, smoking, moderate and vigorous physical activity, comorbidities, and physical limitations, quantified associations between walking and incident depression (N=4,146; 55.4% female) and GAD (N=3,326; 52.6% female) in participants without depression (CES-D≥16) or GAD (abbreviated Penn State Worry Questionnaire ≥23) at baseline. Likelihood ratio tests examined covariate significance.

RESULTS: Incidence of depression and GAD were 5.0% (n=207) and 0.9% (n=29), respectively. Compared to people who reported no walking, odds (odds ratio, 95% confidence interval) of incident depression were lower among those engaging in Low (0.908, 0.876-0.940; p<0.001), Moderate (0.893, 0.858-0.929; p<0.001), and High (0.897, 0.865-0.931; p<0.001) walking doses. Odds of incident GAD were also lower among those engaging in Low (0.411, 0.335-0.406; p<0.001), Moderate (0.710, 0.6432-0.786; p<0.001), and High (0.614, 0.555-0.678; p<0.001) walking doses. All covariates significantly contributed to the models (p<0.001).

Conclusion: Among a large, nationally representative sample of older adults, self-reported walking was associated with lower odds of incident depression and GAD independent of moderate and vigorous intensity physical activity. These findings support policy and national guidelines in promoting walking for its mental health benefits.

E-13 Clinical Case Slide - Knee II

Friday, May 29, 2020, 9:30 AM - 11:10 AM

Room: CC-2020

2507 Chair: Mark R. Hutchinson, FACSM. *University of Illinois, Elmhurst, IL.*

(No relevant relationships reported)

2508 Discussant: Jason Pothast. *University of Florida, Gainesville, FL.*

(No relevant relationships reported)

2509 Discussant: Emily A. Sweeney. *Children's Hospital Colorado, Aurora, CO.*

(No relevant relationships reported)

2510 May 29 9:30 AM - 9:50 AM
Left Knee, Leg Pain After A Hand Cycling Accident

Cameron Fausett, Alexander Sheng. *Shirley Ryan Ability Lab, Chicago, IL.* (Sponsor: Dr. Joseph Ihm, FACSM)

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(No relevant relationships reported)

HISTORY:

A 56 year old female with past medical history of Ehlers-Danlos Syndrome and stroke with residual left hemiparesis sustained a left knee and leg injury while hand cycling. Patient was on a ride when she collided with another cyclist, causing her to fall onto her left leg and thigh. She reported immediate pain, swelling and bruising of her left knee and leg. She presented to her primary care physician a few days later due to persistent pain. X-rays were negative for fracture. Patient had no new numbness or tingling. Her strength in her left lower extremity is minimal due to her stroke but she had noticed more difficulty with transfers due to pain

PHYSICAL EXAMINATION: There was a large area of swelling on the lateral aspect of the distal left thigh that was firm and tender to palpation. Left knee showed no obvious deformity. There was diffuse tenderness to palpation over the medial and lateral knee and proximal tibia. There was no erythema or effusion. She had full knee range of motion in flexion/extension without pain. There was no ligamentous laxity in varus/valgus testing. Anterior and posterior drawer, Lachman's/McMurry's tests were negative. Strength was 1/5 in hip flexion, 0/5 in knee flexion/extension which, per patient report, was baseline. Sensation was intact to light touch.

DIFFERENTIAL DIAGNOSIS: Femoral/tibial fracture, bone contusion, medial/lateral collateral ligament sprain, meniscus injury

TEST AND RESULTS: MRI KNEE LT WO CONTRAST

There is a T2 hyperintense 1.8 x 8.1 cm (transverse by AP) fluid collection layering over the iliotibial band and superficial fascial biceps femoris, with free floating internal fat lobules. Favored to represent a Morel-Lavallee lesion. The menisci, cruciate and medial collateral ligaments, lateral collateral ligamentous complex and extensor mechanism are intact.

FINAL WORKING DIAGNOSIS: Morel-Lavallee lesion of left thigh

TREATMENT AND OUTCOMES:

Patient referred to plastic surgery who recommended percutaneous drainage. She underwent ultrasound guided drainage of 25 ml of serosanguinous fluid. At follow up no further fluid collection seen on ultrasound. Pain was resolving. Patient advised to wear compression garment to assist with healing. Cleared to return to activity as tolerated. Patient seen one year later with resolved symptoms and physical exam findings.

2511 May 29 9:50 AM - 10:10 AM

Mechanical Locking Of The Knee: Retired Rugby Union Player-What Is The Catch?

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(No relevant relationships reported)

HISTORY: A 29-year-old male retired rugby player presented to the sports medicine clinic during an emergency appointment with his right knee acutely locked in full flexion. He was bending into a squat position when he felt something "giving way". He was subsequently unable to stand or straighten his knee. There was no acute trauma reported in relation to his present complaint. There was no pop or swelling of the knee nor pain or discomfort. Previously, he sustained multiple knee injuries, including patella dislocation, patella-femoral tendon and medial collateral ligament injury which resulted in surgery complicated by post-operative intra-articular sepsis and septicemia. He reported a previous dislocation of the patella during rugby matches at school.

PHYSICAL EXAMINATION: Examination revealed a young, healthy male with his right knee in full flexion. Active and passive extension were impossible. There was no obvious swelling or joint line tenderness yet, comprehensive examination of the knee was impossible due to the locked knee. The ankle, hip, lower back found to be normal. Further systemic examination was unremarkable.

DIFFERENTIAL DIAGNOSIS: Displaced meniscus tear. Loose bodies. Osteochondral fragment. Soft tissue mass. **TEST AND RESULTS:** 1) Referral to orthopedic surgeon for urgent consultation. Immediate arthroscopic examination and surgery revealed a large intra-articular effusion. The medial condyle and patella showed cartilage degeneration. A soft tissue mass was discovered in the intercondylar notch causing notch impingement. It was excised and sent for histology. 2) Histological analysis revealed that the mass consisted of pigmented villonodular synovitis

FINAL WORKING DIAGNOSIS: Pigmented villonodular synovitis **TREATMENT AND OUTCOMES:** Started with physiotherapy rehabilitation immediately post-operative and continued for 6 weeks.

Immobilized-partial weight bearing on crutches (2 weeks). Functional return - swimming (2 weeks), jogging (6 weeks). The patient returned to jogging and completed several 10 km events without any discomfort. Yet he experienced marked pain and discomfort in events more than 10 km. He does not partake in any sport with a collision nature. Long term follow-up needed to monitor for growth recurrence.

2512 May 29 10:10 AM - 10:30 AM

Inclusion Of Wearable Sensors In The Treatment Of Patellofemoral Pain

Lindsay Wasserman. *Spaulding National Running Center, Cambridge, MA.* (Sponsor: Irene Davis, FACSM)

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(No relevant relationships reported)

TEXT:

HISTORY: 32 yr. old male with 2 yr history of bilateral (BIL) patellofemoral pain (PFP) which began at the end of a marathon. Symptoms resolved with rest. However, 1 year later, patient was training for another marathon. Speed work was added to this training and the patient alternated between running in cushioned and highly cushioned shoes. PFP developed quickly stopping the patient within 3 miles of running. Knee pain increased up to 8/10 with running, prolonged sitting, stairs and hiking.

PHYSICAL EXAM:

1. Weakness of the hip extensors, abductors and external rotators BIL and core muscles
 2. (+) Obers & Thomas test
 3. (+) Patella compression test with medial patella tenderness BIL
 4. Weakness of the calves, and foot intrinsic BIL
 5. Running Gait Analysis
- Excessive and prolonged foot pronation through stance BIL

Decreased knee flexion at footstrike BIL

Increased hip ADD BIL

R CPD and L ipsilateral trunk lean

Significantly high vertical rates of loading

WORKING DIAGNOSIS

PPF due to increased impact loads during landing, as well as excessive hip ADD, CPD and trunk lean due to poor dynamic control of the foot and hip associated with weakness. These issues of loading and alignment have both been shown to contribute to patellofemoral pain.

TREATMENT:

Pre Gait Retraining

1. Transition to minimal shoes for walking to promote foot/ankle strength
2. Improve foot/ankle function and control with heel raises, balance exercises and plyometrics
3. Increase hip/core strength to improve dynamic alignment

Gait retraining

1. *Wearable sensor feedback*: an accelerometer was attached to the ankle and set to sound an alarm when impact exceeded a set threshold. Initially the threshold was set to 6 gs, but reduced to 5 gs as the patient's ability to control his landings improved
2. *Mirror feedback*: patient was instructed to activate his arch muscles and his gluteals as he ran and was provided mirror feedback to reinforce this. Feedback was gradually faded.

OUTCOME: Patient had 9 pre-gait visits and 12 visits of gait retraining with focus on soft landings and improved alignment. Pt's rates of loading reduced and was able to exhibit reduced hip ADD, CPD, trunk lean, and pronation. The patient is able to run 30 minutes pain free. This case demonstrates the value of using wearable sensor devices to assist in gait retraining.

2513 May 29 10:30 AM - 10:50 AM

Rare Knee Injury In A Hurdler

Ravi M. Shah¹, Marc Breslow², Kaleigh Ann Suhs¹. ¹Advocate Lutheran General Hospital, Park Ridge, IL. ²Illinois Bone and Joint, Niles, IL.

(No relevant relationships reported)

History: 18-year-old female with history of asthma presented to the ED with injury to knee. About 20 minutes prior to arrival she tripped over a hurdle and landed awkwardly. Immediately felt pain to the left knee and left hip and had an obvious left knee deformity. The high school trainer was able to palpate distal pulses. EMS was called and patient was placed in an air splint and transferred to the ED. **Physical Exam:** In the ED Patient had stable vital signs. She had notable deformity to the left knee, left lower limb notably shorter than right and externally rotated with dimpling at the medial knee. Unable to flex at the left knee joint. Tenderness at the left knee joint, no erythema, no swelling. Able to wiggle toes, dorsiflex and plantarflex. L3-S1 Sensation intact. Dorsalis pedis and posterior tibialis pulses 1+ on the left, weaker than the right. Brisk cap refill. **Differential Diagnoses:** 1. Anterior Knee Dislocation with multiple ligamentous damage with vascular compromise. 2. Anterior Knee Dislocation with multiple ligamentous damage without vascular compromise. 3. Anterior Knee Dislocation with minimal ligamentous injury. 4. Hip Fracture/dislocation **Tests and Results:** 1. **XR KNEE LT 2V IMPRESSION:** Complete dislocation at the left knee joint. Distal femur displaced posteriorly with respect to proximal tibia. No fractures noted. No radiopaque foreign body. 2. **XR PELVIS 1V IMPRESSION:** Normal Xray, no fracture, dislocations or deformities noted. 3. **XR KNEE LT 2V Post Reduction IMPRESSION:** Relocation of previously seen dislocation. Normal alignment noted. No fractures. **Final Working Diagnosis:** Anterior Knee Dislocation with multiple ligamentous damage and vascular compromise. **Treatment and Outcome:** 1. Pt underwent a closed reduction in the ED with sedation by ortho and ED physicians. 2. Distal pulses improved and patient was placed in an immobilizer. 3. Vascular surgery was consulted, and a CTA of the lower extremity was done which showed no vascular injury. 4. Pt had external fixation procedure with fluoroscopy for knee stabilization. 5. Pt was followed up with outpatient Ortho. External fixation was removed 2-3 months after the surgery. 6. Pt was placed in an immobilizer and was started with physical therapy. Further management pending orthopedic evaluation and patient progression.

2514 May 29 10:50 AM - 11:10 AM

Knee Injury-Football

Andrea Dockry MD, Michael Baria MD MBA. *Ohio State University Wexner Medical Center, Columbus, OH.*
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(No relevant relationships reported)

HISTORY: A 17 year old high school football offensive lineman with PMH of patellar dislocation, DVT, and heterozygous positive for Factor V Leiden mutation (FVLM) sustained a knee injury after hit in the posterior knee. He experienced immediate swelling and anterior knee pain, worse with weight bearing. He was able to bear weight after this injury but did not resume practice. He denied hearing or feeling a pop. He denied symptoms of instability and paresthesia. Athletic trainer diagnosed him with patellar dislocation and reduced his patella.

PHYSICAL EXAMINATION: Examination in the sports medicine clinic revealed 17 year old male in no acute distress, alert, oriented, with affect appropriate to mood. He was neurovascularly intact in all limbs. His left knee exhibited an effusion. There was no instability on varus or valgus testing. Lachman and patellar apprehension testing was negative. His skin was warm, dry, without erythema, induration, or rashes. There was no calf tenderness or edema.

DIFFERENTIAL DIAGNOSIS:

Patellar Dislocation

ACL rupture

PCL rupture

PLC injury

MCL sprain

TESTS AND RESULTS

MRI L knee without contrast: Moderate joint effusion with synovitis. Remote MCL sprain. Ruptured Baker's cyst. Large osteochondral impaction injury of the medial facet of the patella with disruption of the medial retinaculum and patellofemoral ligament compatible with prior patellar dislocation. Fissuring along the medial facet of the patella. Large osteochondral impaction injury of the lateral femoral condyle with an adjacent osseous fragment. Mild tendinosis of the proximal infrapatellar tendon

FINAL/WORKING DIAGNOSIS

Patellar dislocation in patient with PMH of heterozygous positive FVLM and prior DVT after previous patellar dislocation

TREATMENT AND OUTCOMES

1. Protection, relative rest, ice, compression, and elevation. Early ambulation as tolerated.
 2. Orthopedic surgery referral due to recurrent patellar dislocation
 3. We were unable to immediately get in contact with patient's hematologist, but we spoke to anticoagulation pharmacist who recommended Xarelto 10 mg BID for 14 days for DVT prevention.
 4. Hematology follow up for anticoagulation duration
 5. 50 calf pumps per hour to further reduce risk of recurrent DVT
 6. Patient was educated on the signs of a DVT
- No grant funding was received for this clinical case.

E-14 Clinical Case Slide - Thigh and Leg I

Friday, May 29, 2020, 9:30 AM - 11:10 AM

Room: CC-2022

2515 **Chair:** Aaron Rubin, FACS. *Kaiser Permanente Sports Medicine Program, Fontana, CA.*

(No relevant relationships reported)

2516 **Discussant:** Elizabeth E. Rothe. *Maine Medical Center Sports Medicine, Portland, ME.*

(No relevant relationships reported)

2517 **Discussant:** Holly Benjamin, FACS. *University of Chicago, Chicago, IL.*

(No relevant relationships reported)

2518 May 29 9:30 AM - 9:50 AM
Leg Injury—ATV Accident

Hunter D. Haley, Jason L. Zaremski, FACS. *University of Florida, Gainesville, FL.*

(No relevant relationships reported)

HISTORY: A 16-year-old female presented with a 2 week history of right knee and lower leg pain following an ATV accident. Outside radiographs of the right tibia-fibula, femur, and right foot were reported as normal. She had noted worsening knee pain as well as tingling in her 2nd-5th toes. She was using crutches and non-weight bearing (WB) at presentation.

PHYSICAL EXAMINATION: Exam revealed 3/5 muscle strength with great toe flexion/extension, 3/5 strength with ankle dorsiflexion, and 4/5 strength with plantar flexion, inversion, and eversion. Decreased sensation noted in the right 1st web space as well as the lateral, medial, and posterior lower leg. Tinel's sign positive at fibular head. Lateral proximal tibia and lateral knee joint line tender to palpation. 4/5 strength with painful flexion/extension of knee, but range of motion (ROM) intact. She had 2+ posterior tibialis and dorsalis pedis pulses.

DIFFERENTIAL DIAGNOSIS: 1) Proximal Lateral Tibia bony stress injury 2) Peroneal Neuropathy 3) Intra-articular knee derangement

TEST AND RESULTS: Due to examination, a knee MRI was obtained as was an EMG/Nerve Conduction Study (NCS) to assess the peroneal nerve. MR Knee revealed a non-depressed subchondral fractures of anterior lateral tibial plateau and femoral condyle. Semimembranosus tendon partial tear near tibial insertion. Grade 1 MCL injury. The EMG/NCS revealed a mild, acute-subacute, peroneal neuropathy.

FINAL WORKING DIAGNOSIS: Non-displaced fractures of lateral tibial plateau and lateral femoral condyle with peroneal neuropathia.

TREATMENT AND OUTCOMES: 1) Initial visit- Ankle Foot Orthosis (AFO) and hinge knee brace provided while MRI and EMG/NCS pending. Remained non-WB with crutches. 2) After MRI and EMG/NCS 1 week later- began home passive and active assisted ROM exercises at home. Continued AFO and crutches when not at home. 3) 4 weeks after first evaluation- began toe-touch WB with progression to partial WB as tolerated and also began PT with right knee/ankle stretching and strengthening. Continued to wear AFO to allow for peroneal nerve healing as she progressed to WB as tolerated. 4) 3 months post injury- AFO removed for activities of daily living but advised against exertional impact activity while completing PT.

2519 May 29 9:50 AM - 10:10 AM

Posterior Thigh Injury-Tennis

Dayna Yorks, Monica Rho. *Shirley Ryan AbilityLab/ Northwestern University Feinberg School of Medicine, Chicago, IL.* (Sponsor: Joseph Ihm, MD, FACSM)
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(No relevant relationships reported)

HISTORY: A 76-year-old male was sprinting for the ball one hour into playing singles tennis with a score of 6-6 when he developed acute onset right posterior mid-thigh pain. He denied an audible “pop.” He stopped playing, took ibuprofen, and applied ice upon returning home. He continued to rest and apply ice. Eight days later, he presented to the outpatient sports medicine clinic with improved pain rated 1-2/10, but with worsened swelling and bruising of the right distal posterior thigh. He denied back pain, hip pain, lower extremity numbness, tingling, or weakness. He denied a history of prior hamstring injury. He typically plays doubles tennis three times/week for two hours at a time. This was his second time playing singles this year.

PHYSICAL EXAMINATION: Examination revealed bruising along the popliteal fossa and distal hamstring on the right. There was palpable swelling and mild tenderness along the medial aspect of the posterior mid-thigh on the right. There was no tenderness to palpation of the ischial tuberosity. Knee flexion strength was 4/5 on the right, 5/5 on the left. Gait was non-antalgic. There was pain with resisted right knee flexion at 135 degrees, with lesser discomfort at 90 and 45 degrees. Bilateral lower extremities were warm with intact sensation and +2 patellar and achilles reflexes.

DIFFERENTIAL DIAGNOSIS:

1. Hamstring muscle strain or tear
2. Hamstring tendon avulsion injury
3. Femoral stress fracture
4. Adductor magnus strain
5. Referred pain from the lumbosacral spine, hip joint, or sacroiliac joint
6. Ischial bursitis

TESTS AND RESULTS:

Right Hamstring Ultrasound:

-Hypoechoogenicity of the right semimembranosus muscle consistent with partial tear
-Intramuscular calcification in the area of the tear

MRI Pelvis Without Contrast:

-Suggestion of grade 2 hamstring muscle strain centered near the central myotendinous complex of one of the hamstring tendons, likely the semimembranosus

FINAL WORKING DIAGNOSIS:

Partial tear of the semimembranosus muscle with calcification

TREATMENT AND OUTCOMES:

1. Rest for 2 weeks post-injury.
2. Walk and cycle if tolerated 3-4 weeks post-injury. No tennis.
3. Started physical therapy 4 weeks post-injury for progressive hamstring strengthening and return to tennis and exercise.

2520 May 29 10:10 AM - 10:30 AM

Knee Pain And Swelling - Volleyball Player

Sarah Weinstein, Karin VanBaak. *University of Colorado, Aurora, CO.* (Sponsor: Morteza Khodae, FACSM)
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(No relevant relationships reported)

History:

An 18 year old volleyball player presented with acute swelling and pain of her right knee with associated nausea, vomiting, and subjective fevers. Aside from an abrasion beneath her knee sustained during practice 2 weeks prior, she denied inciting injury or trauma. She complained of knee tightness, but denied feelings of instability or mechanical symptoms. She denied history of skin or soft tissue infections.

Physical exam:

On initial examination, she was febrile to 102°F (38.9°C). She had notably increased warmth and erythema along the lateral aspect of her right knee with tenderness to palpation. She had evidence of a healed abrasion inferior to her right knee without an associated joint effusion. There did appear to be swelling localized to the lateral aspect of her knee. She had full range of motion of her right knee without any indication of ligamentous injury. Her gait was non-antalgic.

Differential diagnosis:

1. Septic prepatellar bursitis
2. Necrotizing infection (cellulitis, myositis, fasciitis)
3. Septic arthritis
4. Morel-Lavallée Lesion
5. Reactive arthritis (gonococcal, chlamydial)

Tests and results:

1. Pertinent labs: White blood cell count 27,000 X 10⁹/L, sodium 127 mEq/L, potassium 3.2 mEq/L
2. Blood cultures negative times 2
3. Lower extremity MRI: Extensive cellulitis and probable phlegmon in subcutaneous fat throughout the distal thigh and knee; myositis in the distal vastus lateralis muscle and biceps femoris
4. Gram stain from I&D right thigh: Positive strep pyogenes (group A)
5. Surgical findings consistent with necrotizing fasciitis.

Final/working diagnosis:

Subacute necrotizing fasciitis

Treatment and outcomes:

1. She was initially treated with broad spectrum antibiotics, subsequently tailored to culture and sensitivities.
2. She underwent three surgical explorations to assess underlying muscle and fascia, including I&D of necrotic tissue along iliotibial tract.
3. With both subjective and objective improvement, she was discharged from the hospital to complete one week of IV Ceftriaxone.
4. She was cleared to start her rehabilitation and progressed to walk/jog/jump for four weeks focusing on quadriceps strengthening.
5. After one week of non contact play and sport specific drills, she returned to full contact practice six weeks after hospital discharge.

2521 May 29 10:30 AM - 10:50 AM

Anterolateral Thigh Pain - Soccer And Ice Hockey

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(No relevant relationships reported)

HISTORY: A 13-year-old male presented with left anterolateral thigh pain that initially occurred during a soccer game. He felt as if he “pulled a muscle” and finished playing the game, but 2 weeks later the pain returned during ice hockey practice. The pain was so severe that he couldn’t finish practice. Over the next two weeks until his clinic visit, the pain kept him out of gym class and ice hockey. His pain worsened as the day went on, while improving with Ibuprofen use.

PHYSICAL EXAMINATION: Antalgic gait, with exacerbation of pain on toe-walking. Tenderness to palpation along the distal aspect of the left greater trochanter. Left hip range of motion limited by pain in flexion and internal rotation. FABER and Stinchfield tests reproduced left lateral thigh pain.

DIFFERENTIAL DIAGNOSIS:

- Iliotibial band syndrome
- Greater trochanteric bursitis
- Slipped Capital Femoral Epiphysis
- Femoroacetabular impingement
- Avulsion fracture

TEST AND RESULTS:

- Left Thigh and Hip Radiographs - Normal
- Left Thigh and Hip MRI - Patchy edema with associated confluent marrow replacing T1 signal within the medial and posterior column of the left acetabulum
- Pelvis CT - 1.8 cm osteolytic lesion within or adjacent to the physis of the left posterior medial acetabulum
- Whole Body Bone Scan - Normal
- ESR and CRP - Normal
- CT Guided Bone Biopsy - Chronic inflammation; Gram stains of tissue and fluid were negative for infection

FINAL WORKING DIAGNOSIS:

- Chronic Nonbacterial Osteomyelitis

TREATMENT AND OUTCOMES:

- Referred to Pediatric Infectious Disease who recommend IV antibiotic treatment due to concern over potential bone destruction from bacterial osteomyelitis and scheduled Ibuprofen
- Patient relapsed after stopping Ibuprofen
- Pediatric Rheumatology evaluated and recommended treatment with Naproxen BID for 2 months, with complete symptom resolution at end of course

- Patient has remained symptom free 7-months post-NSAID treatment and back to playing soccer/ice hockey



2522 May 29 10:50 AM - 11:10 AM
Progressive Post-traumatic Leg Pain In An Ncaa Division 1 Basketball Player

Avinash Sridhar. *University of Virginia, Charlottesville, VA.*
 (Sponsor: John M. MacKnight, MD, FACSM)
 (No relevant relationships reported)

HISTORY:

A 19-year-old male NCAA Division 1 college basketball player sustained two blunt force injuries to the anterior portion of his right thigh during practice. This area was struck by an opponent's knee in both events. He had a similar injury to this area the week prior but otherwise has had no previous issues with his right lower extremity. After the second collision, he continued to participate in drills until his pain progressed to the point when he became unable to bear weight on his right leg over the course of 1.5 hours. He was then taken to the emergency department for further evaluation.

PHYSICAL EXAMINATION: Height: 6'11"

Examination of the right lower extremity in the emergency department was remarkable for significant swelling of the anterior portion of the right thigh. The anterior compartment was exquisitely tender and firm with minimal compression. The medial and posterior compartments were non-tender and easily compressible. The right foot was warm and well-perfused with 2+ dorsalis pedis and posterior tibial pulses. Sensation was intact to light touch in the L4-S1 nerve distribution. He was able to dorsiflex and plantarflex his right foot but was unable to extend his knee. He was not able to ambulate and his pain worsened over the next hour.

DIFFERENTIAL DIAGNOSIS:

1. Right anterior thigh hematoma
2. Anterior thigh compartment syndrome
3. Quadriceps femoris muscle group tear

TESTS AND RESULTS:

- CBC: Hb 12.6, Hct 36.8
- CMP: CO2 19, BUN 27- PT 12.1, PTT 29.6

- Ultrasound right thigh: Large heterogeneous subcutaneous anterior thigh hematoma measuring 27 x 6 cm. No flow is visualized within. Visualized vasculature is patent on color Doppler imaging. Patent middle right femoral vein and artery

FINAL/WORKING DIAGNOSIS: Right anterior thigh hematoma with developing anterior compartment syndrome, query underlying bleeding diathesis

TREATMENT AND OUTCOMES:

1. Urgent surgical treatment in the operating room for right anterior thigh compartment release with irrigation and evacuation of hematoma
2. Post-operative care and knee immobilizer
3. Touch-down weight bearing of right lower extremity
4. Indomethacin 25 mg PO TID for heterotopic ossification prophylaxis
5. Gradual return to sport after medical and surgical clearance

E-24 Free Communication/Poster - Health and Wellness

Friday, May 29, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

2540 Board #1 May 29 9:30 AM - 11:00 AM

Run Out Blood Pressure: The Correlation Between Physical Activity And Blood Pressure And Sit Time

Megan L. Conner, Constance Haynes, Jonathan Williams, Larissa Boyd, Melissa Powers. *University of Central Oklahoma, Edmond, OK.*

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(No relevant relationships reported)

The implementation of the new American College of Cardiology (ACC) and American Heart Association (AHA) blood pressure guidelines has added to the increase in the number of individuals classified as hypertensive. Increasing physical activity and reducing sit-time is recommended to combat hypertension. **PURPOSE:** The purpose of this study was to evaluate the correlation between physical activity (PA) and sit-time (ST) and blood pressure (BP) in university employees. It was hypothesized that there would be a significant inverse relationship between PA and BP and a direct relationship between ST and BP. **METHODS:** In this study the participants were faculty and staff members of a regional university in the Midwest, that were included in a larger workplace intervention ($N=51$). Baseline data was used for this study. The participants completed a self-reported physical activity questionnaire (The International Physical Activity Questionnaire [IPAQ]) to determine their amount of PA engagement ($\text{met}/\text{min}/\text{wk}^{-1}$) and ST. Both systolic and diastolic resting BP (mmHg) were assessed using a stethoscope and sphygmomanometer following at least five minutes of sitting. **RESULTS:** There was a non-significant relationship between PA and BP ($p>0.05$) and ST and BP ($p>0.05$) when analyzed with a Pearson's Product Moment Correlation. To further analyze these results, the participants were classified based on BP as normal ($<120/<80$; $n = 23$), pre-hypertensive ($120-129/<80$; $n = 6$), or hypertensive ($>130/>80$; $n = 22$). However, due to a low amount of participants classified as prehypertensive, only participants classified as normal and hypertensive were analyzed. Differences in PA and ST between the groups based on BP classification were also non-significant ($p>0.05$) when analyzed with an independent t -test. **CONCLUSION:** Self-reported PA and ST were not related to BP in this study; however, other research reports significant correlations. The participants in this study were a part of a larger study including a workplace intervention to decrease sedentary time. This could explain the difference between the results from this study and those from previous studies. Future studies should focus on the relationship between PA and ST and BP in a variety of groups with diverse backgrounds.

2541 Board #2 May 29 9:30 AM - 11:00 AM

A New Model For Introducing Undergraduate Students To Energy Budgets

Marshall D. McCue, Laura Arbutina, John R.B. Lighton. *Sable Systems International, North Las Vegas, NV.*

(No relevant relationships reported)

PURPOSE: Teaching the fundamental concepts of human bioenergetics and energy expenditure (EE) to students can be difficult because the units of measure (e.g., joules/hour, watts, calories, Calories, METS, etc.) are often abstract and intangible. Moreover, the calibration and proper use of respirometry equipment needed to make accurate metabolic measurements can be a college course in itself. We sought to address these issues by developing an easy-to-use, self-calibrating respirometry system that students with no previous experience in respirometry could use to measure their own energy expenditure (in terms of Cal/day) in real time and model their energy budgets.

METHODS: The system was then given to a sophomore biology student and who was asked to make predictions about her EE during various activities (i.e., sitting, standing, reading, texting, cycling, and crunches) and then make actual measurements to test those predictions. The student used the device during the subsequent four weeks to examine her predictions.

RESULTS: Data supported her hypothesis that the EE would not differ between measurement modalities; paired-tests of EE collected using a facemask (5-min.) vs. a whole-body respirometry tent (10-min) showed no significant differences while sitting ($p=0.487$), laying ($df=18$, $p=0.370$), or reading ($p=0.160$). Contrary to her hypothesis there were no differences in EE while resting at different body positions (laying vs. sitting; $df=38$, $p=0.968$), or seated while reading vs. texting ($df=18$; $p=0.414$). Her hypothesis that standing caused higher EE was higher (~15%) than sitting ($df=18$, $p=0.033$) was supported. The two forms of exercise she compared (crunches vs. cycling) revealed much larger (3.4-fold) differences in EE than she predicted ($df=18$, $p<0.001$).

CONCLUSIONS:

Our next step will be to develop student teaching modules so that students working in small groups can practice experimental design and hypothesis testing to learn more about modeling their own energy budgets.

2542 Board #3 May 29 9:30 AM - 11:00 AM

Health And Lifestyle Behaviors Of International Masters World Cup Field Hockey Athletes

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(No relevant relationships reported)

The number of Masters Athletes competing worldwide has increased, yet little research on the health and lifestyle behaviors of Masters Athletes participating in team sports has been undertaken. **PURPOSE:** The purpose of this study was to examine the health and lifestyle behaviors of international Masters Field Hockey Athletes competing in the Masters Field Hockey World Cup in Barcelona, Spain in 2018. **METHODS:** Participants were 488 athletes (301 women, 186 men) from 26 countries, 35 to 76 years of age (51.4±7.9 years). Participants completed the 42-item Health and Wellbeing of Master's Field Hockey Athletes Survey, which asked about demographics, health status, and lifestyle behaviors. **RESULTS:** Mean body mass index was 24.2±2.9 kg/m² (range = 15.2 to 35.3 kg/m²). Participants rated their health as "very good" or "excellent" (86.9%), had no major health conditions (64.8%), medication use (84.2%), or injuries (51.0%). Perceived stress was rated as "rare" or "not at all" by 57.9% of participants. Participants consumed ≥2 fruits (65.3%) and ≥2 vegetables per day (78.3%), daily breakfast (68%), ≤1 sugar-sweetened beverage (80.1%) per day, ≥7 cups of water (43.0%) per day, and ≤2 alcoholic beverages per week (54.9%). Only 5.3% of participants reported using tobacco products. Participants reported ≥7 hours of sleep per night (68.4%), with no or little restless sleep (48.0%). Just under half of participants reported sitting ≥5 hours per day (45.3%). Exercise frequency at ≥3 days per week and ≥30 minutes per session was cited by 92.9% and 93.5% of the sample, respectively. Aside from field hockey, predominant activities included: jogging (62.9%), walking (56.1%), high intensity training (41.4%), and cycling (29.7%). **CONCLUSION:** While there are areas for improvement, Masters Field Hockey Athletes generally practice lifestyle behaviors conducive to positive health.

2543 Board #4 May 29 9:30 AM - 11:00 AM

Perceived Daily Wellness Responses Following Games During A Professional American Football Season

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Reported Relationships: E.C. Freese: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc...

Purpose: The purpose of this study was to investigate the perceptual wellness responses and time course of recovery following an American football game and if those responses vary across a professional American football season. **Methods:** Twenty-four male, American football players (25.9 ± 2.7 y) were recruited to complete a standardized daily wellness survey the day before each game (GD-1), game day (GD) and each day following game day (GD+1, GD+2, GD+3, GD+4, and GD+5) during the seven week season. The surveys were obtained each morning via automated text messages to assess perceptions of energy, motivation, stress, and soreness utilizing 10-point Likert scales. A composite daily wellness score (DWS) was created where a higher score indicated better overall wellness. Eight players met the minimum survey response rate set at 70% and were therefore included in the study. All variables were used to determine the time course of perceptual recovery following a game, as well as cumulative recovery across the season. A mixed-effects model was used to measure changes in all markers including the DWS. **Results:** There were no significant interactions for day x week ($p > 0.05$) across the season for the DWS or individual wellness markers. DWS was significantly higher on GD-1 (28.4 ± 6.1; $p < 0.01$) than GD+1, +2, +4, +5 (23.0 ± 6.0; 25.5 ± 6.3; 26.3 ± 6.2; 27.0 ± 6.1, respectively), but lower than GD (31.5 ± 4.1) and similar to GD+3 (26.8 ± 5.5; $p > 0.05$). Perceived energy was significantly lower on GD+1, +3, +4 (5.6 ± 1.9; 5.9 ± 1.9; 5.9 ± 2.1, respectively) compared to GD-1 (6.9 ± 2.1; $p < 0.05$). Perceived motivation was significantly higher on GD (8.5 ± 1.6) compared to GD-1 (7.2 ± 1.9; $p < 0.05$), but then declined on GD+1 (5.3 ± 2.4) and GD+2 (5.7 ± 2.3). Perceived muscle soreness was the lowest on GD (1.9 ± SD) and significantly higher the days following (GD+1: 5.4 ± 2.1; GD +2: 4.1 ± 2.2; GD+4 3.8 ± 1.8; and GD +5: 3.8 ± 1.9) compared to GD-1 (3.0

± 1.6; $p < 0.05$). There was no daily effect on perceived stress ($p > 0.05$). **Conclusions:** Perceptual wellness markers are negatively impacted immediately after and days following a professional football game, and those affects remained consistent across the season. The DWS and individual markers of perceptual wellness may take up to 5 days to return to pregame levels and should be considered when planning player training.

2544 Board #5 May 29 9:30 AM - 11:00 AM

Algorithms, Filters And Corrections Compound Differences Between Multiple Lifestyle Physical Activity Estimates

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(No relevant relationships reported)

Physical activity (PA) can be objectively and conveniently measured using accelerometers. The use of wrist-worn devices has grown dramatically over the past decade, becoming the preferred choice in many recreational, clinical and research applications. ActiGraph is a leading company in this field, wherein data from accelerometers can be analyzed in their ActiLife software. However, the effects of multiple algorithms, filters and corrections on PA outcomes are not always clear. **PURPOSE:** To examine how lifestyle PA estimates are impacted by multiple scoring methods in a commercial software platform. **METHODS:** We collected lifestyle wrist-worn accelerometer data (ActiGraph GT3X+) from 132 adults with a range of activity levels with and without chronic pain (low back pain, fibromyalgia, pain-free). We analyzed accelerations in ActiLife using multiple algorithms, with and without the wrist correction and proprietary low-frequency extension (LFE) across four PA domains: total EE (METs), active EE (kCal), MVPA time, and steps. Accelerometer and self-reported (International Physical Activity Questionnaire) PA outcomes were compared. **RESULTS:** PA estimates differed notably across most algorithms with highly variable, but typically large effect sizes ($p < 0.05$, median % change = 33.5% [6.9% – 62.6%], $d = 1.04$ [0.60 – 1.45]). The wrist correction reduced PA estimates across all outcomes ($p < 0.05$, % change = -15.0% [-3.9% – -31.8%], $d = 0.56$ [0.31 – 0.93]) save steps and one daily EE algorithm (no change). The LFE increased steps considerably ($p < 0.05$, % change = 72.3%, $d = 1.44$) yet had little effect across all other outcomes ($p < 0.05$, % change = 4.7% [2.9% – 4.9%], $d = 0.13$ [0.11 – 0.14]). Differences were always greater when multiple factors were considered (% change = 89.2% [80.7% – 201.3%]). Correlations between objective and self-reported PA were typically moderate ($p = 0.55$ [0.36 – 0.88]), were further reduced by the wrist correction, and affected minimally by the LFE. **CONCLUSIONS:** Previously-validated scoring methods are not necessarily interchangeable. The wrist correction and LFE inconsistently inflate PA estimates, with variability increasing when multiple factors are considered. Researchers should consistently report detailed methodology to optimize comparisons across studies and to normative guidelines.

2545 Board #6 May 29 9:30 AM - 11:00 AM

Fitness Levels In College-aged Females: A 20-year Follow-up

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(No relevant relationships reported)

PURPOSE: A decline in fitness levels of both children and young adults has been reported over the last two decades. The purpose of this study was to determine to what extent this claim is true, and which components of fitness may be involved in this decline.

METHODS: Researchers examined several components of fitness, including estimated cardiorespiratory fitness, muscular fitness, percent body fat, and body mass index (BMI) during 1999. Subjects for the original study were 72 college females enrolled in general education fitness classes. The assessment was repeated at the same university in 2019 with 69 college females, also enrolled in general education fitness classes. During both time periods, students were assessed at the beginning of the course using the Queens College Step Test to estimate cardiorespiratory fitness, the YMCA bench press test to assess muscular fitness, and 3-site skinfolds to estimate percent body fat. Height and weight were measured to calculate BMI. Data were analyzed using independent measures t-tests to evaluate differences between the 1999 and 2019 groups. Participants were also categorized as normal weight/overweight and obese/nonobese, and Pearson chi-square evaluated significant differences in those categories from 1999 to 2019.

RESULTS: Participants were significantly higher in percent fat (25.45 ± 0.72%) in 2019 than in 1999 (22.97 ± 0.71%; $p = 0.0149$). Performance on the YMCA bench press test decreased in 2019 (11.78 ± 9.48 reps) compared with the same test in 1999 (23.7 ± 9.37 reps; $p < 0.0001$). BMI was statistically the same from 1999 to 2019 (22.79 ±

0.43 kg/m² in 1999 vs. 22.90 ± 0.44 in 2019; p=0.86), as was estimated VO₂ max in ml/kg/min (35.72 ± 0.42 in 1999 vs. 36.20 ± 0.43 in 2019; p=0.4258). Although BMI was statistically the same during both years, the percent of students who were obese (BMI > 30) increased from 2 out of 72 (2.78%) in 1999 to 5 out of 69 (7.24%) in 2019. According to the Pearson chi-square test, this was not a significant difference in BMI classification (p=0.2682).

CONCLUSIONS: According to this study, college females have increased in percent body fat and decreased in muscular fitness in the past 20 years.

2546 Board #7 May 29 9:30 AM - 11:00 AM
Cross-sectional And Longitudinal Relationships
Between Physical Fitness And Health Status Among
University Students

Yuichi Nakahara-Gondoh¹, Kenji Tsunoda², Takahiro Ikeda¹, Toshihiko Fujimoto³. ¹Fukuoka Prefectural University, Fukuoka, Japan. ²Yamaguchi Prefectural University, Yamaguchi, Japan. ³Tohoku University, Sendai, Japan.

(No relevant relationships reported)

Since physical fitness (PF) is based on past lifestyle that include physical activity (PA), current PF could reflect health status. Although previous studies have identified a positive relationship between health status and PA and among university students, the relationship with PF is unclear. **PURPOSE:** The present study aimed to determine whether the PF level of university students is related to health status independently of PA, by cross-sectional and one-year follow-up designs. **METHODS:** The study surveyed 245 freshman university students in April 2018 (immediately after university admission) and February 2019 (end of second semester). We examine PF by having the students complete physical fitness test were standardized by the Japanese Ministry of Education. Sleep sufficiency, happiness, and subjective health status were assessed using numeric rating scales from 0 to 10. Sleep duration and the CES-D were also assessed. We examined cross-sectional correlations by assessing partial correlations with adjustments for gender, PA (IPAQ-short), living arrangements, and economic status. Longitudinal data were assessed using two-way repeated ANCOVA with the above adjustments. Students were considered to have high, medium, and low (n = 61, 94, and 72, respectively) PF levels based on standardized scores derived from the physical performance tests. **RESULTS:** PF correlated with sleep sufficiency (partial r = 0.129), happiness (partial r = 0.180), and subjective health status (partial r = 0.247), independently of PA. Health indexes did not interact in the longitudinal design. However, a significant group effect was identified in sleep sufficiency, happiness, and subjective health status; students with higher PF were more likely to have to better health status than others during the followup period. The adjusted mean baseline and followup values for subjective health status remained significantly lower in the group with low PF than in the groups with medium and high PF (baseline: 5.9 vs. 6.7 and 7.3, respectively; followup: 5.1 vs. 6.2 and 6.9, respectively). **CONCLUSIONS:** University students with higher PF had better health status than others during a followup period. Maintaining higher PF could have positive health benefits for university students independently of PA. Supported by JSPS KAKENHI Grant Number 18K10931.

2547 Board #8 May 29 9:30 AM - 11:00 AM
Long-term Participation In Four Different Sports
(Aerobics, Tai-chi, Track And Field And Diabolo): A
Comparison Of Fitness Measures

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(No relevant relationships reported)

It is well-known that long-term participation in sports is beneficial for physical fitness, especially for older adults. However, little is known about potential differences in fitness effects with long-term participation in different common sports.

Purpose: This study investigated the fitness effects of long-term participation in four popular sports (Aerobics, Tai-chi, Diabolo, and Track and Field) in middle-aged females.

Methods: One hundred and fifteen female subjects (aged 45-54 years old), who were selected to be National Sports Instructors (NSI) in China (2016 and 2017), participated in this study. All of them had been performing their specific sports specialty for at least nine years, which was also the basic requirement to become a NSI. Sports included Aerobics (N=30), Tai-chi (N=28), Diabolo (N=29), and Track and Field (N=28).

Measures included height, weight, body composition, waist-hip ratio, resting heart rate, blood pressure, vital capacity, grip strength, flexibility (sit and reach), reaction time, and balance (time on one-leg standing with eyes closed). Data were analyzed using one-way analysis of variance (ANOVA), and Fisher's LSD test was used for post hoc comparisons of significant differences.

Results: As shown in Table 1, vital capacity and flexibility were greater (*P<0.05) in the Aerobics group versus other groups. Lean body mass was greater in the Tai-chi group versus other groups (**P<0.05). No significant differences between groups existed for the other variables.

	Aerobics (N=30)	Tai-chi (N=28)	Diabolo (N=29)	Track and Field (N=28)
Vital capacity (mL)	3072.80± 659.77*	2645.77± 576.38	2483.35± 244.05	2957.46± 659.99
Flexibility (cm)	24.41± 8.72*	20.73± 8.25	16.93± 7.91	16.33± 7.24
Lean body mass (kg)	58.51± 7.06	61.87± 8.34**	61.06± 7.15	65.20± 6.43

Conclusions: Several different fitness outcomes differed by sports participation in female participants. Those participating in aerobics had the greatest vital capacity and flexibility, while those participating in Tai-chi had the greater lean body mass. Future research should continue to explore fitness outcomes in these sports. This is especially true for diabolo, in which there is limited research compared to the other sports.

2548 Board #9 May 29 9:30 AM - 11:00 AM
The Effects Of Aerobic And/Or Resistance Training On
The Sf-36 Health Survey From Stride-AT/RT

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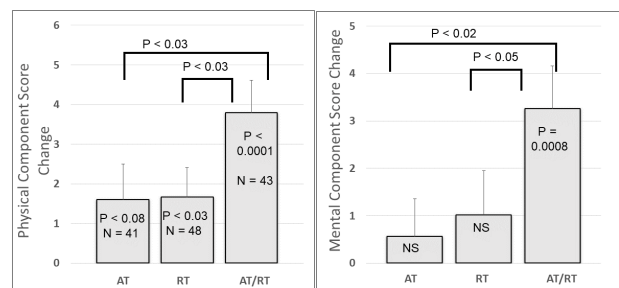
(No relevant relationships reported)

Purpose. While exercise has numerous health benefits, the optimal exercise mode is unknown. Many organizations recommend aerobic training (AT) and resistance training (RT), yet few studies have compared their effects alone or in combination. The purpose of this study, as part of the Studies Targeting Risk Reduction Interventions through Defined Exercise - AT/RT (STRIDE AT/RT), was to compare the effects of AT, RT and the combination of the complete AT and complete RT training programs on the Physical and Mental Component scores from the SF-36 Health Survey.

Methods. Subjects were 18-70 y, sedentary, overweight/obese with moderate dyslipidemia. Of those randomized, 74% or 155 subjects completed the 8-month intervention. A subset of participants (132) had complete SF-36 data pre and post training. The randomized training groups were: 1) Resistance Training (RT) (3 d/wk, 3 sets/day, 8-12 rep/set) for 8 RT exercises = 72 sets/wk (~ 135-160 min/wk), 2) Aerobic Training (AT), [equivalent to ~12 miles/wk at 65-80% peak VO₂], required an average of 133 min/wk, 3) Aerobic Training + Resistance Training (AT/RT = complete RT + complete AT).

Results. Figures show intervention effects on change in the Physical and Mental Component scores from the SF-36 questionnaire. The p-values inside each bar indicate significant within group changes. The bars with p-values connecting 2 groups show a significant difference between groups.

Summary. All exercise groups experienced significant improvements in Physical Component score. However, only the AT/RT group had a significant improvement in the Mental Component score. Further, the AT/RT group experienced significantly greater improvements in both component scores compared to the AT and RT alone groups. Finally, the AT/RT group appeared to have an additive response (i.e., AT/RT = AT + RT) for the Physical Component score; whereas, the improvement in the mental component score suggests a synergistic (greater than additive) response.



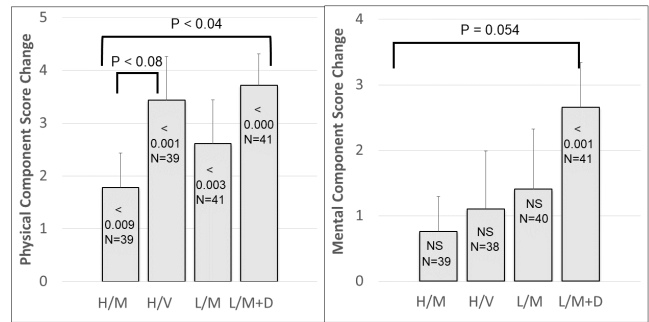
2549 Board #10 May 29 9:30 AM - 11:00 AM
Motivation Of Student Athletes: A Self Determination Theory Perspective

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 (No relevant relationships reported)

PURPOSE: To examine student athletes' motivation toward sport participation, and to compare male and female student athletes' motivation.
METHODS: The sample consisted of 290 athletes (167 males, 123 females), university students of sport and physical education. In order to assess student athletes' motivation, the Sport Motivation Scale (SMS) was used (Pelletier et al. 1995, 2012, 2013). The scale consists of 28 items assigned to seven subscales: amotivation, extrinsic motivation (external regulation, introjected regulation, identified regulation), and intrinsic motivation (to know, to accomplish and to experience stimulation). Descriptive statistics (means and standard deviations) were calculated. Cronbach's alpha was used to estimate reliability and internal consistency of the scales. In order to compare the mean values of the subscales (males and females), ANOVA with repeated measures was applied. The assumed significance level was set at $\alpha < .05$.
RESULTS: The Cronbach alpha values were high for all the subscales (SMS .87; AMS .90). Significant differences between males and females motivation toward sport participation were found for intrinsic motivation to accomplish (males $M=5.71$, $SD=1.20$; females $M=6.24$, $SD=.82$). There were no statistically significant differences in amotivation (males $M=2.32$, $SD=1.22$; females $M=2.08$, $SD=1.17$), external regulation (males $M=3.67$, $SD=1.50$; females $M=3.42$, $SD=1.48$), introjected regulation (males $M=5.48$, $SD=1.20$; females $M=5.29$, $SD=1.23$), identified regulation (males $M=4.90$, $SD=1.17$; females $M=5.13$, $SD=1.09$), intrinsic motivation to know (males $M=5.38$, $SD=1.29$; females $M=5.80$, $SD=1.00$), intrinsic motivation to experience stimulation (males $M=5.94$, $SD=1.02$; females $M=6.21$, $SD=.75$).
CONCLUSIONS: Results revealed that female student athletes' motivation toward sport participation showed higher levels of intrinsic motivation to accomplish than males. The mean values for amotivation subscale were significantly lower than for other subscales.

2550 Board #11 May 29 9:30 AM - 11:00 AM
Effects Of Exercise Training Alone Vs A Combined Exercise/Diet Intervention On The Sf-36 Health Survey
 Lorraine G. Elliott-Penry¹, Katherine A. Collins¹, Cris A. Slentz¹, Leslie H. Willis¹, Lori A. Bateman², Lucy W. Piner¹, Kim M. Huffman¹, William E. Kraus, FACSM¹. ¹Duke Univ., Durham, NC. ²Duke University, Durham, NC. (Sponsor: William E. Kraus, FACSM)
 (No relevant relationships reported)

Purpose. Although the Diabetes Prevention Program (DPP) established diet, exercise and weight loss as the 'gold standard' in preventive therapy for diabetes, the contribution of an exercise-only interventions on quality of life is not known. The purpose of this study, part of the Studies Targeting Risk Reduction Interventions through Defined Exercise - Prediabetes (STRIDE PD), was to compare the effects of different exercise groups vs DPP-like intervention on change in the Physical and Mental Component scores from the SF-36 Health Survey.
Methods. Subjects were healthy 45-75 y, sedentary, overweight/obese, with impaired fasting glucose, randomized as follows: 1) Low Amount/Moderate Intensity (L/M) - equivalent to exercising at 50% of VO_2 peak to expend 10 kcal per Kg of body wt per wk; 2) High Amount/Moderate Intensity (H/M) (16 kcal/kg/wk @ 50%); 3) High Amount/Vigorous Intensity (H/V) (16 kcal/kg/wk at 75% of VO_2 peak) and 4) Low Amt/Mod Intensity exercise + Diet/weight loss (L/M + D). The SF-36® Health Survey was administered pre and post intervention. This survey measures 8 domains of health, 4 combine to provide a Physical Component score and the other 4 combine for a Mental Component score.
Results. The figures below show the effects of each group on change in the Physical and Mental Component scores. The p-values inside each bar indicate significant within group changes. The lines with p-values above and connecting two groups show a significant difference between groups.
Summary. All intervention groups experienced highly significant improvements in the Physical Component score. However, only the Low/Mod/Diet group had a significant improvement in the Mental Component score. While these data need to be replicated, the clinical significance of these results suggest that many amounts/intensities of aerobic exercise training can improve self-rated physical function scores, and that exercise plus a weight loss diet improves mental and physical scores.



2551 Board #12 May 29 9:30 AM - 11:00 AM
Functional Movement And Subjective Well-being Assessments Of Female Track And Field Athletes: Pre- And Post-indoor Season

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Track and Field (TF) is a sport that includes short- and long-distance running events and field events. Because of these diverse events, TF athletes employ a wide range of energy system demands and specific skills/techniques during performances.
PURPOSE: To evaluate functional movements and subjective well-being of NCAA Division I, TF female athletes when measured before and after a 7-week indoor season to identify the benefits and detriments of competing during an indoor season (January to March).
METHODS: Participants completed pre- and post-season measures: the Functional Movement Screen (FMS; Cook, 2010), the Y-Balance Test (YBT; Plisky et al., 2009), Physical Activity Enjoyment Scale-Trait (PACES-T; Kendzierski & DeCarlo, 1991), and the Satisfaction with Life Scale (SWLS; Diener et al., 1985). Athletes ($N=21$ completed all testing; 3 dropped out due to injury; Mean age \pm S.D., 20.0 ± 1.4 yrs) were grouped by event: throwers (shot put, weight throw), distance runners, and other competitors (sprinters, hurdlers, and jumpers). For all dependent variables, 3 (Group) by 2 (Time) ANOVAs and Pearson correlations were calculated.
RESULTS: Although there were no group differences, athletes' total FMS scores improved significantly pre- (14.8 ± 2.5) to post-season (15.6 ± 2.2 ; $p = .03$). Scores from each pre- to post-season FMS test were analyzed using Wilcoxon signed-rank tests. Scores for the Deep Squat ($p = .025$) and Right Shoulder Mobility ($p = .007$) improved significantly. However, scores for the Left Hurdle Step (hip flexion and extension; $p = .034$) decreased over the indoor season. The YBT posteromedial reach distance was significantly greater when pushing with the left leg ($p < .05$) perhaps reflecting the right-leg dominance for most athletes (83% were right leg dominant). The relatively high scores on PACES-T and SWLS did not change after the season (post-season: 102.5 ± 17.4 ; 27.1 ± 5.1 , respectively). PACES-T was related to SWLS both at pre-season ($r = .50$) and post-season ($r = .60$; $p < .01$).
CONCLUSIONS: In support of the physiological and psychological benefits of college TF participation, these Division I athletes improved their total FMS scores pre- to post-season. They also reported high exercise enjoyment and satisfaction with life scores despite participating in a demanding indoor, competitive season.

2552 Board #13 May 29 9:30 AM - 11:00 AM
Relationships Among Motivation Type, Academic Achievement, And College Athlete Status

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Motivations to attend college differ between college athletes and non-athletes. Previous literature indicates a relationship between motivation type and college student GPA. However, the role of athlete status in this relationship has not been explored.
PURPOSE: To evaluate the differences in GPA 1) between student-athletes and non-athletes and 2) among motivation types to attend college. In addition, this study aimed to 3) investigate motivation to attend college as a moderating variable in the relationship between student-athlete status and GPA.
METHODS: Participants were recruited through a health-related college and athletic program at a NCAA

Division II Liberal Arts College in the Midwest and were asked to complete an online survey (n=209). Multiple demographic variables were assessed. In addition, students were asked to report athlete status (current athlete, yes/no), college cumulative GPA (4.0 scale), and to complete a modified version of the American Motivation Scale College Version (AMS-C). A primary motivation type was identified based on the AMS-C results. Motivation types with small sample sizes were combined together. Means, standard deviations, and percentages were calculated for all variables of interest. Independent samples t-test, ANOVA and ANCOVA were used to assess purposes 1, 2, and 3, respectively. **RESULTS:** The majority of students were freshmen (33.5%), female (75.1%), and white (90.4%). On average, students reported a college cumulative GPA of 3.42±0.43. Most students identified as extrinsically motivated (82%), 6% identified as intrinsically motivated, 12% identified as both, and no participants identified as amotivated. No differences were found in GPA between athletes (3.43±0.42) and non-athletes (3.41±0.44), p=0.70. No differences were found in GPA among motivation types, p=0.751. The interaction between motivation type and athlete status did not significantly relate to GPA (p=0.447). **CONCLUSION:** Athlete status and motivation type do not relate to self-reported college student GPA. Future research should investigate these relationships in a more heterogeneous sample. Further, it is important to continue to investigate extrinsic motivation in college students and its influence on academic success.

2553 Board #14 May 29 9:30 AM - 11:00 AM
Relationship Between Physical Activity Intensity And Bone Mineral Density In Premenopausal Women

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Osteoporosis has become a global health problem. Mechanical loading during physical activity (PA) and exercise increases and maintains bone mass and strength. Quantitative PA measures are needed to identify the functional loading intensity that is beneficial for bone health.

PURPOSE: This study aimed to examine the relationship between PA intensity and bone mineral density (BMD) at the femur and spine in premenopausal women. **METHODS:** The data from 2005–2006 National Health and Nutrition Examination Survey (NHANES) were used for this study. PA was assessed using ActiGraph accelerometers, and bone health metrics were measured through dual-energy X-ray absorptiometry. After removing all missing values, 1446 female participants (Age: 47.61 ± 5.39 yr., Height: 162.01 ± 6.30 cm, Weight: 74.60 ± 16.80 kg, BMI: 28.45 ± 6.30 kg/m²) remained. PA intensity is translated from accelerometer counts per minute (cnts/min) using the thresholds in previous calibration studies, e.g.: Light intensity activity = 100–1951 cnts/min, Moderate–vigorous intensity = 1952–5724 cnts/min, and Vigorous intensity > 5724 cnts/min. The bone health metrics were the BMD of femur neck, trochanter, total femur, and total spine. The correlations between PA intensity with bone health metrics were computed. **RESULTS:** The means and standard deviations of Light intensity = 537.79 ± 85.59 (cnts/min), Moderate-vigorous intensity = 2694.48 ± 340.54 (cnts/min), and Vigorous intensity = 7120.53 ± 1721.06 (cnts/min). A low correlation between overall PA intensity and total BMD (r = 0.01) was found. Correlations between different PA intensities and BMD are summarized below:

Bone Mineral Density	Light Intensity	Moderate–vigorous Intensity	Vigorous Intensity
Femur neck	0.06	-0.07	0.02
Trochanter	0.10	-0.01	0.03
Total femur	0.09	-0.03	0.01
Total spine	0.03	-0.02	-0.09

CONCLUSION: Although low correlation was found between PA intensity and BMD, only no or low correlation was found between BMD and a specific PA intensity. Lack of variabilities within a specific PA intensity may be the reason. More studies are needed to understand the relationship between PA intensity and bone health.

2554 Board #15 May 29 9:30 AM - 11:00 AM
Pre-performance Motivational Music Enhances Force Output Parameters In Healthy Adults

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Music is integral to sport, and is commonly heard during intervals between play, such as a timeout in basketball or as a baseball batter approaches the plate. When competition resumes, music is typically ceased owing to potential distraction. The

ergogenic effect of music during physical performance is well established; the effect of listening prior to activity is not. **PURPOSE:** To test the effect of pre-participation music on force output. **METHODS:** 23 recreationally active adults (7 men, 16 women) between the ages of 18-50 with no history of lower leg injury completed dominant leg flexion and extension using a Cybex HUMAC NORM dynamometer. After a standardized familiarization protocol, subjects completed 3 trials separated by 3 minutes. The experimental conditions were: 1) no preparational music, 2) researcher-selected music, and 3) participant-selected music. The order of trials was randomized and listening conditions were constant: headphones were worn during the silent trial, and volume and duration were identical during music trials. Peak torque (PT) and time to achieve peak torque (TPT) were recorded. Mixed ANOVA with repeated measures tested the difference between preparational music conditions. **RESULTS:** Subjects were 26.7 ± 8.4 years old. Across all trials, PT was 86.0 ± 36.6 ft-lb for extension and 50.5 ± 21.7 ft-lb for flexion; TPT was 1.2 ± 0.7 sec for extension and 0.9 ± 0.6 sec for flexion. Repeated measures ANOVA with a Greenhouse-Geisser correction found a PT difference in the trials for flexion (F=5.077; p=0.016) and extension (F=4.020; p=0.036). In both movements, the highest PT was achieved with participant-selected music and the lowest during the non-music trial. For flexion, post hoc tests using the Bonferroni correction revealed participant-selected music to have significantly higher PT than the non-music trial (p=0.043) and a weak trend for higher PT than the administrator-collected trial (p=0.099). These relationships were less significant in extension. Although the same patterns were reflected in TPT, the differences failed to reach significance for flexion (p=0.125) and extension (p=0.420). **CONCLUSIONS:** These findings support the ergogenic effect of pre-participation music on post-listening performance, and the importance of administrator selection.

2555 Board #16 May 29 9:30 AM - 11:00 AM
Assessment Of Undergraduate Dancers' Health And Fitness Profiles At A Liberal Arts Public University

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 (No relevant relationships reported)

PURPOSE: ACSM is an affiliate of and contributor to “Athletes and the Arts” (A&A). A&A recognizes the demands and needs of performing artists and acknowledges their limited access to prevention and treatment services. Dance is one of the most grueling of the performing arts, particularly in terms of musculoskeletal injuries. This study’s purpose was to assess undergraduate dance students at a regional university in terms of their overall health and fitness profile to identify potential weaknesses that could be addressed through prevention focused efforts. **METHODS:** College dancers (N=22, M age = 19.8 ± 1.3; 18 female, 4 male) underwent a battery of 69 anthropometric, clinical, health, and fitness assessments. Clinical assessments were administered by licensed physical therapists, where all other data were collected and/or supervised by an “ACSM Certified Exercise Physiologist.” The analysis consisted of identifying primary weaknesses (i.e., those affecting >50% of the dancers) within the amalgamated areas. Due to space constraints, areas affecting <=50% of the dancers are minimally reported. **RESULTS:** Flexibility limitations were identified in the ankles (100%), hips (100%), and legs (86.4%), more than the knees (45.5%), x²(1) = 4.97, p=0.03. Weaknesses in strength were observed in the abdominals (90.9%), hips (77.3%), shoulders (77.3%), knees (63.6%), and ankles (54.5%), more than the feet (9.1%), x²(1) = 11.96, p<0.001. Postural misalignments were noticeable in the pelvis (100%), spine (95.5%), feet (77.3%), and shoulders (77.3%), more than the head/neck (50%) and knees (13.6%), x²(2) = 15.3, p<0.001. Specific concerns included weight distribution (100%), balance (90.9%), pelvic tilt (86.4%), iliac crest height (86.4%), shoulder height (86.4%), hamstring ROM (81.8%), thoracic curvature (81.8%), trapezius strength (72.7%), hip abductor strength (68.2%), scapula/shoulder placement (68.2%), knee flexor strength (63.6%), external hip rotator ROM (59.1%), ankle-foot alignment (59.1%), and lumbar curvature (54.5%). **CONCLUSION:** Dance technique classes are insufficient for addressing these problems and may even contribute to them. Dancer screens and individualized, supplemental conditioning and referral to medical professionals is needed. ACSM/A&A can support these efforts through advocacy.

2556 Board #17 May 29 9:30 AM - 11:00 AM
The Association Between Physical Activity Behaviors And Academic Performance In College Students

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PURPOSE: The purpose of this study was to determine how sedentary and physical activity behaviors correlate with academic performance among undergraduate college students, implementing two objective measures and a subjective measure of physical activity.

METHODS: Fifty-one (22 males, 29 females) participants (age 20.2 ± 0.1 years) were instructed to simultaneously wear ActiGraph and ActivPAL monitors continuously,

24h each day for seven days. Sleep/non-wear time was excluded from analysis. Demographics data, including self-reported grade point average (GPA), and mean daily minutes of sedentary (sitting time), light, moderate, and vigorous intensity physical activity (PA) were collected. Participants also kept a 7-day self-reported physical activity log and completed the International Physical Activity Questionnaire (IPAQ) at the end of the seven days.

RESULTS: Females engaged in significantly higher mean daily minutes of moderate intensity activity than males (60.1 ± 25.4 vs. 47.3 ± 13.2 ; $p = 0.047$). Self-reported GPA for females was significantly greater than males (3.7 ± 0.3 vs. 3.4 ± 0.3 ; $p = 0.019$). For males, mean minutes of light intensity PA measured by ActivPAL and Actigraph was negatively correlated with GPA ($r = -0.448$ and $r = -0.491$, respectively; both $p < 0.05$). When considering self-reported PA by males, mean sitting time was positively correlated with GPA ($r = 0.702$; $p < 0.001$), but there was not association with GPA for females. For females, ActivPAL-measured light intensity PA was positively correlated with GPA ($r = 0.504$; $p < 0.05$).

CONCLUSIONS: Results of this study showed that female college students spent more time in moderate intensity PA than males. Further, for both objectively and subjectively measured PA behavior, more daily sitting was associated with a higher self-reported GPA in males, but the opposite was true for females. Interestingly, the more time male college students spent in light intensity the lower their GPA, but the opposite was true for females. These results suggest that physical activity behaviors have different relationships with academic performance in college males and females.

E-25 Free Communication/Poster - Muscle and Mechanics

Friday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

2557 Board #18 May 29 9:30 AM - 11:00 AM Detecting Swimming Strokes Using Pattern Recognition Analysis

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PURPOSE: While exercises such as walking, running or cycling can be distinguished well by accelerometry, little was reported for swimming. Purpose of this study was to detect four common swimming strokes using a pattern recognition analysis and determine the swimming time of each stroke.

METHODS: A total of 17 swimming athletes (9 females, 53%) from the Southeast University, China were recruited and their age (M±SD, male: 20 ± 0.8 , female: 19.4 ± 1.0 , total: 19.7 ± 0.9 yr.), height (184.5 ± 3.2 , 172.1 ± 5.4 , 178.3 ± 7.7 cm), body weight (82.9 ± 6.0 , 61.3 ± 5.3 , 72.1 ± 12.4 kg), years of training on swimming (12.5 ± 1.8 , 12.9 ± 1.9 , 12.7 ± 1.8 yr.) were collected. Each participant performed breaststroke, front crawl, backstroke and butterfly in their own preferred orders four laps in a 50-meter pool, with an Actigraph GT9X inertia measurement unit on right or left wrist with their own preference. The middle two minutes recording of each stroke were extracted out and divided into 12 segments with 10 seconds each. Each segment was coded based on the stroke type. Two classifiers, linear discriminant analysis (LDA) and support vector machine (SVM), were used for the analysis. Random 13 people were selected into training data and the remaining 4 participants for cross validation. Swimming time of each stroke is the sum of time that recognised as certain stroke. The analysis was performed using R.

RESULTS: The accuracy of correct classification is 0.995 ± 0.012 by LDA and 0.984 ± 0.021 by SVM while corresponding cross-validation accuracy are 0.917 ± 0.085 and 0.964 ± 0.046 , respectively, with no statistical significant difference between male and female. As a result, SVM was used to further determine the sensitivity and specificity of the algorithm of each stroke and swimming time accuracy:

Sensitivity, Specificity and Time Accuracy				
	Breaststroke	Front Crawl	Backstroke	Butterfly
Sensitivity	0.985 ± 0.044	0.966 ± 0.066	0.971 ± 0.083	0.995 ± 0.020
Specificity	1.000 ± 0.000	0.961 ± 0.069	0.984 ± 0.051	0.982 ± 0.034
Accuracy of Time	98.5%	94.1%	95.1%	97.5%

CONCLUSIONS: With a wearable device and SVM like pattern recognise algorithm, swimming strokes can be accurately detected, which provides a great convenience to track the participation time of swimming activities.

2558 Board #19 May 29 9:30 AM - 11:00 AM Reactive Strength Index Scores Are Associated With Injury Risk And Game Performance In Female Collegiate Volleyball Players

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PURPOSE: The reactive strength index (RSI) is a measure used by coaches to quantify an athlete's explosiveness. The RSI score is calculated based on one's drop vertical jump (DVJ) performance ($RSI = \text{jump height [m]} / \text{contact time [sec]}$). The purpose of this study was twofold. The first purpose of this study was to evaluate the ability of preseason RSI scores to discriminate injury risk in female collegiate volleyball (VB) players. The second purpose was to evaluate correlations between preseason RSI scores and game statistics. **METHODS:** 117 female collegiate VB players representing 3 levels of competition participated. Reflective markers were applied to the pelvis and the lower extremities. Athletes performed 3 DVJ from a 30.48 cm box. Subjects were instructed to drop off the box, land with one foot on each force plate (BP 600600 force plate, ATMI, Watertown, MA), and then immediately upon landing jump as high as possible. Reflective marker and force data was collected simultaneously with an 11 camera Qualisys motion system (Gothenburg, Sweden) at 100 Hz for the 3D marker data and 1000 Hz for the force plates. Visual3D (C-Motion, Germantown, Maryland) was used to create the kinematics and kinetics. A receiver operator characteristic curve was constructed to identify a cutoff score for subsequent risk analysis. Relative risk was calculated to determine the difference in injury risk between two groups based on cutoff score dichotomization. The Pearson product-moment correlation coefficient was calculated to determine the relationship between preseason RSI scores and game statistics. **RESULTS:** Mean preseason RSI scores were 0.88 m/s (± 0.31). Athletes with a lower preseason RSI score (0.9125 m/s or less) were 4 times more likely (relative risk = 4.4 [95% CI: 1.0, 18.4]; p -value = 0.022) to experience a noncontact time-loss injury to the low back or lower extremities during the season. There was a significant correlation between preseason RSI score and kills/set ($r = 0.369$; p -value = 0.000) and points/set ($r = 0.360$; p -value = 0.000). **CONCLUSIONS:** The RSI measure should be collected as part of a preseason screening clinic to identify female collegiate VB players at risk for a noncontact time-loss injury to the low back or lower extremities. The RSI score could also be used by VB coaches when evaluating current and future athletes.

2559 Board #20 May 29 9:30 AM - 11:00 AM Can Lower Body Instabilities Influence Shoulder Mobility And Predict Injury Risk In Collegiate Athletes?

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PURPOSE: Throughout the NCAA, over half of the student-athlete population predominantly use their upper body for success in their sport. Unfortunately, these athletes are also highly prone to upper body injury. One possible explanation for this could be disturbances in the kinetic chain of movement. To examine the possible relationship between hip, knee, and ankle instabilities and shoulder mobility in upper-body dominant, collegiate athletes.

METHODS: A total of 26 UBAs were recruited from Hamline University and completed a series of tests. The tests that were administered were the Functional Movement Screen (FMS), a shoulder range of motion test, a vertical jump test, and sport-specific movement. These tests were recorded using a 3D motion capture system, comprising of 39 reflective markers and six infrared cameras. To examine the relationship between upper and lower-body measures, a correlational analysis was used to help reveal the strength of possible predictive relationships between specific lower body instability tests and upper body stability. Additionally, qualitative analysis was performed on movement recordings to identify abnormalities.

RESULTS: Quantitative results indicated strong relationships existed between the FMS Left Hurdle Test and FMS Right Shoulder Mobility (0.55 , $p = 0.004$), FMS Left Lunge Test and Rotator Cuff Internal Rotation (-0.52 , $p = 0.007$), and FMS Right Lunge and Rotator Cuff Ext. Rotation (-0.50 , $p = 0.009$). Additionally, qualitative results of the study suggest that participants who show instabilities may have some shoulder mobility issues demonstrated performing sport specific movements. **CONCLUSIONS:** The FMS may show that a lower body instability may result in heightened risk of injury in the upper body due to decreased range of motion and improper force transfers. The FMS was limited in information provided, therefore qualitative analysis may be more beneficial in predicting injury risk in UBA.

2560 Board #21 May 29 9:30 AM - 11:00 AM
Functional Movement Screen Scores And Injury Risk Factors In NCAA Division III Football Players
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The functional movement screen (FMS) is used to identify asymmetries and imbalances in the body. It contains seven movement patterns rated on a 0 to 3 scale: deep squat (DS), hurdle step (HS), in-line lunge (ILL), shoulder mobility (SM), active straight leg raise (ASLR), trunk stability push up (TSPU), and rotary stability (RS) (Cook, 2006). In professional football players, FMS composite scores below 14 are associated with increased injury risk (Kiesel, 2007). In junior Australian players, the presence of two tests with asymmetries was indicative of injury risk (Chalmers, 2017). There are no established normative scores for NCAA Division III football players; furthermore, it is not known how many athletes display risk factors for injury. **PURPOSE:** To describe FMS scores and potential injury risk in NCAA Division III football players. **METHODS:** Fourteen current football players from an urban Midwestern University were recruited and consented to participate in this pilot study. Participants were assessed in the FMS by one certified level 1 tester, according to the procedures described by Cook et al. (2006). Scores below 14 and players with more than two asymmetrical scores were totaled.

RESULTS: The mean FMS composite score was 14.57 (SD=2.2). Three (21%) athletes had composite scores below 14. Two athletes (14%) had two or more asymmetries.

DISCUSSION: FMS composite scores were similar to the mean score of 14.1 described for healthy Division I athletes by Warren (2015), but below the mean of 16.9 for professional football players (Kiesel, 2007). Two of the athletes with scores below 14 had sustained previous knee injuries, but were fully rehabilitated at the time of the testing. One of these athletes also had a composite score below 14, suggesting that a history of previous injury places athletes at greater risk for re-injury. Athletic training and coaching staff should consider these factors when assessing return to play readiness in DIII football players.

CONCLUSIONS: FMS composite scores for DIII were similar to DI football players, but lower than professionals. Previous history of injury may impact the number of asymmetries displayed in the FMS, potentially resulting in higher re-injury risk.

2561 Board #22 May 29 9:30 AM - 11:00 AM
Functional Movement Screen: Single Items For Injury Prediction Of Physical Education And Exercise Science Students.

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 (No relevant relationships reported)

Screening tools for the individual risk of injury in athletes have gained high popularity lately. Not only professional athletes, but also college students are in need for cost efficient and quick screening tools to allow targeted injury prevention. The applicability of the Functional Movement Screen (FMS) as a valid screening tool for injury prediction among various populations has been evaluated in several studies. Most studies have drawn their conclusions from the composite score. Only a few studies have examined the validity of single items for injury prediction. In addition, gender differences have only been taken into account to a limited extent.

PURPOSE: The aim of the study was to determine the applicability of the FMS composite score and its seven single items for the sex-specific prediction of injury among German physical education and exercise science students. **METHODS:** Overall, $N = 99$ physical active college students (female: 53, male: 46) between 18-29 years of age were recruited. All participants performed a FMS at the beginning of two consecutive semesters. All injuries were recorded monthly for the entire semester. Receiver operating characteristic (ROC) curves and area under the curve (AUC) were used to estimate an optimal cut-off score for females and males separately and to assess the ability of the FMS sum score to predict an injury. Logistic regression analysis was utilized to assess odds ratios for the chance of injury related to single items of the FMS. **RESULTS:** The ROC curves indicated moderate ability in the injury prediction for women (AUC: 0.66, $p = 0.02$) and poor injury prediction for men (AUC: 0.40, $p = 0.19$). However no satisfying cut-off score could be determined for any gender due to poor sensitivity and specificity. The logistic regressions revealed the Deep Squat (DS) to be significant for women ($p = 0.03$, OR= 0.2). **Conclusion:** The FMS is frequently cited as a useful screening tool for subsequent injury. In this regard, cut-off values are used to identify persons at high risk for injury. The DS was the only significant single item for women in this study, but had no strong prediction effect. Results of this study cannot provide solid gender-specific recommendations for the use of the FMS composite score or single items as an injury screening tool for German physical education and sports science students.

2562 Board #23 May 29 9:30 AM - 11:00 AM
Frontal Plane Knee Biomechanics And Functional Movement Screen Scores Of Previously Injured DIII Football Players
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Football has the highest rate of knee injuries when compared to other contact sports (Rothenberg, 2016). It is important to investigate whether the risk for such injuries in NCAA Division III football players can be assessed by the Functional Movement Screen (FMS) and frontal plane knee alignment during a single leg squat (SLS), as suggested by Kiesel et al (2007) and Ugalde (2015), respectively.

PURPOSE: To compare FMS deep squat (DS) and active straight leg raise (ASLR) scores and to determine the relationship between frontal plane knee biomechanics in the SLS and ASLR and DS scores in healthy NCAA Division III football players and athletes with previous knee injuries.

METHODS: Fourteen football players (mean age = 21.4) were recruited and consented to participate in this study. They completed the FMS and were rated by a certified level 1 FMS tester, then changed into black compression clothing. Markers were placed on the tibial tuberosity and distal tibia to define absolute valgus and varus angles at the deepest point of the SLS, where the supporting heel was still in contact with the ground. Trials were recorded using a digital camera facing the frontal plane and angles were measured using Dartfish Software.

RESULTS: For the previously injured group ($n=7$), mean right SLS angle was 0.5° (valgus) and mean left SLS angle was 0.38° (varus), mean DS was 1.86, mean ASLR was 2.43, and mean composite score was 14.14. DS was negatively correlated with right ($r = -0.13$) and left ($r = -0.12$) SLS angles, right ASLR was negatively associated with right SLS ($r = -0.12$), left ASLR was negatively correlated to left SLS ($r = -0.13$). For the non-injured group ($n=7$), right SLS mean angle was 3.55° (valgus) and left mean SLS was 2.27° (valgus), mean DS was 2, mean ASLR was 2.43, and mean composite score was 15. DS was positively correlated with right ($r = 0.59$) and left ($r = 0.86$) SLS angles, right ASLR was negatively associated with right SLS ($r = -0.13$), left ASLR was negatively correlated to left SLS ($r = -0.66$). There was no significant difference in SLS angles, DS, or ASLR scores between groups ($p > 0.05$).

CONCLUSION: Knee angles in the SLS, DS, and ASLR scores did not differ between groups. For the healthy group, DS had strong positive relationships with SLS angles and left ASLR had a moderate negative relationship to left SLS angles.

2563 Board #24 May 29 9:30 AM - 11:00 AM
Does Baseline Performance On Return-to-Sport Tests Differ Amongst Injured And Uninjured NCAA Division 1 Athletes
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One of the most well established risk factors for future injury in athletes is having sustained a previous injury. Currently there is a lack of research regarding baseline performance of athletes on the common return to sport tests. Research evaluating baseline performance can expose the need of implementing an anticipatory rehabilitation program to avoid the risk of future injury.

PURPOSE: To investigate the differences in performance on a battery of tests amongst incoming collegiate athletes who have sustained a lower extremity injury in the past 6 months and those who have not.

METHODS: 40 (Males: 19 Females: 21) incoming collegiate athletes from an NCAA Division I University completed a battery of baseline tests that assessed their strength, flexibility, dynamic balance, power and speed. Individuals were categorized as injured and uninjured, with injury defined as having a lower extremity injury in the past 6 months (Injured: 16 Uninjured: 24).

RESULTS: The left knee flexion strength for injured (.32 \bar{F} .12/BW) was significantly greater than that of uninjured (.25 \bar{F} .1/BW; $p = .041$). The right hip internal rotation strength for injured (.20 \bar{F} .07/BW) was significantly greater than that of uninjured (.15 \bar{F} .06/BW; $p = .014$). The left hip strength was also significantly greater in injured (.20 \bar{F} .05/BW) compared to uninjured (.15 \bar{F} .06/BW; $p = .004$). For balance, the posterolateral reach from the Y-Balance test indicated a significant difference with uninjured (7.58 \bar{F} 6.38 cm) having a greater limb asymmetry compared to injured (3.49 \bar{F} 3.26 cm; $p = .03$). The flexibility, power and speed tests did not identify any differences.

CONCLUSIONS: The results indicated that athletes who were injured performed better on isometric strength tests and Y-Balance than those with no recent injuries. One potential hypothesis to account for these differences is that the injured athletes could have participated in an individualized rehabilitation program after injury to

address their functional deficits, which improved performance. Therefore, this study shows that it could be critical to screen all athletes, whether injured or uninjured, prior to participation in the athletic season.

2564 Board #25 May 29 9:30 AM - 11:00 AM
Does Lower Extremity ROM Asymmetry Or Previous Injury Predict Weight Shift During The FMS Squat?

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The Functional Movement Screen (FMS) Deep Squat Test (DS) assesses bilateral mobility of the ankle, knee and hip through a movement pattern that is intended to be performed with bilateral symmetry. Past history of lower extremity (LE) injury may influence LE joint range of motion (ROM). Previous studies have examined the influence of LE ROM on squat depth, but not its influence on lateral weight shift (LWS). **PURPOSE:** The purpose of this study was to determine if bilateral asymmetry in ankle, knee, and hip ROM or previous history of LE injury predicts LWS during the FMS DS. **METHODS:** Thirty-seven physically active subjects (19 F, 18 M, 20.8 ± 1.4 yrs) completed this IRB approved study. All subjects granted informed consent and completed a health history questionnaire including history of LE orthopedic injury. Subjects' hip flexion (HF), knee flexion (KF), and ankle dorsiflexion (DF) ROM were measured with a goniometer using standard methodologies. A loaded lunge (LL) measurement was also taken to determine peak closed chain dorsiflexion. ROM asymmetry was calculated for each measurement. Participants then completed three trials of the FMS DS on 2 force plates (1200 Hz) and a Matlab script processed vertical ground reaction force (vGRF) data with a lowpass filter and computed limb symmetry index during the descent phase and full squat position. Multiple regression models were computed for both the descent phase and the full squat position of the DS to determine if ankle, knee, and hip ROM asymmetry, LL asymmetry, and LE injury history are predictors of LWS during the DS. **RESULTS:** Mean ROM asymmetries for HF (-0.09% ± 3.37), KF (0.24% ± 1.8), DF (-5.30% ± 43.28) and LL (5.14% ± 8.93) were calculated. The overall regression model for the descent phase was not significant, ($F(5, 31) = 0.47, p = 0.796, r^2 = 0.07$) for the prediction of LWS. Additionally, the overall regression model for the full squat position was also not significant ($F(5, 31) = 1.67, p = 0.17, r^2 = 0.21$) for the prediction of LWS. **CONCLUSION:** Asymmetry in HF, KF, and DF ROM along with LL asymmetry and previous history of LE injury do not predict LWS during FMS DS performance. Further investigation is needed to identify the causes of asymmetric DS performance to aid clinicians in corrective exercise prescription.

2565 Board #26 May 29 9:30 AM - 11:00 AM
Electromyography Assessments: Traditional Versus Non-Traditional Shoulder-Related Pre-/Rehabilitative Exercises

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PURPOSE: To investigate the electromyographic difference between traditional versus non-traditional shoulder-related pre-/rehabilitative exercises. **METHODS:** Eighteen participants (Age = 22.2 ± 3.7 yrs; Height = 183.0 ± 6.9 cm; Body Mass = 84.5 ± 12.7 kg; Body Fat = 13.6 ± 5.7%) with no history of shoulder-related injuries performed three traditional (T) free weight and three non-traditional (NT) pre-/rehabilitative exercises, specifically, A, Y, and pushup plus (PU+). Surface dwelling electromyography electrodes were placed parallel to the fiber orientation on the belly of the mid-deltoid, mid-latissimus dorsi, pectoralis major, and upper trapezius. Root mean square (RMS) muscle activation was calculated for each of the exercises.

RESULTS: Table 1. Root mean square (mean ± SE) measured in μV between traditional and non-traditional A, Y, and pushup plus.

	Mid-Deltoid	Mid-Latissimus Dorsi	Pectoralis Major	Upper Trapezius
T A	246.9±31.6	180.6±25.7	109.6±27.2	129.5±19.9
NT A	192.1±32.8	161.2±26.1	79.3±27.3	167.0±20.1
T PU+	278.8±23.0*	133.4±56.6	213.6±25.8*	185.8±36.6
NT PU+	208.8±30.9	71.0±9.8	109.8±16.9	163.1±28.7
T Y	324.4±41.9	60.2±6.0	142.4±14.2	405.4±48.7
NT Y	346.2±46.4	73.1±15.0	159.5±28.7	585.5±66.8*

* $p \leq 0.05$

CONCLUSIONS: Neuromuscular activity between traditional and non-traditional A and Y exercises were relatively similar, thus supporting the notion that non-traditional shoulder-related pre-/rehabilitative exercises is a comparable method to supplement shoulder-related issues. Traditional pushup plus, however, evoked greater neuromuscular activity amongst two of the four targeted muscle groups, which may be explained due to the angular differences from the pivot point. From an applied perspective, therefore, practitioners and clinicians may utilize the non-traditional A and Y as another pre-/rehabilitative modality for shoulder-girdle augmentation.

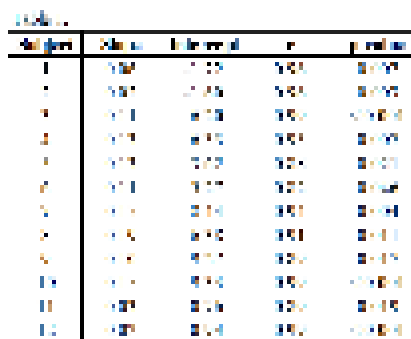
2566 Board #27 May 29 9:30 AM - 11:00 AM
The Impact Of Fatiguing, Intermittent Isometric Contractions On Muscle Force Variability

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(No relevant relationships reported)

PURPOSE: To evaluate the influence of fatigue on force variability of the vastus lateralis (VL) during repeated isometric exercise performed at 30% maximal voluntary isometric contraction force (MVIC). **METHODS:** Twelve resistance-trained males (23.8 ± 3.6 y; 87.3 ± 10.5 kg; 176.3 ± 6 cm) completed MVIC testing and then repeated isometric contractions at 30% MVIC while tracking target force trajectories repetitively until they could no longer achieve 95% target force. Force and surface electromyographic (EMG) signals from the VL were collected during exercise. One-way repeated measures ANOVAs were used to analyze average force (F_{AVG}), coefficient of variation of force (F_{CV}), EMG amplitude (EMG_{RMS}), and median power frequency (MDF) during every 25% of the repetitions (REP) completed. To examine the relationship between EMG_{RMS} and F_{CV} across the work bout, F_{CV} was plotted against EMG_{RMS} , linear regression lines were fit, and correlation coefficients were calculated for each subject. **RESULTS:** No main effect of REP was observed for F_{AVG} ($p = 0.07$) or MDF ($p = 0.29$), but there was for F_{CV} and EMG_{RMS} ($p < 0.0001$). F_{CV} increased from the first to the 50-100% REP ($p \leq 0.001-0.02$), 25% to the 100% REP ($p < 0.001$), and the 50% to the 100% REP ($p < 0.001$). EMG_{RMS} increased from the first to the 25-100% REP ($p = 0.002-0.024$), the 25% to the 50-100% REP ($p = 0.001-0.019$), the 50% to the 75-100% REP ($p = 0.002-0.018$) and the 75% to the 100% REP ($p = 0.014$). Additionally, all 12 subjects displayed strong, significant, positive relationships for F_{CV} vs. EMG_{RMS} across the exercise bout (Table 1). **CONCLUSIONS:** The increase in both F_{CV} and EMG_{RMS} suggest that as fatigue develops during intermittent isometric exercise, force steadiness decreases while EMG amplitude increases. It is possible that the decrease in force steadiness occurred due to increased common synaptic input to the motor neuron pool secondary to fatigue-induced increases in net excitatory input.



2567 Board #28 May 29 9:30 AM - 11:00 AM

Does A Relationship Exist Between Range Of Motion And Proprioception Of The Ankle In Athletes

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(No relevant relationships reported)

Prevention and rehabilitation methods for ankle and Anterior Cruciate Ligament (ACL) injuries now include proprioception and Range of Motion (ROM) exercises as they are proven to be successful techniques. The purpose of this study is to determine if a relationship between lower extremity proprioceptive scores and ankle ROM in uninjured female collegiate soccer athletes exist. **PURPOSE:** To investigate a comparison between proprioception scores and Range of Motion (ROM) scores of the ankle in female collegiate soccer athletes to determine if a relationship exists. **METHODS:** A one shot case study design was used to determine if a relationship exists between proprioception scores and range of motion in female collegiate soccer athletes. Proprioception was tested using the Bertec Balance Posturography Plate measuring Center of Pressure (COP) on a normal surface (NS) and perturbed surface (PS) with eyes open (EO) and eyes closed (EC) as well as measuring Limit of Stability (LOS) with eyes open. The Goniometer was used to measure Inversion and Eversion in both the left ankle (LA) and right ankle (RA) joint. **RESULTS:** There were no significant relationship between proprioception and ROM in the ankle documented either in Inversion or Eversion. Statistical analysis indicated inversion of the left ankle resulted in diminished proprioception scores in both a normal surface with eyes open and perturbed surface eyes open compared to both surfaces with eyes closed, (LA NS-EO $p=0.105$, LA NS-EC $p=0.84$, LA PS-EO $p=0.225$, LA PS-EC $p=0.094$). There were no relationships between the variables due to the correlation coefficient resulting close to zero. (NS-EO: LA inversion $r=0.011$, LA eversion $r=0.060$, RA inversion $r=0.030$, RA eversion $r=0.006$) (NS-EC: LA inversion $r=0.175$, LA eversion $r=0.019$, RA inversion $r=0.003$, RA eversion $r=0.131$) (PS-EO: LA inversion $r=0.091$, LA eversion $r=0.017$, RA inversion $r=0.315$, RA eversion $r=0.040$) (PR-EC: LA inversion $r=0.165$, LA eversion $r=0.033$, RA inversion $r=1.556$, RA eversion $r=0.026$). **CONCLUSION:** These results suggest that no significant relationship exists between ankle joint ROM and proprioception scores. Further studies examining healthy uninjured ankle ROM in athletes should be conducted in order to identify relationships that could prevent ankle injuries from occurring.

2568 Board #29 May 29 9:30 AM - 11:00 AM

Relationship Between Dietary Calcium Intake And Muscle Performance In College Aged Adults

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(No relevant relationships reported)

It has been well established that several minerals such as calcium, potassium, and iron play an important role in muscle metabolism, muscle function, and physical performance. Although the importance of calcium has been well studied in bone metabolism, there is still a wide research gap in understanding the relationship between calcium intake and muscle performance, especially in young adults. **PURPOSE:** The purpose of this study is to investigate the relationship between dietary calcium intake and muscle performance in college-aged students. **METHODS:** This was a non-randomized cross-sectional study participated by 70 college-aged students. The dietary calcium intake questionnaire was used to estimate the amount of calcium consumed daily based on the content of the specific foods and was derived from a validated and quantitative food frequency questionnaire. The participant's lower and upper body strength was assessed by a vertical jump test (Just Jump Mat, Tendo Sports Machine), and handgrip test (Takei, Japan), respectively. **RESULTS:** The average calcium intake was found to be 1098 mg/day. A statistically significant positive relationship was observed between jump velocity ($r=0.31$; $p<0.01$), and relative power ($r=0.35$; $p<0.01$) with calcium intake. However, there were no significant relationships between calcium intake with jump height, time in air, and upper body muscular strength ($p>0.05$). **CONCLUSIONS:** Although the result suggests calcium intake was related to lower body muscle performance, in future experimental study should explore and control confounding variables to understand role of calcium intake on muscle performance in larger samples and in different sports.

Table 1. Participant's physical and muscle performance characteristics (n=70)

Variables	Mean \pm SE
Age (yrs)	20.81 \pm 0.19
Height (cm)	173.59 \pm 1.23
Weight (kg)	79.88 \pm 2.01
BMI (kg/m ²)	26.43 \pm 0.52
Dietary Calcium Intake	1098.09 \pm 72.05
Jump Height (inches)	20.72 \pm 0.62
Time in Air (sec)	0.64 \pm 0.01
Velocity (m/s)	1.34 \pm 0.02
Power (watts)	1058.26 \pm 36.18
Relative Power (watts/kg)	13.10 \pm 0.20
Right Hand Grip Strength (kg)	52.73 \pm 2.52
Left Hand Grip Strength (kg)	48.22 \pm 2.26

2569 Board #30 May 29 9:30 AM - 11:00 AM

Comparing Bilateral Muscular Imbalance Ratios In The Upper Extremities

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(No relevant relationships reported)

Muscular imbalances may increase the risk of injury and decrease physical performance. Conventional wisdom suggests dominant side musculature may be more developed owing to preferred usage. Quantifying muscle imbalance between non-dominant and dominant arms is facilitated by technology that permits the measurement of arm power output across a range of resistances. **PURPOSE:** To compare power output achieved by the dominant and non-dominant arms under various load conditions. **METHODS:** 18 females and 14 males (21.0 \pm 2.3 years, 66.9 \pm 4.3 inches, 168.3 \pm 36.2 lbs) were enrolled into an optimal muscle loading program using Proteus (Proteus Motion, USA). Each subject performed the following ten movements: abduction, adduction, external rotation, internal rotation, biceps curl, triceps extension, horizontal push, horizontal row, vertical push, and vertical row. Each movement was repeated twice under four separate loads: 7lb, 14lb, 21lb, and 28lb. Maximum average power for each movement was recorded in watts for further analysis. A paired-samples t-test, under the 28lb condition, was used to determine the relationship between the mean power of all subjects' dominant versus non-dominant arms. Repeated measures ANOVA was run to then determine differences in mean powers. **RESULTS:** Power achieved in all movements was similar (r values ranged from 0.723-0.954; $p<0.001$) at the 28 lb load. On average, an individual's dominant arm during abduction produced less power than the non-dominant arm (143.6 \pm 63.5 watts compared to 127.7 \pm 50.2; $p=0.050$). However, external rotation of the dominant arm tended to generate more than non-dominant arms ($p=0.053$). Correlation values close to 1.00 across all comparisons demonstrated the variance between arms was minimal. The results of the ANOVA showed no statistical differences between arms. **CONCLUSIONS:** The current assumption that dominant limbs are capable of greater power may not be true in all planes and when tested with isotonic loads applied in three-dimensional space. Our subjects did not demonstrate power imbalances between dominant and non-dominant arms.

2570 Board #31 May 29 9:30 AM - 11:00 AM

Abstract Withdrawn

2571 Board #32 May 29 9:30 AM - 11:00 AM

The Effectiveness Of An Augmented Musculoskeletal Feedback System Compared To Traditional Core Stabilization Exercises

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PURPOSE: A prevailing health problem is low back pain (LBP). A common clinical strategy to treat LBP is the strengthening of key core stabilization muscles, the transverse abdominis (TrA) and lumbar multifidus (LM). The purpose of this study was to compare the effectiveness of using an augmented biofeedback device

versus traditional core stabilization exercises at strengthening the TrA and LM in healthy participants. **METHODS:** University students (41 females, 13 males), ages 18-25 years with no recent history of back injury and no history of back surgery were recruited. Participants were tested on the maximum voluntary contraction (MVC) of the TrA and LM at lumbar vertebrae levels L4 and L5 using wireless electromyography (EMG). Participants were split into two groups. The control group performed traditional core stabilization exercises, the experimental group used an augmented biofeedback device. Participants performed the exercises 3 times a week for 20 minutes. Participants returned after 8 weeks to retest the MVC. **RESULTS:** Paired-sample t-tests revealed significant improvements for Left L4 ($t(52) = 2.08, p < .05$), Left L5 ($t(52) = 2.14, p < .05$), Right L4 ($t(52) = 2.34, p < .05$), and Right L5 ($t(52) = 2.41, p < .05$) over the course of the 8-week exercise period. To determine if improvements differed across exercise conditions, a series of analyses of covariance (ANCOVA) were used. In all analyses, change scores were entered as the dependent variable with pre-test MVC entered as covariates. Exercise condition was entered as the independent variable. Results of the analyses revealed no significant effect of exercise condition on change score for Left L4 ($F(1,51) = .47, p = .50$), Left L5 ($F(1,51) = 1.72, p = .20$), Right L4 ($F(1,51) = .01, p = .95$), Right L5 ($F(1,51) = .18, p = .68$), Left TrA ($F(1,51) = .03, p = .86$), or Right TrA ($F(1,51) = .00, p = .95$). **CONCLUSION:** Results of the study found that MVC of the LM significantly improved in both groups. MVC of the TrA improved in both groups as well, however changes did not reach statistical significance. An augmented biofeedback device could be used as an alternative to traditional core stabilization exercises to strengthen the TrA and LM.

2572 Board #33 May 29 9:30 AM - 11:00 AM
COMPARISON OF MUSCLE ACTIVATION BETWEEN THE CONVENTIONAL, SUMO AND STIFF-LEG DEADLIFT
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(No relevant relationships reported)

Purpose

The purpose of this study was to compare differences in muscle activation of the primary agonist muscles during three variations of deadlift - sumo (SDL), stiff-leg (SLDL), and conventional (DL) - in both men and women.

Methods

Twelve recreationally trained subjects (six males, six females; age: 23 ± 0.5 years, height: 182 ± 3.2 cm, body mass: 74 ± 6.1 kg, DL 1-RM: 128 ± 53.6 kg, SDL 1-RM: 127 ± 56.8 kg, SLDL 1-RM: 117 ± 49.6 kg) participated in this within-subject crossover design. Electromyographic (EMG), activity of the DL, SDL, and SLDL for the vastus lateralis (VL), vastus medialis (VM), biceps femoris (BF), medial hamstring group (MH), and erector spinae (ES) was measured. Gender differences were evaluated, comparing the difference in the H:Q ratio between male and female. For the second session, participants completed three repetitions at 80% of their 1RM for each lift as EMG data was collected. Raw EMG data was smoothed and rectified with NORAXON software (150 Hz) and mean peak activation was expressed as the root mean square (RMS). EMG values obtained during the 3 repetition experimental session were averaged then normalized to the EMG values achieved in the 1RM.

Results

Results showed no significant differences ($p > 0.05$) in normalized EMG values between the five measured muscles during the DL, SDL and SLDL. No significant difference ($p > 0.05$) was found in HQ ratios between males to females; however, there was a statistical trend in the SLDL that indicated sex differences in the HQ ratio, with males having the higher HQ ratio ($p = 0.063$).

Conclusions

This study revealed that no variation is superior in activating the quadriceps, hamstrings, or low back, indicating all three variations are acceptable methods to train the aforementioned musculature. Moreover, the lack of significant disparity between males and females suggests women are not quadriceps-dominant and display similar activation patterns to males.

2573 Board #34 May 29 9:30 AM - 11:00 AM
The Effect Of Concentric Prime Movers Vs. Synergist Muscle Contraction On Coactivation Ratios
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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the coactivation ratio of agonist to antagonist muscle groups with varying pre-exhaustion protocols, and to see if postactivation potentiation is influenced by pre-exhaustion.

METHODS: Eight college age males and females were recruited for the study. Each participant visited the Human Performance Laboratory four times over the duration

of the study. Subjects were monitored via EMG and randomly performed 1 set of 50 repetitions maximal voluntary knee extension, knee flexion, and knee extension/flexion at $60^\circ \cdot s^{-1}$ using an isokinetic machine on the dominant leg. They performed 1 set of 10 repetitions of modified Peterson step-up testing at pre-exercise, immediately post-exercise, and seven (7) min following exercise.

RESULTS: The 50 repetitions of isokinetic knee extension, flexion, extension/flexion at $60^\circ \cdot s^{-1}$ resulted in a significant drop in peak torque in all groups ($P < 0.01$). Pre-exhausting the agonist muscle group prior to Pearson step-up improved agonist skeletal muscle motor unit recruitment ($P < 0.05$). Pre-exhausting the antagonist muscle group with flexion and combination prior to Pearson step-up did not have any effect on agonist skeletal muscle motor unit recruitment. Pre-exhausting the agonist muscle group down-regulated antagonist muscle activity. Coactivation improved only by fatiguing the agonist muscle group. Postactivation potentiation was only affected by fatiguing the agonist muscle group ($P < 0.05$).

CONCLUSIONS: We conclude that pre-exhausting the agonist muscle group might be beneficial for improving muscle activity in functional rehabilitation exercises and during the period of recovery. Given the small number of subjects in this study, additional research using larger subject groups and different fatiguing and post-activation protocols is warranted to support the use of pre-exhaustion techniques to improve activity/recruitment of atrophied muscle in physical therapy settings.

2574 Board #35 May 29 9:30 AM - 11:00 AM
Electromyographic Analysis Of Steel Mace Exercises: A Descriptive Study Of Alternative Training Modalities
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Alternative training modalities (ATM) have recently gained popularity as a form of resistance exercise through non-traditional methods and equipment. ATM share a common characteristic, the incorporation of non-traditional exercise movements and equipment in efforts to develop strength in a multi-planar fashion. Forms of common ATM include kettlebells, battle ropes, tires, and the steel mace. The steel mace, like a sledgehammer, consists of a long-levered club attached with a heavy sphere (i.e. mace head) fixed at one end. What remains relatively unknown are the neuromuscular demands of specific muscles or muscle groups among steel mace exercises. **PURPOSE:** To examine the electromyographic profile of four common steel mace exercises: the overhead squat, 360° overhead rotation, reverse lunge offset, and lap offset squat. **METHODS:** Twenty-nine resistance-trained males ($n=15$) and females ($n=14$) were recruited to participate in this cross-over experimental design investigation. All participants completed each of the four exercises with the mace head (i.e. heavy sphere) on both dominant and non-dominant sides of the body. Normalized surface electromyography (EMG) of the dominant-side upper trapezius, anterior deltoid, pectoralis major, triceps brachii, biceps brachii, external oblique, rectus femoris, and biceps femoris were analyzed. A one-way ANOVA was used to compare normalized EMG among muscles within each exercise and among exercises for each muscle. **RESULTS:** As a summary of major findings, for each exercise and muscle group, EMG activity was significantly altered when positioning the mace head ipsilateral vs. contralateral to the dominant side ($p < 0.05$). Additionally, each exercise demonstrated differential EMG activities among muscle groups ($p < 0.05$). Overall, the upper trapezius and rectus femoris exhibited the greatest EMG activity ($p < 0.05$). All muscle groups except for the biceps brachii and external oblique showed differential EMG activity among exercises ($p < 0.05$). **CONCLUSIONS:** The present findings provide practically significant information regarding the muscle-specific demands of popular steel mace exercises which may provide valuable insight for athletes, fitness enthusiasts, and exercise practitioners who implement steel mace training programs.

2575 Board #36 May 29 9:30 AM - 11:00 AM
Inter-Repetition Rest Interval Affects Peak Power Independent Of Its Rate Of Development
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Numerous variables influence performance in resistance training. The duration between sets has been explored both for its acute effect on the subsequent set as well as its effect on the physiological responses to exercise. However, the duration of rest between repetitions is relatively unexplored. **PURPOSE:** To evaluate the effect of inter-repetition rest interval (IRRI) duration on power parameters within a single set. **METHODS:** We tested 206 healthy men and women between the ages of 15 and 70 using Proteus technology (Proteus Motion, USA). Subjects performed

36,728 repetitions across 4,566 sets of 25 exercises at various loads (1lb to 25lb) of three-dimensional isotonic resistance. Proteus software calculated the IRR duration (milliseconds) and each repetition's peak power (watts) and peak force development rate (watts/sec). Linear regression models tested the effect of IRR duration on the peak power and peak force development rate of the subsequent repetition while controlling for other significant predictors. **RESULTS:** In upper body motions, holding constant exercise performed ($p<0.001$), resistance applied ($p<0.001$), and repetition number ($p=0.045$), each additional second of IRR predicted a 2.23-watt increase of peak power in the next repetition ($p<0.001$; 95% CI: 1.81-2.65). The overall model was significant ($R^2=0.613$; $p<0.001$). Lower limb motions displayed a similar pattern ($R^2=0.620$; $p<0.001$) but the magnitude of effect by IRR duration was smaller ($p=0.001$; $\beta=1.13$; 95% CI: 0.67-1.59). Lower limb peak force development rate was unaffected by IRR ($p=0.714$); in upper body motions, there was a weak negative trend ($\beta=-2.08$; $p=0.090$). At loads under 20lb, IRR was less influential to performance; for loads of 20-25lb, the optimal IRR duration was 2.50-3.00 seconds. Holding confounders constant, repetitions that followed this duration of IRR experienced a 40.99-watt increase in power ($p<0.001$; 95% CI: 17.76-64.22). That duration had no effect on peak force development rate ($p=0.443$). **CONCLUSIONS:** Performance in resistance training is affected by innumerable factors. Our findings add one more for consideration: the duration of rest between repetitions within a single set. To achieve maximum power in the subsequent repetition, a rest interval of 2.50 to 3.00 seconds appears ideal.

2576 Board #37 May 29 9:30 AM - 11:00 AM
Evaluation Of Stretch Shortening Cycle Performance Of Upper Limbs

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to suggest an indicator for the Rebound Jump-index (RJ-index) of upper limbs that reflects the Stretch-Shortening Cycle performance (SSC performance) of the upper limbs, and elucidate the inter-trial reliability and the criterion-related validity of this indicator.

METHODS: The subjects were 31 male university track-and-field athletes between the ages of 18 and 21 years. Using an optical sensor, five rebound jumps with the upper limbs were performed on-site, and a jump height derived from the ground contact time and airborne time was calculated. The jump height was further divided by the ground contact time, and treated as the RJ-index of the upper limbs. For the rebound jumps, we instructed the subjects to keep their elbows as straight as possible during ground contact, keep the ground contact time short, and jump high. At the start of measurement, the hip joint angle was fixed to be 0°, and both upper limbs were kept perpendicular to the floor. In order to verify the reproducibility (inter-trial reliability) of the RJ-index measurement values of the upper limbs, we performed the same measurements 2 weeks later and derived the intraclass correlation coefficients (ICC) between the measurement values. In addition, to assess the criterion-related validity of the RJ-index of the upper limbs, we performed to the correlation between the RJ-index measurement and the shot put records.

RESULTS: ICC (1,1) between the RJ-index measurement of upper limbs (0.19+0.07) and the re-measurement (0.18+0.08) was $\rho=0.83$, and ICC (1,2) was $\rho=0.91$. These values indicate that the measurement reproducibility was relatively high. Upon deriving the partial correlation coefficient assuming age and weight as control variables, a relatively high correlation was seen between the RJ-index of the upper limbs and the shot put records ($r=0.59$, $p<0.01$).

CONCLUSIONS: Therefore, we think that it is apparent that the RJ-index of the upper limbs had a definite inter-trial reliability and this test may possibly have criterion-related validity as an assessment test for SCC performance of the upper limbs.

2577 Board #38 May 29 9:30 AM - 11:00 AM
Muscular Excitation Is Not Greater During Conventional Arm Care Exercises Than During Overarm Throwing

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Conventional arm care exercises include the use of rubber tubing (Jaeger Bands) and soft weighted balls (Plyocare Balls). It is postulated that these training devices may be used to prepare the arm for the forces present during overarm throwing. However, little research exists on the physiological effect of conventional arm care exercises.

PURPOSE: To test the hypothesis that muscular excitation is greater during conventional arm care exercises than overarm throwing.

METHODS: Nineteen males (age: 21 y, BMI: 26.6 kg/m²) participated in this investigation. Two independent wireless surface electromyography (sEMG) devices

(Somaxis Cricket) were used to assess muscular excitation of the shoulder (SH) and the forearm (FA). Following a standardized warm-up, maximal voluntary isometric contractions (MVIC) of the SH and FA were measured. Each visit consisted of various Jaeger Band Exercises targeting SH rotation and Plyocare Ball Exercises targeting arm force absorption. The arm care exercises were compared to overarm throwing via a one-way ANOVA and a Pearson correlation. Data are presented as a percentage (%) of MVIC (mean±SD).

RESULTS: Peak sEMG amplitude of the SH was not significantly different for Jaeger Band External Rotation (45±22%, $p=0.91$), Reverse Throw Green (55±21%, $p>0.99$), and Rebounders Black (41±16%, $p=0.35$) when compared to overarm throwing (56±21%). Peak sEMG amplitude of the FA was not significantly different for Jaeger Bands External Rotation (45±31%, $p=0.06$), Reverse Throw Green (57±22%, $p=0.46$), and Rebounders Black (72±22%, $p>0.99$) when compared to overarm throwing (72±17%). For the SH, Jaeger Bands External Rotation ($r=-0.18$, $p=0.24$), Reverse Throw Green ($r=-0.03$, $p=0.46$), and Rebounders Black ($r=0.16$, $p=0.27$) were not significantly correlated with overarm throwing. For the FA, Jaeger Bands External Rotation ($r=0.43$, $p=0.04$) was significantly correlated, while reverse Throw Green ($r=0.15$, $p=0.27$) and Rebounders ($r=0.39$, $p=0.06$) were not significantly correlated with overarm throwing.

CONCLUSION: These data indicate that conventional arm care exercises do not generate greater muscular excitation than overarm throwing. Therefore, it does not appear that these arm care exercises adequately prepare the arm to throw at high velocities.

2578 Board #39 May 29 9:30 AM - 11:00 AM
Overspeed Exercises Of The Arm Produces Greater Muscular Excitation Than An Overarm Throw

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(No relevant relationships reported)

Overspeed (OS) training is used to train the body at speeds that are faster than regular competitive speeds. To this end, OS training enhances muscular rate coding, which leads to muscular adaptation. Recently, OS training of the legs with resistance bands was shown to increase vertical jump height in trained males. However, little is known about OS training of the arm as it relates to an overarm throw.

PURPOSE: To test the hypothesis that muscular excitation of the arm is greater during OS training than an overarm throw.

METHODS: Nineteen males (age: 21 y, BMI: 26.6 kg/m²) completed four visits to the laboratory. Muscular excitation of the anterior forearm (FA) and posterior shoulder (SH) were assessed using two independent wireless surface electromyography (sEMG) devices (Somaxis Cricket). Maximal voluntary isometric contractions (MVIC) of the FA and SH were assessed after a standardized warm-up. Each visit consisted of various band assisted OS exercises. In general, the subject placed their arm between a stretched resistance band and moved their arm at maximum intent for ~six seconds. The position of the body was dependent upon the exercise and the amount of weight in the hand varied. The exercises were compared to an overarm throw via a one-way ANOVA and a Pearson correlation. Data are presented as a percentage (%) of MVIC (mean±SD).

RESULTS: Peak sEMG amplitude of the FA was significantly greater for the OS Unweighted Shoulder Y (110±33%, $p=0.01$) and the OS Weighted Drop Shoulder Y (95±27%, $p=0.01$) when compared to the overarm throw (72±17%). Peak sEMG amplitude of the SH was significantly greater for the OS Unweighted Shoulder Y (82±29%, $p=0.03$) when compared to an overarm throw (56±21%). Peak sEMG amplitude of the SH was not significantly different for the OS Weighted Drop Shoulder Y (65±21%, $p=0.39$) than the overarm throw. For the FA, OS Unweighted Shoulder Y ($r=0.57$, $p<0.01$) and OS Weighted Drop Shoulder Y ($r=0.72$, $p<0.01$) were significantly correlated with overarm throwing. For the SH, OS Unweighted Shoulder Y ($r=0.52$, $p=0.01$) and OS Weighted Drop Shoulder Y ($r=0.77$, $p<0.01$) were significantly correlated with overarm throwing.

CONCLUSION: These data indicate that OS training generates greater peak sEMG amplitude than an overarm throw. Yet, it remains unclear whether OS training will enhance throwing velocity.

2579 Board #40 May 29 9:30 AM - 11:00 AM
Differences In Quadriceps Muscle Endurance Between Healthy Males And Females

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Muscle endurance is critical for many sports, but is rarely assessed. Previous work has used a sustained contraction to measure muscle endurance, finding that females have greater endurance than males. However, a sustained contraction results in greater ischemia and is driven by peak strength. Thus, new clinical assessments of muscle endurance that overcome this challenge are needed. **PURPOSE:** To evaluate

quadriceps endurance between healthy males and females, and compare quadriceps endurance to quadriceps strength. **METHODS:** 19 healthy subjects (10 M, 26.8 ± 7.6 y; 77.6 ± 12.2 kg; 9 F, 23.8 ± 7.3 y; 60.4 ± 6.2 kg; Tegner 7.0 ± 0.9) participated in this study. Leg dominance was self-reported. Maximum voluntary isometric contraction (MVIC) and endurance were assessed at 90° of flexion on a Biodex dynamometer. Endurance was assessed via 5-second contractions followed by 3-second rests at a target of 70% MVIC. Once the subject's torque output fell below 50% of the target for 3 repetitions, the test was completed. Endurance was calculated as the area under the torque curve summed across repetitions. Independent t-tests compared differences between males and females. Pearson product moment correlation coefficients assessed the relationship between quadriceps strength and endurance. **RESULTS:** There were no significant differences in peak isometric strength normalized to body weight (M: 2.6 ± 0.6 Nm/kg, F: 2.6 ± 0.5 Nm/kg), nor was there a relationship between cumulative work and peak strength (p = 0.85, r = -0.05), age (p = 0.22, r = 0.30) or bodyweight (p = 0.31, r = 0.25). Males displayed greater cumulative work than females (M: 242.9 ± 127.3 Nm*s/kg, F: 142.9 ± 71.6 Nm*s/kg, p = 0.05). Both males and females showed significantly greater endurance in the dominant limb (Dominant: 194.9 ± 114.3; Non-dominant: 122.2 ± 55.3; p = 0.003). **CONCLUSIONS:** The muscle endurance test was not influenced by strength, age, or bodyweight. However, we did find significant differences in limb dominance which could be due to greater use of the dominant limb. In contrast to prior studies, males had greater endurance. We speculate that this could be due to differences in how the muscle reperuses during rest periods. Future work should assess if these differences carry over after injury and evaluate the physiological determinants for the observed differences.

2580 Board #41 May 29 9:30 AM - 11:00 AM
Water Vs. Land-based Squat Exercise In Postmenopausal Women: Effects On Neuromuscular Activity And Metabolic Equivalents

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Overweight and obesity are osteoarthritis (OA) risk factors. The prevalence of OA in women is higher than that of men. The squat exercise is a simple and effective strength training mode for lower extremities. The buoyancy and warm temperature of the water can reduce joint discomfort during the squat exercise. However, it is unclear the responses of neuromuscular activity (MA) and metabolic equivalents (METs) when squat exercise at different speeds was performed. **PURPOSE:** This study was to compare the responses of MA, rating of perceived exertion (RPE), and METs following squat exercise at slow (20bpm), medium (60bpm), and the fast as possible speed between in water and on-land in postmenopausal women. We recruited 23 postmenopausal women over the age of 50 with a BMI ≥ 24 or body fat ≥ 30%. Participants performed 15 repetitions squat exercise at medium speed, slow speed and fast speed in water and on land by random order. We measured the maximum voluntary contractions of quadriceps and hamstring muscle and standing posture oxygen consumption before exercise testing and collected RPE, METs, and MA in the exercise period. Paired-samples t tests were performed to test all parameters in water and on land. **RESULTS:** MA of quadriceps in water were significantly lower than that on land at three-speed squat exercise (slow: 11.95±3.93 vs 31.21±10.70, medium 17.02 ±5.31 vs 42.79±16.46, the fastest: 30.48±7.74 vs. 72.12±25.86 rms %, p<0.05). MA of hamstring was no difference between in water and on land following medium and fast-speed squat exercise. The METs in water were lower than that of on land at slow and medium speed squat exercise (slow: 1.73±0.37 vs.2.40±0.40, medium: 1.91±0.35 vs. 2.34 ±0.42, the fastest: 2.21±0.79 vs. 2.50±0.63, p<0.05). The RPE responses of squat exercise at all speeds in water were lower than that of on land (slow: 2.04±0.64 vs. 3.00±1.16, medium: 1.91±0.60 vs. 2.61 ±1.08, the fastest: 2.21±0.85 vs. 3.39±1.34, p<0.05). Conclusion: The responses of MA of hamstring and METs following the fastest-speed squat exercise were similar to those of on land, whereas it had a lower RPE.

2581 Board #42 May 29 9:30 AM - 11:00 AM
Different Methods Of Post Activation Potential On Swimming

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PURPOSE: The purpose of this study was to compare the effect of post-activation potentiation (PAP) on countermovement jump (CMJ) using different set configurations and loads on conditioning activity (CA) in highly trained swimmers.

METHODS: Sixteen national level swimmers participated in this study and performed a total of six visits to the laboratory. The first session was used for familiarization, the second session was utilized to determine a five repetitions maximum (RM) in the half squat (HS), and the following four visits consisted of four CA protocols performed in a counterbalanced order. Two CAs were performed as traditional sets (TS) with sequential repetition, with different load, which involved one set of five repetitions at 100% (TS₁₀₀) or 65% of 5 RM load (TS₆₅). Additionally, two CAs included one set of five repetitions with intraset rests, 30 second interrepetition rest (IRR), with both relative loads (IRR₁₀₀ and IRR₆₅). Countermovement jump height was measured at baseline, immediately after the CA, and every 2-min until 12-min. **RESULTS:** Significantly faster peak and mean barbell velocity was observed for the CAs with lower relative loads (p < 0.05). When evaluating the peak CMJ height, considered the best result after the CA, TS₁₀₀ improved CMJ performance (effect size = 0.39; p = 0.027; Δ% = 4.8 ± 7.3). **CONCLUSIONS:** Thus, set configuration using IRR does not promote PAP and TS with a high-load should be adopted for an acute improvement in CMJ for highly trained swimmers.

2582 Board #43 May 29 9:30 AM - 11:00 AM
The Effect Of Reflexive Performance Reset And Gluteal Activation Exercises On Muscular Excitation During Sprints

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Reflexive performance reset (RPR) has been reported to mitigate compensation patterns to reduce pain, increase flexibility, and enhance performance during sport and exercise. Furthermore, gluteal activation exercises (GA) have been postulated to enhance gluteal recruitment during exercise. However, it is currently unknown whether RPR or GA alter muscular excitation during exercise.

PURPOSE: To test the hypothesis that RPR improves hamstring excitation and GA improves glutei maximi excitation when compared to a dynamic warm-up.

METHODS: Ten male subjects (age: 21±1 y, BMI: 25.2±2.4 kg/m²) randomly completed a control visit (Control), a RPR visit (RPR), and a GA (GA) visit. Whole-body feeling was assessed using the feeling scale (-5=very bad, 0=neutral, 5=very good) and sprint time was assessed using slow motion video capture. The total contribution of muscular work was assessed for the quadriceps, the glutei maximi, and the hamstrings using surface electromyography (Athos Training System). Subjects performed a standardized dynamic warm-up (Control), had RPR performed on them by a trained technician (RPR), or completed a series gluteal activation exercises (GA). Maximal voluntary isometric contractions for the quadriceps, the glutei maximi, and the hamstrings were assessed, after which the subject ran three all-out 9.14 m sprints. The feeling scale and sprint time were analyzed via a one-way ANOVA and the total contribution of muscular work was analyzed via a two-way ANOVA. Data are presented as mean±SD.

RESULTS: There were no statistical differences between Control (2.9±1.4 a.u.), RPR (2.9±1.6 a.u.), or GA (3.2±1.7 a.u.) for the feeling scale (p=0.80). There were no statistical differences between Control (2.01±0.03 s), RPR (2.02±0.07 s), or GA (1.93±0.31 s) for sprint time (p=0.48). Total muscular contribution was not statistically different (condition main effect: p=0.90) during Control (quadriceps: 70±12%, glutei maximi: 16±8%, hamstrings: 14±9%), RPR (quadriceps: 61±11%, glutei maximi: 17±5%, hamstrings: 22±8%), or GA (quadriceps: 65±11%, glutei maximi: 17±5%, hamstrings: 18±8%).

CONCLUSION: These data indicate no alterations in muscular excitation following RPR or GA during short sprints in healthy males. Furthermore, RPR or GA did not enhance whole-body feeling or performance.

2583 Board #44 May 29 9:30 AM - 11:00 AM
Case Study: Shoulder Muscle Activity While Swimming With Different Wetsuit Conditions And Swimming Paces.

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During swimming, the wetsuit is an important piece of equipment can benefit swim performance. Triathletes can select different types of wetsuit based on personal preference, body type, and swimming technique. It is not clear if wetsuit design or swim pace influences shoulder muscle activity. **Purpose:** To determine how swimming with different types of wetsuit (HUUB design., Aegis II 3:5, Sphere) using different swimming paces influence shoulder muscle activity. **Methods:** One male subject (height: 181.6cm, body mass: 81.1kg) completed total four swim conditions in a 25 m pool: 1) No wetsuit (NWS), 2) Sleeveless wetsuit (SLW), 3) Full-sleeve

wetsuit (FSW), 4) Buoyancy shorts (BS) x 3 swimming paces: slow, medium, fast. A wireless waterproof EMG system (Cometa, Italy) was used to measure shoulder electromyography (EMG) (Anterior Deltoid: AD & Posterior Deltoid: PD) and swimming pace was measured by stopwatch. EMG data were averaged across 5 consecutive stroke cycles with stroke rate calculated. EMG data were normalized to NWS slow speed. **Results:** Stroke rate (slow: 1.92 ± 0.05 Hz, medium: 1.75 ± 0.05 Hz, fast: 1.46 ± 0.06 Hz) decreased as swimming velocity (m/s) increased (NWS - Slow: 1.12 ± 0.04 , Medium: 1.21 ± 0.02 , Fast: 1.32 ± 0.01 / SLW - Slow: 1.27 ± 0.02 , Medium: 1.34 ± 0.01 , Fast: 1.52 ± 0.01 / FSW - Slow: 1.25 ± 0.02 , Medium: 1.38 ± 0.02 , Fast: 1.48 ± 0.04 / BS - Slow: 1.21 ± 0.02 , Medium: 1.30 ± 0.01 , Fast: 1.40 ± 0.02). Inspecting EMG trends, AD EMG was greatest during BS vs. other conditions and increased with swim velocity during FSW and BS conditions. PD muscle activity did not exhibit any clear pattern between conditions or across swimming velocities. Table 1. Anterior and posterior deltoid muscle activities (%NWS slow) across the wetsuit conditions.

Condition	Anterior Deltoid			Posterior Deltoid		
	Slow	Medium	Fast	Slow	Medium	Fast
NWS	79.9 ± 19.4	73.7 ± 1.1	80.4 ± 4.8	93.8 ± 7.4	75.9 ± 33.4	87.7 ± 21.1
SLW	92.2 ± 13.2	76.1 ± 1.8	81.1 ± 2.2	102.7 ± 22.6	187.7 ± 22.2	157.3 ± 8.9
FSW	65.2 ± 3.6	76.8 ± 4.3	103.5 ± 14.9	162.1 ± 26.5	121.1 ± 3.7	149.3 ± 1.4
BS	111.7 ± 1.6	122.8 ± 5.7	149.4 ± 9.3	98.6 ± 48.5	83.4 ± 60.4	83.1 ± 48.2

Note: Anterior Deltoid and Posterior Deltoid as percent of Slow-No Wetsuit (NWS) condition during sleeveless wetsuit (SLW), full sleeve wetsuit (FSW), and neoprene shorts (BS).

Conclusion: It is important to establish techniques to measure muscle activity during swimming in different wetsuit conditions since muscle activity is influenced by a complex interaction of wetsuit condition, pace, and swim technique.

2584 Board #45 May 29 9:30 AM - 11:00 AM
How Do Different Forms Of Feedback Effect Maximal Voluntary Force In The Forearm Flexors?

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Biofeedback provides a unique stimulus enhancement to the maximal voluntary isometric contraction (MVIC) ability in several muscle groups. However, limited research has investigated the use of biofeedback in the upper extremities specifically, the forearm flexors (FF). **PURPOSE:** The purpose of this study was to examine whether different methods of biofeedback affect the maximal force achieved during the FF MVIC test. **METHODS:** Twenty subjects (10 Male) consented to participate in this randomized counter-balanced experiment. In a single visit, subjects were exposed to the following conditions whilst performing the FF MVIC test. These included, 1) Visual and verbal feedback (VIVE); 2) Verbal feedback only (VE); 3) Visual feedback only (VI); and 4) no feedback at all (NOVIVE). Real-time force output was displayed on a monitor for VIVE and VI, and loud standardized verbal encouragement of 'pull, pull, pull' was utilized for VIVE and VE. For each condition, a total of three, 5-second MVIC trials were completed with a two-minute rest between each trial. In addition, a 5-minute rest was provided between consecutive conditions. A 4 x 2 repeated measures ANOVA was performed using the peak MVIC (in Newton) with a significance level set at 0.05. Condition (VIVE vs. VE vs. VI vs. NOVIVE) was a within subject factor and sex (Male vs. Female) was a between subject factor. **RESULTS:** A significant main effect for condition ($p < .001$) but no interaction was revealed, with follow-up Bonferroni-adjusted pairwise comparisons demonstrating significantly greater force production in the VIVE compared to VE (mean ± standard error (SE): 330.80 ± 16.09 vs. 310.62 ± 15.51 , $p = .006$), and NOVIVE (mean ± SE: 330.80 ± 16.09 vs. 304.42 ± 15.88 , $p = .001$) conditions; as well as, significantly greater force production in the VI compared to VE (mean ± SE: 327.24 ± 15.84 vs. 310.62 ± 15.51 , $p < .001$), and NOVIVE (mean ± SE: 327.24 ± 15.84 vs. 304.42 ± 15.88 , $p = .004$) conditions. **CONCLUSIONS:** The main finding is that both VIVE and VI biofeedback provide the most effective form of encouragement during FF MVIC tests by demonstrating the greatest force output. Many studies commonly include VE feedback only, however, here we demonstrate the importance of providing VI biofeedback. Therefore, it is suggested that future studies include VIVE feedback during MVIC trials in the FF.

2585 Board #46 May 29 9:30 AM - 11:00 AM
The Effect Of Vibrating Foam Roller Exercise On Bilateral Ankle Proprioception In Basketball Players

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PURPOSE: Research evidence has shown hemispheric specialization in the utilization of proprioception. The purpose of this study was to investigate the immediate effect vibrating foam roller exercise (VFRE) on bilateral ankle proprioception in recreational basketball players (RBP). **METHODS:** This was a randomized cross-over study. Twenty-two right-footed male RBP (Age = 23.6 ± 0.3) volunteered. After baseline assessment of ankle proprioception in barefoot, RBP were randomly assigned to either vibrating the peroneal muscle (VFRE-p, $n = 11$) or the gastrocnemius muscle (VFRE-g, $n = 11$) group. Bilateral ankle proprioception was re-assessed after VFRE. After 24h washout, the two groups swapped exercise and bilateral ankle proprioception was re-assessed. The VFRE for each muscle group was 3x30s vibration at the frequency of 50 Hz, with a 30s rest between sets. Ankle proprioception was measured by active movement extent discrimination apparatus (AMEDA). Repeated measures and Pearson's correlation was used to analyze the data. **RESULTS:** There was no significant Side ($R = 0.411$, $p = 0.057$), Muscle or Time effect ($F = 0.826$, $p = 0.445$; $F = 0.441$, $p = 0.647$, respectively). However, when RBP were divided into superior (SG, $n = 11$) and inferior (IG, $n = 11$) groups, according to the median of bilateral ankle proprioception, we found: 1) the dominant right ankle proprioception worsen significantly after both VFRE-p ($p = 0.022$) and VFRE-g ($p = 0.02$) in the SG, but not in the IG ($F = 1.748$, $p = 0.2$); 2) the non-dominant left ankle proprioception improved significantly after both VFRE-p ($p = 0.046$) and VFRE-g ($p = 0.01$) in the IG, but not in the SG ($F = 1.461$, $p = 0.256$). These findings suggest that VFRE can impair the dominant right ankle proprioceptive performance in those who initially have superior proprioception, and conversely improve the non-dominant left ankle proprioceptive performance in those who initially have inferior proprioception. **CONCLUSIONS:** This study has revealed a novel hemispheric specialization effect in proprioceptive information processing associated with VFRE. Specifically, VFRE affects proprioception of the dominant and non-dominant hemispheric systems differently suggesting that the clinical application of VFRE should be considered regarding each individual's initial ankle proprioception and footedness.

2586 Board #47 May 29 9:30 AM - 11:00 AM
Comparison Of Warm-Up Strategies On Internal And External Rotation Mechanics In Collegiate Pitchers

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 (No relevant relationships reported)

Rotator cuff strains are the most common musculoskeletal injury in collegiate baseball pitchers. A variety of warm-up routines are employed, the effects of these routines on the subsequent function of the rotator cuff lack comparison. **PURPOSE:** To test the effect of four different warm-up routines on internal (IR) and external rotation (ER) shoulder kinematics. **METHODS:** Seven D1 collegiate pitchers were enrolled in an experiment involving four testing sessions. Each session began with one of four warm-up protocols: 1) Jaeger bands (JB), 2) standard dynamic warm-up (DW), 3) Jaeger bands and standard dynamic warm-up (JBDW), or 4) dynamic warm-up using collinear resistance (CR). Immediately after the warm-up, athletes underwent biomechanical analysis of internal and external shoulder rotation using Proteus (Proteus Motion, USA). They performed 12 repetitions of each motion using 5lb of 3D magnetic resistance. 48 hours of rest separated each session. The assigned sequence of protocols was counter-balanced. Proteus software computed peak power in watts (w), peak force development rate in watts/second, range of motion in meters (ROM), consistency (the ability to replicate ROM in three-dimensional space), and endurance (replication of power parameters in successive repetitions). A one-way repeated measures ANOVA was used. **RESULTS:** Subjects were 20.4 ± 1.4 years of age. Across all conditions, peak power was 96.3 ± 13.7 w in IR and 99.3 ± 15.7 w in ER; peak force development rate was 387.7 ± 118.5 w/sec in IR, and 418.7 ± 195.6 w/sec in ER. Differences were detected in the four warm-up conditions in peak power (CR highest; $p = 0.015$), peak force development rate (CR highest; $p = 0.072$), and ROM (CR highest; $p = 0.015$). No difference was found in deceleration ($p = 0.336$), consistency ($p = 0.903$), or endurance ($p = 0.769$). External rotation was different in the four warm-up conditions in peak force development rate (CR highest; $p = 0.045$). No statistical difference was found in power (CR was highest, but did not reach significance; $p = 0.104$), deceleration ($p = 0.520$), consistency ($p = 0.478$), endurance ($p = 0.145$), or ROM ($p = 0.543$). **CONCLUSION:**

The simulated dynamic warm-up using three-dimensional resistance elicited the best subsequent function, follow up studies should examine mechanisms that produce this difference.

2587 Board #48 May 29 9:30 AM - 11:00 AM
The Relationship Between Mountain Bike Seat Tube Angle, Knee-pedal Alignment, And Knee Range Of Motion

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(No relevant relationships reported)

PURPOSE: Newer bicycles have increasingly steep seat tube angles. Seat tube angle (STA) is consistent within each bike model, but changes with seat height and post positioning. Traditionally, a bike fit will vertically align the knee with the pedal at the midpoint of the downstroke. This positioning has an effect on a rider's knee range-of-motion (ROM) potentially affecting fatigue rates. Additionally, the ROM may affect the knee-pedal spindle alignment position thereby affecting power capacity. Therefore, the purpose of this study was to determine if effective seat tube angle affects knee-pedal alignment and knee ROM.

METHODS: Participants included 17 male and female (176.9 ± 3.9 cm, 66.6 ± 25.4 kg), amateur and elite, cross-country mountain bike racers. Reflective markers were placed by the same researcher at locations on the participants dominant side: greater trochanter of femur, lateral condyle of femur, and lateral malleolus of fibula. Photographs were taken of the bike alone and with the participant in their typical riding position, with leg at full extension, full flexion, and halfway through the downstroke. Photographs were analyzed to determine knee-to-spindle horizontal distance (KTS), peak knee flexion angle (KFA), and STA using digital measurement software (Dartfish USA, Alpharetta, GA). Linear regression was used to statistically analyze the data (alpha=0.05).

RESULTS: For every 1 degree increase in STA, knee position moved forward 1.42 cm closer to the handlebars (p=0.050, R²= 0.23). After accounting for STA, KFA explained an additional 44% of the variance in KTS (p<0.001) where every 1 degree increase in KFA resulted in knee position moving 0.58 cm further away from the handlebars. When combined, STA and KFA explain 67% of the variance in KTS.

CONCLUSIONS: It is generally accepted that KTS should be 0 to have optimal power transfer to the pedals and limit sagittal forces on the knee joint. Changing STA in order to decrease KTS may be effective to increase performance. Further research should examine how individualized STA could affect rider positioning and performance during endurance efforts.

E-26 Free Communication/Poster - Acute Exercise

Friday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

2588 Board #49 May 29 10:30 AM - 12:00 PM
Energy Resource Of Four Styles Of 30s All-out Rope Skipping

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(No relevant relationships reported)

Rope jumping has been popular and a major tool for training and entertainment. When skipping rate per jump increments from single under to quad under, flight time prolonged and increased swinging frequency, the proportion of aerobic and anaerobic energy supply may be different.

Purpose: To compare 30-s all-out rope skipping energy resource between four styles.

Method: 10 elite rope-skipper from Shanghai University of Sport (height=169.3±4.7cm; body mass=65.5±9.2kg; age=23.2±2.1 yrs, years of training=3.8±1.3 yrs) volunteered for this study. Participants conducted 30-second rope skipping test at 1 skip per jump (single under, SU), 2 skip per jump (double under, DU), 3 skip per jump (triple under, TU) and 4 skip per jump (quad under, QU), and completed as many repetitions as possible with 24 hours between trials. VO₂ were monitored at rest, during test and up to 1 hour after test. Blood lactate was measured immediately, minute by minute after test. Lactic (W_{bla}) and alactic anaerobic (W_{pcr}) energy outputs were calculated from net lactate production and the fast component of EPOC. Aerobic metabolism (W_{acr}) was determined from VO₂ during exercise. Net energy expenditure (W_{tot}) was calculated as summary of W_{pcr}, W_{bla} and W_{acr}.

Result: SU exhibited significantly lower W_{tot} value (49.9±12.70 kJ) than in DU (69.2±11.05), TU (72.0±13.59) and QU (81.0±16.25) (p<0.01). W_{pcr} (kJ) was significantly different between SU (23.4±6.9), TU (33.7±12.8) and QU (40.0±10.5) (p<0.05), and DU (29.1±8.0) and QU (p<0.05). W_{bla} (kJ) in SU and QU were significantly different (16.5±6.8 v.s 27.2±12.4, p<0.05). SU (10.0±2.2) had

significantly lower W_{acr} (kJ) value than the other styles (DU 12.3±3.1, TU 14.8±2.4, QU 13.7±3.7, p<0.05). W_{pcr} and W_{bla} accounted for 45.6%~50.2% and 32.2%~35.3% of total energy in four styles with no difference between styles (p>0.05). Aerobic provided 16.8~22.1% of total energy in all styles, with significant difference between SU and QU (20.6±4.8% v.s 16.8 ±2.5%, p<0.05), TU (22.1±8.6%) and QU (p<0.05). **Conclusion:** Four styles of 30s all-out rope skipping are all anaerobic-dominated with similar fractions, PCr and anaerobic lactic account for 45.6%~50.2% and 32.2%~35.3% of total energy.

Keywords: rope skipping, metabolism, energy resource

2589 Board #50 May 29 10:30 AM - 12:00 PM
Physiological Responses And Energetic Of Two Sprint Interval Exercise Protocols Based On Rope-skipping And Cycling

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(No relevant relationships reported)

High-intensity interval training could improve performance effectively. However, the acute physiological response and energy expenditure of a low-volume, high-intensity rope-skipping based protocol have not been determined.

PURPOSE: To compare the physiological response and energy resource in repeated bouts of sprint interval cycling (SIC) and high-intensity intermittent double-under rope skipping (HIT-RS).

METHOD: Fifteen college students (age=20.2±0.8 yrs, body mass=67.7±4.8kg, BMI=22.4±1.2kg.m², VO_{2peak}=51.90±7.83ml.kg⁻¹.min⁻¹) volunteered for this study. Participants completed two protocols (4 30s with 4min active recovery) on separate days with 1 week between trials. VO₂ and heart rate were monitored at rest, during test and continue to 1 hour after test. Blood lactate was measured 3 minutes after each bout, and minute by minute after the last bout. Lactic (W_{bla}) and alactic anaerobic (W_{pcr}) energy outputs were calculated from net lactate production and the fast component of EPOC. Aerobic metabolism (W_{acr}) was determined from VO₂ during exercise.

RESULT: Mean values for %VO_{2peak} and %HR_{peak} for SIC (78.79±15.35% and 85.33±4.69%) and HIT-RS (74.93±16.21% and 83.17±5.37%) were not significantly different (p>0.05). The overall energy cost for SIC (102.75±13.15 kJ) was significantly higher (p<0.001) compared to HIT-RS (70.86±10.25 kJ). W_{acr}, W_{bla} and W_{pcr} for SIC (17.39±3.08, 59.50±8.10 and 25.86±5.40 kJ) and HIT-RS (13.05±2.01, 27.97±6.77 and 29.84±6.28 kJ) were significantly different (p<0.01). Fractions of W_{acr}, W_{bla} and W_{pcr} for SIC (16.92±1.77%, 57.99±4.70% and 25.09±3.65%) and HIT-RS (18.80±3.13%, 38.84±6.09% and 42.36±5.98%) were significantly different (p<0.001). Both protocols were anaerobic-dominated with similar fraction (SIC:83.08±3.01% vs HIT-RS: 81.20±4.52%). Compared to SIC, HIT-RS was more PCr dominant (42.36±5.98% vs 25.09±3.65%, p<0.01) with lower anaerobic lactic contribution (38.84±6.09% vs 57.99±4.70%, p<0.001).

Conclusion: High-intensity interval protocol of rope skipping elicits vigorous cardiorespiratory responses and may confer physiological adaptations and performance improvements resembling as SIC.

2590 Board #51 May 29 10:30 AM - 12:00 PM
Determinants Of Metabolic Cost During Four Styles Of 30-second Sprint Rope Skipping

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Rope jumping has been a major training tool for many sports. However, no study has been conducted as yet to determine energy expenditure with incremental skipping rate per jump (difficulty) from single under to quad under.

Purpose: To determine and compare 30-seconds all-out effort energy expenditure between four incremental rope skipping difficulties.

Method: Ten skilled rope-jumpers (height=169.3±4.7cm, body mass=65.5±9.2kg, age=23.2±2.1 yrs, years of training=3.8±1.3 yrs) volunteered to participate this study. Participants conducted rope skipping as many repetitions as possible at 1 skip.jump⁻¹ (single under, SU), 2 skips.jump⁻¹ (double under, DU), 3 skips.jump⁻¹ (triple under, TU) and 4 skips.jump⁻¹ (quad under, QU) during 30-second test with 24 hours between trials. Kinematic and kinetic data were collected to calculate flight time (FT) and vertical center of mass displacement (vCOM). Each style was assessed in three trials and then averaged. Net energy expenditure (W_{tot}) was calculated from VO₂ during exercise, the fast component of the EPOC above resting and net blood lactate production.

Result: SU exhibited significantly lower VO_{2peak} (28.01±4.62 ml.kg⁻¹.min⁻¹, p<0.05) compared to TU (34.96±3.45) and QU (36.12±6.38). W_{tot} (J.jump⁻¹) in QU (7975.1±3265.66 J.jump⁻¹) was significantly higher than these values of the other three styles (SU 474.9±108.80, DU 1086.4±183.17, TU 1769.3±540.46, p<0.05). FT (ms) and vCOM (cm) increased significantly with increase in difficulty (SU: 125.0±19.6

and 1.95 ± 0.66 , DU: 276.6 ± 36.1 and 9.53 ± 2.24 , TU: 473.6 ± 32.1 and 27.64 ± 3.76 , QU: 544.4 ± 60.5 and 36.76 ± 8.15 , $p < 0.01$). 30s skip repetitions in QU (46.0 ± 19.34) was significantly lower than the other styles (SU 105.2 ± 12.08 , DU 128.2 ± 15.12 , TU 126.9 ± 20.39 , $p < 0.01$). Standard Workload (J.kg⁻¹.jump⁻¹) was exponentially related to skipping difficulty from 1 skip.jump⁻¹ to 4 skips.jump⁻¹ ($R^2 = 0.89$, $p < 0.001$). **Conclusion:** Skipping difficulty (skip per jump) is one of the main determinants of metabolic cost, whereas skip repetition does not significantly contribute to metabolic cost during 30 seconds all-out rope skipping.

2591 Board #52 May 29 10:30 AM - 12:00 PM
The Effects Of A Counterpulsation Auditory Prompt On Hemodynamics And Metabolism During Endurance Running

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(No relevant relationships reported)

Recent studies in elite runners suggest that cardiocomotor synchronization, when step rate and heart rate naturally occur with a 1:1 ratio, can lead to hemodynamic advantages of counterpulsation when the foot strikes occur during the diastolic phase of the cardiac cycle. **PURPOSE:** Healthy non-elite runners were studied to investigate the hemodynamic and metabolic responses to prolonged counterpulsation by prompting individuals to step during the diastolic phase of their cardiac cycles during endurance running. We hypothesized that an auditory prompt that elicited counterpulsation would result in a lower heart rate, pulse pressure, respiratory exchange ratio (RER), ventilation and blood lactate, and higher oxygen consumption and blood glucose compared to an auditory prompt that did not elicit counterpulsation. **METHODS:** Fifteen healthy subjects (8 male, 7 female) completed two single-blinded sessions of 20-minutes of continuous treadmill running at an intensity of 60-80% of $\dot{V}O_{2max}$ in randomized order: 1) with an auditory prompt adaptive to the subject's real-time heart rate and stepping phase to guide diastolic stepping, and 2) with a non-adaptive, constant frequency auditory prompt set at each subject's natural step rate. Heart rate and indirect calorimetry were measured continuously throughout exercise followed by 10 minutes of sedentary recovery. Finger pricks for blood lactate and glucose were done every five minutes during exercise and every two minutes during recovery. Blood pressure was measured pre- and post-exercise and post-recovery. **RESULTS:** The adaptive auditory prompt successfully guided runners to step in diastole >75% of the steps and resulted in a significantly lower pulse pressure following the post-exercise recovery compared to the non-adaptive prompt (31 ± 2 vs. 36 ± 3 mmHg, $p < 0.05$). We also observed trends in lower heart rate (2-6 beats/min) and higher blood glucose (0.1-0.3 mM) during exercise guided by the adaptive auditory prompt compared to the non-adaptive prompt. No differences were observed in the other variables. **CONCLUSION:** Counterpulsation, through prompted cardiocomotor synchronization, may have hemodynamic advantages during and after endurance running in a healthy recreationally active population.

2592 Board #53 May 29 10:30 AM - 12:00 PM
Comparing Isometric Exercise Protocols Using A Novel Exercise Ball Versus A Traditional Computerized Dynamometer

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(No relevant relationships reported)

Hypertension is the leading risk factor for death and disability worldwide. Isometric handgrip (IHG) training is endorsed as one of the "Best Proven Nonpharmacological Interventions for Prevention and Treatment of Hypertension" by the American Heart Association/American College of Cardiology in their current guidelines. Barriers such as cost of the handgrip devices and tedium arising from repeating the same exercises, pose a challenge for widespread implementation of IHG training. Therefore, alternative devices that provide potential for a wide variety of isometric exercises warrant further investigation. **PURPOSE:** To determine whether an acute bout of IHG exercise, performed with a novel exercise ball (NEB), elicits similar cardiovascular responses and ratings of perceived exertion (RPE) to a traditional IHG device (TID). **METHODS:** Ten healthy adults (age: 24 ± 7 yrs; $\bar{Q} = 7$; systolic blood pressure (BP)/diastolic BP: $99/56 \pm 9/6$ mmHg) randomly performed two different IHG exercise protocols, one with the NEB, and the other with the TID. Both protocols involved 4, 2-min isometric contractions with 1-min rest periods between contractions, but NEB employed hand and adductor isometric contractions at 20-30% of maximum voluntary contraction (MVC), while the TID protocol involved alternating handgrip contractions performed at 30% of MVC. Heart rate (HR) and BP were recorded pre-, mid-, and post-exercise bout, as well as every 5-min during seated rest. RPE was assessed using the Borg CR-10 scale, following each contraction. The two protocol bouts were separated by 30-min of seated rest. **RESULTS:** The NEB and TID protocols elicited

similar HR and systolic BP responses ($p > 0.05$). However, the TID protocol elicited a greater diastolic BP response (12 ± 1 mmHg) than the NEB protocol (8 ± 1 mmHg; $p = 0.026$). Additionally, a higher RPE was observed for TID, compared to NEB ($p < 0.001$). **CONCLUSION:** This preliminary data suggests that the NEB protocol elicits similar cardiovascular responses (HR and systolic BP) while being perceived to require less effort, compared to the TID. Such an isometric exercise ball offers the potential for a wide variety of isometric exercises to be performed during training. Supported by University of Windsor Research Stimulus Fund Grant 813306

2593 Board #54 May 29 10:30 AM - 12:00 PM
Evidence That Women With Polycystic Ovary Syndrome Exhibit Altered Vascular Function To High-intensity Exercise

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(No relevant relationships reported)

PURPOSE: Women with Polycystic Ovary Syndrome (PCOS) have an increased risk of cardiovascular disease (CVD). The link between PCOS and CVD is believed to be related to vascular dysfunction. An integral component of the management and prevention of CVD is high-intensity (HI) exercise, which has been shown to improve vascular function. However, there is currently a lack of evidence regarding the vascular response following an acute HI exercise bout in PCOS. Therefore, we assessed vascular function via brachial artery flow-mediated dilation (FMD) in response to an acute HI treadmill exercise bout in women with PCOS and healthy controls (CON). **METHODS:** 8 PCOS (age: 26 ± 4 y; height 166 ± 5 cm; weight 66 ± 11 kg) and 10 CON (age: 28 ± 6 y; height 166 ± 7 cm; weight 59 ± 12 kg) were studied. All participants performed a maximal incremental treadmill test to determine peak oxygen uptake ($\dot{V}O_{2peak}$). On a separate day, subjects performed a 30min constant-load HI treadmill test at 75% of their individual $\dot{V}O_{2peak}$. FMD was measured at baseline (pre-HI) and immediately after (post-HI) exercise. A two-way group (PCOS vs CON) by time (pre-HI vs post-HI) analysis of variance was conducted. **RESULTS:** $\dot{V}O_{2peak}$ was similar between groups (PCOS: 2.78 ± 0.42 ; CON: 2.41 ± 0.48 L·min⁻¹, $p = 0.118$). The reduction in FMD post-HI was similar ($p = 0.985$) in PCOS ($-0.66 \pm 1.26\%$) and CON ($-0.47 \pm 0.79\%$). SRAUC increased ($p = 0.035$) in PCOS post-HI (4167 ± 6239 cm·s⁻¹), whereas a reduction ($p = 0.048$) was observed in CON (-4133 ± 7462 cm·s⁻¹). When FMD was normalized for shear rate, as defined by the area under the curve (SRAUC) following hyperaemia, the FMD:SRAUC ratio decreased ($p = 0.020$) to a greater extent in PCOS (-0.90 ± 0.84) compared with CON (0.03 ± 0.10) post-HI. **CONCLUSIONS:** Despite being young and active individuals, we provide new evidence that, for a given shear stress evoked by HI exercise, the impairment in vasodilatory function is worse in women with PCOS compared with CON. Whether this alteration in exercise-induced changes in vascular function plays a role in the elevated risk of developing CVD in this population is presently unclear. Further investigation into the underlying mechanisms of the altered vascular response to HI exercise in women with PCOS is warranted.

2594 Board #55 May 29 10:30 AM - 12:00 PM
The Impact Of Age On Critical Speed And Distance: Insight From The Masters World Championships

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(No relevant relationships reported)

PURPOSE: The impact of age on critical speed (CS), the maximum sustainable speed a person can run under aerobic, steady-state conditions, and Distance-prime (D'), the finite amount of work a person can perform above CS, is unknown. The purpose of this study was to examine how CS and D' vary with age in a population of active adults. **METHODS:** In 2019, the World Masters Association held the Indoor Track and Field World Championships for masters athletes ranging from 35 to 100+ years old. Race times for the top 8 finishers of the 60-10,000m races for each 5-year age group (ages 35-75 yrs) and sex (Females: $n=72$, Males: $n=72$) were taken to explore the effect of age on the relationship between average running speed and distance (Univariate ANOVA). CS and D' were subsequently calculated using the 1/time method for all individuals who completed both the 1,500m and 3,000m events during the championships (Males: $n=63$, 35-85 yrs, Females: $n=39$, 35-80 yrs). Linear regression was then utilized to determine the relationship between age, CS and D'. **RESULTS:** A typical curvilinear relationship between speed and distance was observed for all ages and sexes (Panels A and B). There was a significant interaction between age and the speed-distance relationship, such that a greater decrease in overall running speed was observed when going from 55 to 75 years than from 35 years to 55 years ($P < 0.05$). As illustrated in Panel C, CS exhibited a non-linear,

inverse relationship with age ($R^2=0.65-0.78, P<0.001$) with the rate of decline of CS steepening after ~55 years. Age was weakly related to D' ($R^2=0.06, P=0.035-0.055$), with an average of a 1.08-1.46 meter decline in D' per year.

CONCLUSIONS: Even in subjects representing some of the fittest individuals in the world for a given age, the speed-distance relationship and CS are impacted in a non-linear manner by age, with steeper declines in CS being observed after age ~55 years.

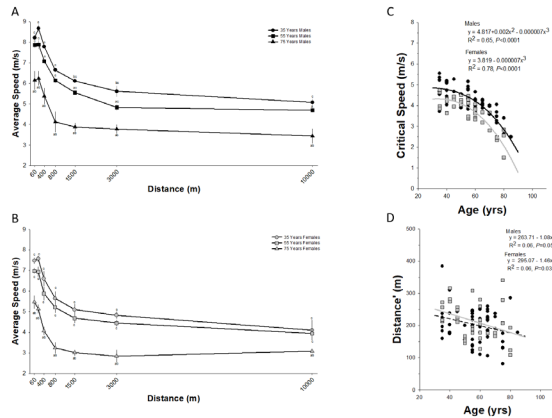


Figure 1: The Impact of Age on the Relationship between Average Race Speed and Race Distance (Panels A and B), Critical Speed (Panel C) and Distance' (Panel D). Black filled circles represent data from males. Gray filled circles represent data from females. a: significantly different from same distance at 35 years. b: significantly different from same distance at 55 years. c: significantly different from same distance at 75 years.

their higher risk for hypertension. It is unknown whether AA and Caucasian Americans (CA) would exhibit different blood pressures following acute bouts of anaerobic exercise.

PURPOSE: To assess hemodynamic changes in healthy, young AA and CA women following repeated bouts (two) of maximal anaerobic exercise. **METHODS:** Eight young, healthy AA women and 9 CA women completed this study. Vascular and hemodynamic measurements were taken at rest, and 5 (P5-1st), 15 (P15-1st), and 30 minutes (P30-1st) following a maximal anaerobic exercise test on cycle ergometer, and 5 (P5-2nd), 15 (P15-2nd), and 30 (P30-2nd) minutes following the second maximal anaerobic exercise test. Brachial systolic (SBP), diastolic (DBP) blood pressures, central aortic SBP, DBP and mean arterial blood pressure (aortic MAP) were measured. Carotid arterial stiffness (beta-stiffness index) were obtained using ultrasonography. **RESULTS:** Data were presented in Table 1 as mean \pm standard error. Resting DBP and aortic DBP were significantly different between AA and CA ($p<0.05$). There was a significant race by time interaction for aortic MAP ($* p<0.05$). And there was a trend towards significance in race by time interaction for beta stiffness index ($p=0.06$). **CONCLUSION:** Acute bouts of anaerobic exercise increase aortic MAP in young AA but not in CA, and it may be related to increases in arterial stiffness in AA. The heightened BP and vascular responses to exercise stimulus may play a role in the pathogenesis of hypertension in AA.

Supported by New England ACSM New Investigator Award to HY.

Table 1. Hemodynamic responses to two acute bouts of maximal anaerobic exercise.

Variables	Race	Rest	P5-1st	P15-1st	P30-1st	P5-2nd	P15-2nd	P30-2nd
SBP (mmHg)	AA	117 \pm 3	131 \pm 3	120 \pm 3	116 \pm 2	130 \pm 4	120 \pm 3	117 \pm 2
	CA	113 \pm 3	129 \pm 3	111 \pm 3	114 \pm 2	134 \pm 4	118 \pm 3	111 \pm 2
DBP (mmHg) §	AA	73 \pm 2	68 \pm 2	68 \pm 2	71 \pm 2	68 \pm 2	69 \pm 2	70 \pm 2
	CA	68 \pm 2	67 \pm 2	63 \pm 2	67 \pm 2	68 \pm 1	65 \pm 2	65 \pm 2
aortic SBP (mmHg)	AA	104 \pm 2	110 \pm 2	104 \pm 3	102 \pm 2	109 \pm 3	100 \pm 2	102 \pm 2
	CA	98 \pm 2	108 \pm 2	97 \pm 3	98 \pm 2	111 \pm 2	97 \pm 2	96 \pm 2
aortic DBP (mmHg) §	AA	74 \pm 2	70 \pm 2	71 \pm 2	73 \pm 2	70 \pm 2	70 \pm 2	73 \pm 2
	CA	68 \pm 2	68 \pm 2	66 \pm 2	69 \pm 2	70 \pm 2	68 \pm 2	68 \pm 2
aortic MAP (mmHg) *	AA	86 \pm 2	87 \pm 2	85 \pm 2	85 \pm 2	86 \pm 2	82 \pm 2	86 \pm 2
	CA	81 \pm 2	86 \pm 2	78 \pm 2	81 \pm 2	88 \pm 2	80 \pm 2	79 \pm 2
beta stiffness index	AA	4.9 \pm 0.5	6.3 \pm 0.5	6.6 \pm 0.5	5.8 \pm 0.5	6.2 \pm 0.6	6.6 \pm 0.5	6.7 \pm 0.6
	CA	5.6 \pm 0.5	6.1 \pm 0.5	5.4 \pm 0.5	5.2 \pm 0.5	6.2 \pm 0.6	5.3 \pm 0.5	5.8 \pm 0.6

2595 Board #56 May 29 10:30 AM - 12:00 PM

Hemodynamics Between Post-exercise Hypotension Responders And Non-responders After Maximal Exercise

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(No relevant relationships reported)

Emerging evidence showed hemodynamic indices derived from arterial waveform predict cardiovascular events and target organ damage. Whether these biomechanical markers change correspondently with post-exercise hypotension (PEH) remain unknown.

PURPOSE: To test the hypothesis that arterial hemodynamic indices following a maximal exercise test in PEH responders would differ from those in non-responders.

METHODS: A total of 71 recreational active young people (age=23.1 \pm 3.8yrs; BMI=23.1 \pm 3.1kg/m²) were recruited and underwent an acute bout of graded maximal exercise. Blood pressure (BP), arterial stiffness, and hemodynamics were measured at baseline, 5-, 15- and 30-min after exercise. Data analysis was compared between PEH responders (reduced brachial systolic or diastolic BP within 30 mins) and non-responders.

RESULTS: There were 43 responders (M/F=18/25) and 28 non-responders (M/F=10/18). The changes of brachial systolic BP, diastolic BP, and central systolic BP in responders were greater than those in non-responders throughout different time points following exercise. There was no group difference on conventional blood biomarkers, brachial-ankle pulse wave velocity, augmentation index, backward pressure, and reservoir pressure integral. Responders had a greater reduction on excessive pressure integral (XSPI) at 5 min post exercise. Overall arterial reservoir indices correlated better with the PEH changes compared to wave reflection indices.

CONCLUSIONS: From arterial hemodynamic perspective, the reduction of XSPI appeared the most pronounced biomechanical marker associated with post-exercise hypotension.

2596 Board #57 May 29 10:30 AM - 12:00 PM

Racial Differences In Cardiovascular Responses Following Acute Bouts Of Anaerobic Exercise

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(No relevant relationships reported)

Despite the growing popularity of high-intensity anaerobic exercise, few studies have examined the acute effects of this form of exercise on cardiovascular hemodynamics, or potential racial differences in these responses. In addition, post exercise hypotension may be absent in African Americans (AA) following aerobic exercise, consistent with

2597 Board #58 May 29 10:30 AM - 12:00 PM

Muscle Damage And Acute Kidney Injury In Endurance Mountain Running

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(No relevant relationships reported)

During mountain running events, athletes can experience muscular impairment as well as adverse health conditions of cardiovascular, immunological, renal and hepatic nature. Specifically, regarding the renal system, it has been shown that physical stress is a factor that contributes to the transitory decrease of renal function known as acute kidney injury (AKI) and muscle disintegration called exertional rhabdomyolysis (ER). The aim of this study was to assess hydration status, kidney function and muscle damage during an endurance mountain running (35.3km trail run, total positive ascend 1815m). A total of 26 experienced and trained mountain runners (age 39.5 \pm 9.23 years, weight 71.26 \pm 11.17 kg, height 171.65 \pm 8.69 cm) took part of the study. Assessments included urine specific gravity (USG), body weight (BW), creatinine (Cr), blood ureic nitrogen (BUN), albumin (ALB), glomerular filtration rate (eGFR) and creatine kinase

(CK), at three distinct moments (pre, post_{0h} and post_{24h}). A repeated measures analysis of variance (ANOVA) was used to verify possible differences between measurement times. There were no differences in USG ($F_{(2,34)} = 0.817$, $p = 0.45$, $\omega_p^2 = 0.01$), however differences were noted in BW ($F_{(1,26)} = 5.37$, $p = 0.029$, $\omega_p^2 = 0.16$, pre > post_{0h}), Cr ($F_{(2,42)} = 34.453$, $p < 0.01$, $\omega_p^2 = 0.6$, pre < post_{24h} < post_{0h}), BUN ($F_{(2,42)} = 15.694$, $p < 0.01$, $\omega_p^2 = 0.39$, pre < post_{0h} < post_{24h}), ALB ($F_{(1,26)} = 7.806$, $p < 0.01$, $\omega_p^2 = 0.2$, pre < post_{24h} < post_{0h}), eGFR ($F_{(1,26)} = 5.403$, $p < 0.01$, $\omega_p^2 = 0.15$, post_{0h} < post_{24h} < pre) and CK ($F_{(1,26)} = 18.957$, $p < 0.01$, $\omega_p^2 = 0.43$, pre < post_{24h} < post_{0h}). Along with a decrease in body weight (BW loss > 2%), a decrease in eGFR and a rise in ALB, BUN, CK and AKI was found (acute absolute Cr difference > 0.3 mg/dL). This constellation of values supports the idea that endurance mountain running can lead to AKI and muscle injury because of mechanical damage of both kidney and muscle due to repeated effort.

2598 Board #59 May 29 10:30 AM - 12:00 PM
Heavy Battle Rope Exercise On Autonomic Modulation: Differences Between The Sexes

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(No relevant relationships reported)

Heavy rope battle exercise (HI-HRE) is used to increase power, muscle hypertrophy and maximal strength. The data regarding autonomic modulation in response to heavy battle rope exercise between the sexes are non-existent. **PURPOSE:** To assess sex differences in autonomic modulation in response to heavy battle rope exercise. **METHODS:** Twenty-six (men: 14; women: 12) resistance-trained individuals volunteered for the study. Heart rate (HR), vagal modulation, and sympathovagal dominance, collected via heart rate variability, were measured at Rest, 15 (Rec1), 30 (Rec2), and 60 (Rec3) minutes after the heavy rope battle exercise. Measures of vagal tone included logarithmically (ln) transformed high-frequency power (lnHF), and the root mean square of successive differences (lnRMSSD). Sympathovagal dominance was assessed using logarithmically (ln) transformed low frequency/high frequency ratio (lnLF/HF). The acute HI-HRE consisted of six, 15-second exercise bouts, using a double wave pattern at 180bpm, separated by 30-seconds of passive recovery intervals. Two-way repeated measures analysis of variance were used to evaluate differences between the sexes (men, women) across the repeated factor of time (Rest, Rec1, Rec2, and Rec3). **RESULTS:** There were no significant two-way interactions (sex by time) for any variable. However, HR demonstrated a significant main effect of time (Rest: 62±10bpm; Rec1: 84±10bpm; Rec2: 76±9bpm; Rec3: 70±8bpm; $p \leq 0.001$) in that each time all three recovery measurements were augmented compared to Rest. There were also significant main effects of time for lnHF (Rest: 7.51±1.09 ms²; Rec1: 4.62±1.30 ms²; Rec2: 5.35±1.20 ms²; Rec3: 6.29±0.97 ms², $p \leq 0.001$) and lnRMSSD (Rest: 4.23±0.63ms; Rec1: 2.71±0.65ms; Rec2: 3.10±0.60ms; Rec3: 3.57±0.51ms, $p \leq 0.001$) in which all three recovery measurements were attenuated compared to Rest. A significant main effect of time was also noted for lnLF/HF (Rest: 0.87±0.11; Rec1: 1.19±0.21; Rec2: 1.14±0.30; Rec3: 1.03±0.15, $p \leq 0.001$) in which all values during recovery were significantly elevated compared to Rest. **CONCLUSIONS:** These data demonstrate that both men and women have the same responses in HR and autonomic modulation during recovery from acute HI-HRE. Collectively, all measures failed to return to resting values within 60 minutes.

2599 Board #60 May 29 10:30 AM - 12:00 PM
Pulse Wave Reflection After Upper-body Resistance Exercise With And Without Blood Flow Restriction Between Sexes

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(No relevant relationships reported)

Acute upper-body resistance exercise (URE) with blood flow restriction (BFR) on pulse wave reflection (PWR) between sexes is unclear. **PURPOSE:** To evaluate the effects of URE, with and without BFR, on PWR between sexes. **METHODS:** Nine women and 14 men volunteered for the study (Mean±SD: Age, 22±2 yrs). Hemodynamics and PWR were assessed at rest (R), and at 10 (R10), 25 (R25), 40 (R40), and 55 (R55) minutes after either URE (lat pulldown and chest press) with or without BFR. The BFR condition consisted of 4 sets of 30, 15, 15, and 15 repetitions with 30% 1-repetition maximum (1RM), while the without BFR (high-load, HL) condition consisted of 4 sets of 8 repetitions at 70% 1RM. A 2x2x5 repeated measures ANOVA was used to evaluate the effect of sexes across conditions and time. **RESULTS:** There were no significant 3-way interactions. There were main effects of time for mean arterial pressure (MAP) and central MAP (cMAP). MAP (BFR, Women vs. Men, R: 80±6 vs. 84±4mmHg, R10: 75±6 vs. 78±6mmHg, R25: 79±5 vs. 81±6mmHg; HL, R: 79±5 vs. 84±7mmHg, R10: 77±4 vs. 81±5mmHg, R25: 77±4 vs. 83±5mmHg, $p = 0.001$) decreased at R10 compared to rest and returned to resting level at R25, while cMAP (BFR, Women vs. Men, R40: 77±5 vs. 78±6mmHg, R55: 78±5 vs. 80±7mmHg;

HL, R40: 77±7 vs. 79±6mmHg, R55: 79±5 vs. 82±7mmHg, $p = 0.038$) increased at R55 compared to R40. There were sexes difference for MAP for the HL (Women vs. Men, R: 79±5 vs. 84±7mmHg, R10: 77±4 vs. 81±5mmHg, R25: 77±4 vs. 83±5mmHg, R40: 77±5 vs. 82±6mmHg, R55: 79±5 vs. 85±6mmHg, $p < 0.05$) condition such that women had lower MAP compared to men at all-time points. There were significant sex by time differences for heart rate (HR), augmentation index (AIx), and AIx normalized to 75bpm (AIx@75) such that women had higher HR at rest (Women: 65±3bpm, Men: 54±2bpm, $p < 0.001$), AIx (Women: 17.2±3%, Men: 10.7±2.3%, $p = 0.002$), and AIx@75 (Women: 12.3±3.3%, Men: 0.5±2.7%, $p < 0.001$) compared to men at rest and R10. **CONCLUSION:** These data suggest that sex difference existed for HR and PWR at rest, and men had greater responses to URE with and without BFR compared to women. Although both sexes had attenuated recovery for PWR in response to URE without BFR, PWR returned to resting levels in both sexes 40 minutes after URE with or without BFR.

2600 Board #61 May 29 10:30 AM - 12:00 PM
Foam Rolling And Hrv

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to determine if a bout of foam rolling could increase parasympathetic activity as measured by heart rate variability (HRV). This study utilized an ultra-short-term HRV finger sensor device and software that records the root mean square sum of standard deviations with the natural log transformation multiplied by 20 (HRV) for easy interpretation of the results.

METHODS: Twenty (20) participants were measured pre-activity for HRV using the finger sensor connected to a tablet while lying supine, and then a second measure was recorded with them sitting upright with feet on the ground. The software collects HRV values in 55 seconds, and directs their breathing with an on-screen prompt. Participants then oscillated on a closed-cell cylindrical foam roller using their body weight on the triceps surae, hamstrings, quadriceps, lumbar spine, and pectoral muscles, respectively, for 60 seconds. Participants first massaged the right limb and then repeated the same muscle group on the left before continuing to the next region. A second HRV measurement was recorded with the same procedures.

RESULTS: Paired samples t-tests revealed no difference between supine measures ($p = 0.56$), nor the seated measures ($p = 0.59$). There was no difference between sexes.

CONCLUSIONS: The single bout of foam rolling across major muscle groups do not increase parasympathetic activity via venous return as hypothesized. The change in HRV values averaged 1.55 and 1.30 decreases between supine and seated, respectively, but those changes are not statistically significant. The task of self-massage may be more metabolically demanding than initially believed, as the required muscle activation overpowers the venous return from massage. More research is needed to determine if passive massage would produce the desired parasympathetic neural increase.

2601 Board #62 May 29 10:30 AM - 12:00 PM
Cool-down Versus Passive Recovery After Supramaximal Interval Exercise On Hemodynamics And Aortic Stiffness

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(No relevant relationships reported)

PURPOSE: To compare the effects of a cool-down (CD) versus passive recovery (PR) after supramaximal interval exercise on hemodynamics and aortic stiffness. **METHODS:** Twelve moderately active individuals (Mean±SD: 23±3 yrs (Men: n=8; Women: n=4) were assessed for hemodynamics and aortic stiffness at Rest, and 15 (R15), 30 (R30), 45 (R45) and 60 (R60) minutes following supramaximal interval exercise. Hemodynamics, via photoplethysmography, included heart rate (HR), mean arterial pressure (MAP), cardiac output (CO), stroke volume (SV), and total peripheral resistance (TPR). Aortic stiffness was measured via pulse wave velocity (PWV). Two-way repeated ANOVAs were used to evaluate the main effects of condition (CD, PR) across time (Rest, and R15, R30, R45 and R60). **RESULTS:** There were no significant condition by time interactions. There were significant ($p \leq 0.001$) main effects of time for HR, CO, SV and TPR such that both conditions responded similarly. HR was elevated at all recovery times compared to Rest (CD: Rest: 59±5bpm; R15: 91±10bpm; R30: 84±15bpm; R45: 74±10bpm; R60: 71±9bpm; PR: Rest: 59±7bpm; R15: 90±10bpm; R30: 80±11bpm; R45: 74±9bpm; R60: 71±11bpm). CO was elevated at R15 compared to Rest (CD: Rest: 5.4±0.9L/min; R15: 8.5±1.8L/min; PR: Rest: 5.8±0.9L/min; R15: 9.4±2.0L/min), with values that returned to Rest by R30. SV was similar to Rest at R15 and R30, and significantly higher at R15 compared to R30, R45 and R60. However, R45 and R60 were attenuated compared to Rest (CD: Rest 92.0±14.5mL/b; R15: 100.5±20.1mL/b; R30: 84.7±16.8mL/b; R45: 79.0±13.7mL/b; R60: 78.6±12.1mL/b; PR: Rest: 96.0±11.6mL/b; R15: 102.9±19.5mL/b; R30:

82.4±17.3mL/b; R45: 79.4±14.8mL/b; R60: 76.1±16.4mL/b). TPR was attenuated at R15 after supramaximal interval exercise compared to Rest (CD: Rest: 0.9±0.2mmHg/mL/min; R15: 0.5±0.1mmHg/mL/min; PR: Rest: 0.9±0.1mmHg/mL/min; R15: 0.5±0.1mmHg/mL/min), such that it decreased in both conditions, before it returned to Rest by R30. The supramaximal interval exercise had no effect on MAP or PWV. **CONCLUSIONS:** Collectively, these data suggest that a proper cool-down does not elicit a means to attenuate transient changes in hemodynamics after supramaximal exercise in moderately-trained individuals.

2602 Board #63 May 29 10:30 AM - 12:00 PM
Sex Differences In Arterial Stiffness Following Acute Resistance Exercise

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(No relevant relationships reported)

During resistance exercise there is an increase in blood pressure, with systolic pressure rising up to 400 mmHg. This transient elevation in pressure has been shown to result in acutely stiffer vessels in young males, however, this has not been well studied in young females. It is possible that the sex hormones of young females may be protective against this pressure load, resulting in differential responses following resistance exercise. **PURPOSE:** The purpose of this study was to determine if there are sex differences in arterial stiffness following an acute resistance exercise bout in young, healthy males and females who are not currently resistance training. **METHODS:** Carotid beta stiffness (β), arterial compliance (AC), and elastic modulus (Ep) measurements were taken in 23 young participants (10 males, 13 females; 26 ± 1 years) before, immediately after, and 30 minutes following full body resistance exercise. Exercise consisted of 2 sets of 10-12 repetitions performed on 8 resistance machines completed at 40% 1RM for the upper body and 60% 1RM for the lower body. Females were tested during the early follicular phase of their menstrual cycle to control for sex hormones. Exercise values (pre, post, post30) were compared between sexes using a repeated measures ANOVA, with significance set at $p < 0.05$. When the interaction was significant, the responses were evaluated with paired samples t-tests within each sex and independent t-tests between sexes. **RESULTS:** There were no sex differences in stiffness values prior to exercise, but males displayed significantly higher β and Ep and lower AC post and post30 compared to females. Males demonstrated significant increases in β (4.2 ± 0.4 to 6.6 ± 0.5 to 5.8 ± 0.5 AU) and Ep (48 ± 5 to 73 ± 6 to 65 ± 6 kPa) and decreases in AC (1.5 ± 0.2 to 0.9 ± 0.1 to 1.1 ± 0.1 mm²/kPa) both immediately and 30 min post resistance exercise compared to baseline values, while females had no change in AC (1.4 ± 0.1 to 1.2 ± 0.1 to 1.5 ± 0.1 mm²/kPa) or Ep (46 ± 4 to 52 ± 5 to 44 ± 5 kPa) with exercise and an immediate increase in β that returned to baseline at 30 min post (4.2 ± 0.3 to 5.1 ± 0.5 to 4.3 ± 0.4 AU). **CONCLUSION:** Acute resistance exercise in females does not result in the elevation of stiffness as seen in males. It appears females may be protected from this increased pressure load, which may be due to the vasodilatory effects of estrogen.

2603 Board #64 May 29 10:30 AM - 12:00 PM
Bilateral And Unilateral Resistance Exercise On Pulse Wave Reflection And Arterial Stiffness

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(No relevant relationships reported)

PURPOSE: To examine changes in pulse wave reflection and arterial stiffness following bilateral (BL) and unilateral (UL) resistance exercise (RE). **METHODS:** Seventeen individuals (Mean±SD: 23 ±3yrs) were assessed for measures of hemodynamics, pulse wave reflection and arterial stiffness at Rest as well as 10, and 30 minutes post-exercise. Two-way repeated measures ANOVAs were used to analyze the effects of RE condition (BL, UL) across time (Rest, 10, 30 minutes). **RESULTS:** While there were no significant interactions, there were significant main effects of time for brachial diastolic blood pressure (BDBP), central diastolic blood pressure (CDBP), augmentation index (AIx), augmentation index at 75bpm (AIx@75), subendocardial viability ratio (SEVR), and pulse wave velocity (PWV). There were no significant main effects for brachial or central systolic blood pressure. BDBP (BL: Rest: 65 ±5mmHg, Rec1: 61±5mmHg, Rec2: 63 ±3mmHg; UL: Rest: 68 ±5mmHg, Rec1: 64 ±7mmHg, Rec2: 66 ±5mmHg, $p = 0.009$) was decreased at 10 and 30 minutes compared to rest following BL. Following UL, BDBP was decreased only at 30 minutes. CDBP (BL: Rest: 65 ±5mmHg, Rec1: 62 ±5mmHg, Rec2: 64±3mmHg, UL: Rest: 69 ±5mmHg, Rec1: 65 ±7mmHg, Rec2: 66 ±5mmHg, $p = 0.009$) was decreased at 10 minutes compared to Rest, and recovered by 30 minutes for BL. Following UL, CDBP was decreased at 10 and 30 minutes compared to Rest. AIx (BL: Rest: 11.6 ±8.4%, Rec1: 23.5 ±15.2%, Rec2: 18.6 ±12.5%; UL: Rest: 11.9 ±6.8%, Rec1: 25.1 ±13.4%, Rec2: 14.9 ±9.4%, $p < 0.001$) and AIx@75 (BL: Rest: 3.6 ±10.4%, Rec1: 22.1 ±15.9%, Rec2: 8.8 ±12.5%; UL: Rest: 4.1 ±7.9%, Rec1: 24.5 ±15.1%, Rec2: 11.2

±13%, $p < 0.001$) increased at 10 and 30 minutes compared to Rest following BL. Following UL, AIx was increased at 10 minutes compared to Rest and recovered by 30 minutes. AIx@75 also increased at 10 minutes but did not recover at 30 minutes for UL. For both conditions, SEVR ($p < 0.001$) decreased at 10 and 30 minutes compared to Rest. PWV ($p = 0.003$) increased at 10 minutes compared to Rest and returned to Rest by 30 minutes for both conditions. **CONCLUSIONS:** Our data suggest that unilateral RE may produce a quicker recovery in terms of central diastolic BP and AIx, thereby returning measures of pulse wave reflection to rest at a faster pace than bilateral RE.

2604 Board #65 May 29 10:30 AM - 12:00 PM
Orthostatic Challenge After High-intensity Interval Exercise Vs. Continuous Aerobic Exercise In Young Women

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Background: Orthostatic intolerance is one of the most common blood pressure regulation disorders and is highly prevalent and more common in young women. Young women tend to experience symptoms such as dizziness and fainting earlier and more often during the orthostatic stress. This tendency may be exacerbated after exercise when the phenomenon of post-exercise hypotension was superimposed. **Purpose:** This study aimed to investigate acute effects of two commonly performed exercises (high-intensity interval exercise and continuous aerobic exercise) on orthostatic responses after exercise in young women. **Methods:** Twenty apparently healthy young women aged 18-35 years were studied. Assessment of peak oxygen consumption ($VO_{2\text{peak}}$) was performed in the first visit. Each participant performed high-intensity interval exercise (HIIE) or continuous aerobic exercise (CAE) for 40 minutes each in a separate day. HIIE was performed at 80-90% of $VO_{2\text{peak}}$ (exercise:rest = 1:2). CAE was performed at 50-60% of $VO_{2\text{peak}}$. Orthostatic challenge tests (i.e., rapid standing from the supine position) were performed before and at 0, 60, and 120 minutes after the exercise session was completed. **Results:** Heart rate responses to the orthostatic stress were not different between the HIIE and CAE sessions. Both modes of exercise induced reductions in systolic blood pressure reductions after exercise. However, the magnitude of systolic blood pressure reduction during the orthostatic challenge was greater after the HIIE session (-13 ± 6 mmHg) than the CAE session (-8 ± 7 mmHg). **Conclusion:** These results suggest that compared with CAE, HIIE induced a greater reduction in systolic blood pressure during the orthostatic challenge and could make young women more prone to orthostatic intolerance.

2605 Board #66 May 29 10:30 AM - 12:00 PM
Sex Differences In Circulating Angiogenic Cells And Circulating Endothelial Cells In Response To Acute Exercise

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Acute exercise provides a stimulus for improving the function and health of the endothelium by initiating release of circulating angiogenic cells (CACs). However, this may also result in endothelial stress through the shedding of endothelial cells into circulation (CECs). The ratio of CACs/CECs may serve as a unique indicator of vascular health but sex differences in the ratio of CACs/CECs in response to acute aerobic exercise are unknown. **PURPOSE:** To determine whether there are sex differences in the CAC and CEC response to a single bout of submaximal treadmill exercise. **METHODS:** Subjects were healthy physically active men (n=15) and women (n=10) between the ages of 18-29 years. Maximal oxygen consumption ($VO_{2\text{max}}$) was assessed and 48 hours later, participants performed 30 minutes of treadmill running at 70% $VO_{2\text{max}}$. Fasted blood was obtained before and 30-minutes after the treadmill exercise. Peripheral blood mononuclear cells were isolated, FeR blocked and immunostained with antibodies specific to CD34-FITC, KDR-PE, CD31-FITC, CD3-APC, CD146-PECy7 and CD45-PerCP, and fixed in paraformaldehyde. The forward-side-scatter plot was used to identify the lymphocyte and monocyte gates from a total of 5,000 events/sample using a flow cytometer. CACs (CD34+/KDR+, CD31dim, and CD31dim/CD3+) and CECs (CD146+/CD45-) were quantified. **RESULTS:** There was no main effect for exercise or sex, or a sex*exercise interaction in the number of CD34+/KDR+ and CD31dim cells ($P > 0.05$ for both). There was no main effect of exercise in CD31dim/CD3+ cells but there was a significant main effect of sex ($P = 0.038$) and a trend for a sex*exercise interaction ($P = 0.069$) in men exhibiting 8% and 3% fewer CD31dim/CD3+ cells vs. women before and after exercise, respectively. Regardless of sex, CECs increased from 45.2 ± 9.7 events to

66.7 ± 18.7 events after the acute exercise bout ($P=0.027$). There was no main effect for exercise or sex, or a sex*exercise interaction in CAC/CEC ratios ($P>0.05$ for all). **CONCLUSIONS:** Regardless of sex, the lack of mobilization of CACs in response to submaximal treadmill exercise suggests that other repair mechanisms may play a stronger role in maintaining the balance between endothelial repair and disturbance in younger physically active adults.

2606 Board #67 May 29 10:30 AM - 12:00 PM
Effects Of Acute Short Sleep And High-intensity Interval Exercise On Heart Rate Variability Frequency Indices

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Short sleep (SS) disrupts the normal functioning of the autonomic nervous system (ANS). Heart rate variability (HRV) is a reproducible measure of ANS function. Reduction in HRV represents a disruption of the ANS. High-intensity interval exercise (HIIE) reduces HRV. The immediate HRV response and its short-term recovery after HIIE is unexplored. SS prior to HIIE may disrupt further the ANS and reduce HRV. **PURPOSE:** To characterize the influence of SS on HRV after a single bout of HIIE in the hours post-exercise (PE). **METHODS:** Fifteen physically active males (age 31.1±5.3 yr) with good sleep quality as determined by the Pittsburgh Sleep Quality Index (PSQI) participated in this study. Participants completed a non-exercise control trial after 9 to 9.5 hrs of reference sleep (RS), a HIIE treadmill running (90% and 40% of $VO_{2\text{reserve}}$ in 3:2 min ratio) to expend 500 kcals after reference sleep (RSX) and after 3 to 3.5 hrs of SS (SSX) in a randomized crossover design. After being in a supine position for 10 minutes in a quiet and temperature-controlled environment heart rate (HR) was recorded for 5 minutes the night before, the morning of the next day, 1-, 2-, 4- and 6-hours PE using an elastic electrode belt (Polar Wearlink®). Sleep was performed at their own residence. Supine resting HRV indices (frequency domain: LF/HF and VLF) obtained from HR were measured and processed by CardioMood®. Data were analyzed using a 3 (condition) by 6 (time) repeated measures ANOVA. Examined variables violated normality and thus were transformed into natural logarithm (ln). Bonferroni was used for post hoc comparisons. Significance was set at $p < 0.05$. All analyses were performed using SPSS®. **RESULTS:** For ln VLF there was a main effect for condition by time interaction ($F_{10,140}=3.60, p=.000, \eta^2=.204$), but not for ln LF/HF condition by time ($F_{10,140}=1.84, p=.060, \eta^2=.116$). In VLF was both decreased in RSX at 1hr PE (6.3±2.5, $p=.001$) and 2hr PE (7.1±2.0, $p=.007$) and in SSX 1hr PE (6.1±2.2, $p=.000$) and 2hr PE (7.4±2.6, $p=.000$) compared to RS. During *post hoc* analysis frequency domain ln LF/HF was increased in SSX at Day 2-baseline (.29±.17, $p=.040$) and at 1hr PE (1.1±.19, $p=.041$). **CONCLUSION:** HIIE with 3:2 min ratio decreases HRV for up to 2 hours PE and takes more than 6 hours to return to baseline levels. These responses are not modified by a single night of short sleep.

2607 Board #68 May 29 10:30 AM - 12:00 PM
Differential Apelin Responses To Physical Stress In Elite Hungarian Athletes

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PURPOSE: To characterize the changes of different fragments of the strong positive inotropic peptide Apelin (AP) upon extreme physical stress in Hungarian handball players. The 77-amino acid preproapelin is cleaved to shorter active peptides, such as AP-36 and AP-13. However, these Apelin receptor agonists may differ in biological efficacy, with the shorter fragments being more potent. **METHODS:** We investigated the response of male athletes ($n=54$; age=24±2) to extreme physical (vita maxima treadmill test) stress. Cardiovascular, metabolic and respiratory parameters were monitored. All parameters were measured at baseline, at maximal stress situation and 30 minutes in the restitution phase. Circulating peptide (AP-13, AP-36, NT-proBNP) levels were measured by ELISA. **RESULTS:** AP-13 levels increased significantly at the peak of the treadmill test (167±71.5 pg/ml), compared to baseline values (144±72.4 pg/ml; $p<0.05$). After 30 minutes of recovery, AP-13 levels decreased significantly (137±65.7 pg/ml; $p<0.001$) returning to the baseline levels ($p=NS$). AP-36 showed a more robust increase in response to the maximal intensity treadmill test (80.7±61.4 pg/ml vs. 159±81.8 pg/ml; $p<0.001$), which decreased below the control levels after 30 minutes of restitution (52.4±23.2 pg/ml; $p<0.001$). NT-proBNP levels remained unchanged in all settings. Importantly, baseline and peak AP-13 levels showed a negative correlation with AP-36 response to the treadmill test ($r=-0.400, p<0.05$; $r=-0.416, p<0.05$; respectively). The

change in AP-13 level upon extreme physical stimulation correlated with the maximal MET ($r=0.374, p<0.05$) and the relative $VO_{2\text{max}}$ ($r=0.340, p<0.05$). Our subjects showed differential AP response: 62% of the individuals showed elevated whereas 38% lower AP-13 levels after the treadmill test. AP-36 increased in 85% and decreased in 15% of the athletes at peak intensity.

CONCLUSION: Collectively, our data show that both Apelin fragments change significantly after a vita maxima treadmill test, suggesting that Apelin as an endogenous positive inotropic peptide may contribute to the stress adaptation of the heart. Athletes having higher baseline and peak AP-13 plasma concentrations had a lower AP-36 response, suggesting the existence of a previously unknown interplay between the distinct fragments.

2608 Board #69 May 29 10:30 AM - 12:00 PM
Dose Smoking Immediately After Exercise Deteriorate Hemodynamic And Autonomic Recovery?

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 (No relevant relationships reported)

Although regular exercise reduces the risk of cardiovascular diseases, post-exercise recovery is thought to be a vulnerable phase for an increased susceptibility to sudden cardiovascular events. Cigarette smoking has been demonstrated to amplify sympathetic activation and cardiovascular stress. Paradoxically, many smokers tend to smoke immediately after leisure-time physical activity or exercise. **PURPOSE:** We tested the hypothesis that smoking immediately after exercise would deteriorate autonomic and hemodynamic recovery following an acute bout of aerobic exercise compared with the sham smoking control. **METHODS:** Ten healthy male smokers (age=21±3yrs; BMI=24.7±3.9kg/m²) participated in two trials in a randomized order: 1)cigarette smoking immediately after exercise (SM), 2)sham cigarette smoking after exercise (SHAM). All subjects exercised on a treadmill at a moderate intensity (40-60% of heart rate reserve) for 30 minutes and smoked one cigarette (0.6mg nicotine) or sham cigarette immediately after exercise. We measured heart rate, brachial and central artery blood pressures, rate-pressure product, carotid-femoral pulse wave velocity (PWV), brachial artery flow-mediated dilation (FMD), and heart rate variability time domains. All variables were measured at baseline and at 10 minutes and 30 minutes after exercise, except for FMD measured at baseline and 30 minutes after exercise. **RESULTS:** Rate-pressure product was significantly higher in the SM trial compared to the SHAM trial (interaction effect; $p=0.008$). Central systolic and diastolic blood pressure increased in the SM trial (interaction effect; $p=0.026, p=0.006$, respectively). PWV was higher post-exercise in the SM trial, but this did not reach statistical significance ($p=0.116$). FMD increased only in the SHAM trial ($p=0.008$). SDNN decreased from baseline more so in the SM trial (SM:51.5±24.5ms to 23.6±15.7ms to 36.3±18.9ms) compared with the SHAM trial (SHAM:56.8±28.1ms to 43.1±17.2ms to 50.8±22.8ms) ($p=0.041$ for interaction). **CONCLUSION:** Cigarette smoking immediately after exercise deteriorated autonomic and hemodynamic recovery in smokers, suggesting that smoking immediately after leisure-time physical activity or exercise should be avoided to reduce in the susceptibility of sudden cardiovascular events.

2609 Board #70 May 29 10:30 AM - 12:00 PM
Postexercise Hypotension, Aortic Pressure And Autonomic Modulation In Men Living With HIV

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A single session of aerobic exercise reduces blood pressure vs. pre-exercise, which is referred as postexercise hypotension (PEH). Changes in cardiac autonomic control and local vasodilatation contribute to PEH. HIV-infected patients present higher risk of hypertension, autonomic and endothelial dysfunction, which may influence the PEH. However, this phenomenon has never been studied in this population. **PURPOSE:** To investigate the effects of acute aerobic exercise upon systemic blood pressure, aortic pressure, and cardiac autonomic modulation in men living with HIV. **METHODS:** After cardiopulmonary exercise testing, 10 HIV-infected (HIV: 47.5 ± 9.7 yrs; 25.2 ± 3.0 kg.m⁻²) and 14 healthy men (CTL: 40.1 ± 10.5 yrs; 25.8 ± 3.4 kg.m⁻²) underwent cycling bouts expending 150 kcal at 50% oxygen uptake reserve (time to achieve 150 kcal - HIV: 24.1 ± 5.5 and CTL: 23.1 ± 3.0 min) and control sessions (20 min), in a randomized counterbalanced order. Systolic blood pressure (SBP), aortic pressure, and heart rate variability were assessed 30 min before and 60 min after each session, by means of oscillometric digital monitor, pulse wave reflection (tonometry), and beat-to-beat heart rate intervals, respectively. Comparisons within-between sessions were made using 2-way ANOVA with repeated measures ($P \leq 0.05$). **RESULTS:** No difference was detected between groups for maximal oxygen uptake (HIV: 27.3 ± 4.2 vs. CTL: 31.4 ± 6.8 mL.kg⁻¹.min⁻¹; $P=0.1$) and SBP at rest (HIV: 117.2 ± 11.6 vs. CTL: 112.2 ±

8.9 vs mmHg; $P=0.2$). Resting aortic pressure was higher in HIV (107.0 ± 9.3 mmHg) vs. CTL (100.0 ± 4.3 mmHg; $P=0.03$), while standard deviation of NN intervals (SDNN) was lower in HIV (28.3 ± 11.2 ms) vs. CTL (43.9 ± 20.8 ms; $P=0.04$). In CTL, SBP (-9.3 ± 5.9 mmHg; $P=0.01$), aortic pressure (-6.3 ± 4.6 mmHg; $P=0.03$), and SDNN (-23.4 ± 44.5 ms; $P=0.05$) decreased after submaximal exercise vs. control sessions. No significant change occurred in HIV for SBP (-4.2 ± 18.9 mmHg; $P=0.5$), aortic pressure (-5.1 ± 13.0 mmHg; $P=0.2$), or SDNN ($+5.5 \pm 25.6$ ms; $P=0.4$). **CONCLUSION:** Healthy, but not HIV-infected men, exhibited acute blood pressure reduction after submaximal aerobic exercise. The higher central arterial stiffness and lower vagal modulation among HIV patients may help to explain the absence of PEH in this group. Supported by FAPERJ Grant.

2610 Board #71 May 29 10:30 AM - 12:00 PM
Fibromyalgia Patients Display Blunted Cardiovascular Responses During Repeated Exercise Stress

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(No relevant relationships reported)

Fibromyalgia syndrome (FMS) affects nearly 10 million people in the United States and an estimated 6% of the world's population. FMS is idiopathic and characterized by severe pain (typically in joints and musculature), fatigue, and malaise. Pain and fatigue may limit physical activity, but other factors such as post-exertional malaise, may also contribute. **PURPOSE:** To examine exertional and post-exertional cardiovascular responses. **METHODS:** Thirty-five patients with fibromyalgia and 8 sedentary controls performed two cardiopulmonary exercise tests (CPET) to maximal exertion separated by 24 hours. Heart rate (HR) was measured continuously via ECG and blood pressure (BP) was recorded every two minutes. Independent samples T-tests compared differences between FMS patients and sedentary controls. Multiple linear regressions observed the effects of FMS on cardiovascular statistics (HR, SBP, Rate pressure product; RPP) at anaerobic threshold (AT) and VO_2 max (peak), controlling for confounding variables (age, sex, BMI, workload, and any additional medical conditions). **RESULTS:** Patients were 44.6 ± 9.8 years old, 27.5 ± 6.1 kg/m² BMI, and mostly female (88.4%). FMS and sedentary controls did not differ in age or BMI. FMS and sedentary controls did not differ in VO_2 ($p=0.62$), workload ($p=0.29$), SBP ($p=0.44$), DBP ($p=0.989$), RPP ($p=0.05$) during test 1. At AT, FMS did not influence HR ($\beta=-3.71$, $p=0.53$), SBP ($\beta=-3.94$, $p=0.67$), or RPP ($\beta=-1,478.37$, $p=0.35$) at test 1, but did at test 2 for HR ($\beta=-20.69$, $p=0.003$) and RPP ($\beta=-5,035.79$, $p=0.003$). When comparing test 1 to test 2 with the same variables, FMS influenced both HR ($\beta=-15.956$, $p=0.001$) and RPP ($\beta=-3,227.35$, $p=0.01$), but not SBP ($\beta=-3.60$, $p=0.686$). At peak, FMS influenced HR ($\beta=-23.80$, $p=0.012$) and RPP ($\beta=-5,078.36$, $p=0.040$) for test 1, but did not influence SBP ($\beta=-2.86$, $p=0.786$). This was also observed during test 2 for HR ($\beta=-23.30$, $p=0.004$), RPP ($\beta=-7,373.82$, $p=0.008$), and SBP ($\beta=-13.27$, $p=0.294$). When comparing test 1 to test 2 at peak, FMS did not influence HR ($\beta=-0.31$, $p=0.974$), or RPP ($\beta=-2,453.78$, $p=0.175$), but did influence SBP ($\beta=-14.72$, $p=0.029$). **CONCLUSION:** Post-exertional effects blunt the cardiovascular responses to exercise in FMS. This post-exertional effect has not been clearly elucidated in this illness and may help in understanding the illness.

2611 Board #72 May 29 10:30 AM - 12:00 PM
A Nonadapted Cardiac Autonomic Regulation Following Repeated Bouts Of Eccentric Exercise

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Due to lower cardiovascular demand despite of high-force generation, eccentric contraction (EC) have recently been preferred in sports and clinical practice. However, EC exercise training may lead to cardiac autonomic imbalance. The effects of EC and repeated bouts of EC on cardiac autonomic regulation and adaptation along with exercise-induced muscle damage (EIMD) are unknown. **PURPOSE:** The present study was performed to examine changes in indices of heart rate variability (HRV) as well as the signs of EIMD after the maximal EC exercise and to determine whether the cardiac autonomic regulation would be adapted by the so-called "repeated bouts effect". **METHODS:** Repeated bouts of maximum voluntary EC of the knee extensors on isokinetic dynamometer were performed in twelve young men. To evaluate signs of EIMD, muscle strength, range of motion (ROM), muscle pain and swelling, creatine kinase activity, and echo intensity of rectus femoris were measured. HRV from RR intervals was analyzed to identify cardiac autonomic balance during 5-min. All parameters were measured before and post-EC (24, 48, 72, and 96 h). The second bout of EC was measured 3-week later using the same leg. **RESULTS:** There were significant changes in ROM, muscle pain and swelling, and echo intensity as EIMD markers following ECC exercise, respectively. After EC exercise, resting normalized low frequency (LF nu) and low to high frequency ratio (LF/HF ratio) of

HRV spectra were significantly increased compared to those at baseline, but these indices did not return to baseline level up to 96 h. Besides, there were no statistical differences between EC and repeated bouts of EC in LF nu and LF/HF ratio, respectively. **CONCLUSIONS:** From these results we suggested EC itself showed the sympathovagal imbalance of HRV index in men. Moreover, unlike the changes in conventional markers of EIMD following EC, the cardiac autonomic regulation was not adapted to the second bouts of EC, suggesting unique pattern of cardiac autonomic regulation following repeated bout of EC. [Sponsored by the National Research Foundation of Korea Grant (NRF-2017R1C1B1006196)]

2612 Board #73 May 29 10:30 AM - 12:00 PM
Natural Counterpulsation Explains Cardiocomotor Synchronization In Distance Runners

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Cardiocomotor synchronization, when step rate and heart rate naturally occur with a 1:1 ratio, has been well-described in studies of running and walking. A proposed explanation for this phenomenon is that the frequency match enables cardiac counterpulsation via diastolic stepping, a potentially adaptive physiological behavior that may improve hemodynamic efficiency during ambulation. **PURPOSE:** Highly trained runners were studied to assess the prevalence of cardiocomotor synchronization and whether the step-to-heart phase timing preferentially occurred during diastole, facilitating natural counterpulsation. We hypothesized that unprompted heart rate and step rate entrainment would be present in our cohort of elite runners and the synchronization would occur during the diastolic phase of their cardiac cycles. **METHODS:** Eleven elite male endurance athletes completed three stages of over-ground running separated by ample recovery. The stages consisted of 12 min at 17.06 km/h (5:40 min/mi), 11 min at 18.67 km/h (5:10 min/mi), and 5 min at 21.08 km/h (4:35 min/mi), for a total running time of 28 minutes. A chest strap-based sensor transmitted and recorded real-time ECG and three-axis accelerometry data. Proprietary software was then used to analyze data for timing comparison of step rate, heart rate and the step-to-heart cycle phase relationship. **RESULTS:** When the frequencies of step and heart rates were matched, six of the eleven athletes displayed episodes of prolonged (>30 sec) diastolic stepping during at least one of the three speeds. Three runners exhibited prolonged diastolic stepping for $18 \pm 6\%$ of the first stage. All six runners exhibited prolonged diastolic stepping for $26 \pm 15\%$ of the second stage. Three runners exhibited prolonged diastolic stepping for $28 \pm 15\%$ of the third stage. Five of the eleven athletes did not experience any episode of cardiocomotor synchronization, due to heart rate being consistently lower than step rate. Only one episode of prolonged systolic stepping was observed. **CONCLUSIONS:** Unprompted cardiocomotor synchronization occurs with highly trained runners and is associated with diastolic stepping and natural counterpulsation, suggesting that the entrainment for hemodynamic advantages may be a driving force behind the coupling of heart rate and step rate.

2613 Board #74 May 29 10:30 AM - 12:00 PM
Resistance Exercise And Caffeine On Performance, Hemodynamics, And Pulse Wave Reflection Measure In Resistance-trained Women

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(No relevant relationships reported)

PURPOSE: To investigate the effects of caffeine ingestion in conjunction with acute resistance exercise in resistance-trained women on resistance exercise performance, cardiovascular hemodynamics, and pulse wave reflection. **METHODS:** Eleven resistance-trained women (Mean Age \pm SD=24 \pm 4yrs) ingested either a placebo (PL) or caffeine (4mg/kg), separated by 72hrs, in a double-blind, crossover design. Heart rate (HR), mean arterial pressure (MAP), and pulse wave reflection measures were assessed at rest (Rest1), 45 minutes post-consumption (Rest2), immediately post-exercise (Post1), and 10 minutes post-exercise (Post2). Participants performed two sets of 10 repetitions at 75% 1-repetition maximum (1RM), and one set with repetitions to failure at 70% 1RM on the squat and bench press. Paired t-tests were used to analyze total volume the across conditions. Hemodynamics and pulse wave reflection were analyzed with repeated measures ANOVAs to determine the effects of condition (PL and caffeine) across time (Rest1, Rest2, Post1, Post2). **RESULTS:** There was no statistical differences for total volume on the squat ($p=0.9$) or bench press ($p=0.4$). There were no significant two-way interactions for any variable. There was no main effect of time for MAP ($p=0.09$). There were significant main effects of time for HR ($p=0.0001$), augmentation index (AIx, $p=0.001$), and for AIx normalized to 75bpm (AIx@75,

$p=0.0001$). HR increased significantly at Rec1 and Rec2 compared to Rest1 and Rest 2 (PL: Rest1: 61 ± 9 bpm, Rest2: 59 ± 10 bpm; Rec1: 87 ± 16 bpm, Rec2: 83 ± 14 bpm; Caffeine: Rest1: 58 ± 7 bpm, Rest2: 58 ± 10 bpm, Rec1: 86 ± 18 bpm, Rec2: 82 ± 15 bpm). This was also seen for AIx (PL: Rest1: $6.8\pm 8.5\%$, Rest2: $2.3\pm 11.6\%$, Rec1: $26.5\pm 9\%$, Rec2: $19.1\pm 9.1\%$; Caffeine: Rest1: $9.6\pm 10.2\%$, Rest2: $7.2\pm 10\%$, Rec1: $27.8\pm 16.2\%$, Rec2: $22.2\pm 12.2\%$) and AIx@75 (PL: Rest1: $1.7\pm 9.1\%$, Rest2: $-5.7\pm 14\%$, Rec1: $32.3\pm 10.8\%$, Rec2: $24.2\pm 12\%$; Caffeine: Rest1: $1.2\pm 11.5\%$, Rest2: $-0.8\pm 11.2\%$, Rec1: $28.9\pm 19.8\%$, Rec2: $23.6\pm 17\%$). **CONCLUSIONS:** These data suggest that the ingestion of 4mg/kg of caffeine provides no ergogenic effect in resistance-trained women. Additionally, caffeine consumption, in addition to performing resistance exercise, does not demonstrate alter hemodynamics or pulse wave reflection in resistance-trained women.

2614 Board #75 May 29 10:30 AM - 12:00 PM
Relationship Between The Blood Pressure Responses To Acute And Chronic Aerobic Exercise Among Adults With Hypertension

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Aerobic exercise acutely reduces blood pressure (BP) 5-7 mmHg among adults with hypertension, termed *postexercise hypotension* (PEH). PEH has been shown to be highly correlated to the BP response to exercise training in the laboratory. However, this relationship has yet to be explored under ambulatory conditions and compared to a control sham session (CONTROL) which is necessary to account for the circadian variation in ambulatory BP (ABP). **PURPOSE:** To examine the relationship between PEH (ABP_{ACUTE}) and the systolic BP (ASBP) and diastolic ambulatory BP (ADBP) responses to aerobic exercise training (ABP_{CHRONIC}). **METHODS:** Adults with hypertension (n=24) completed a graded-exercise stress test (GEST) and CONTROL before and after 12wk moderate intensity aerobic exercise training. Ambulatory BP was assessed immediately after each experiment until the next morning and averaged at hourly intervals over 19hr. ABP_{ACUTE} was the difference between pre-training GEST minus CONTROL ABP. ABP_{CHRONIC} was post- minus pre-training CONTROL ABP. ANCOVA tested differences in ABP over time with resting BP as a covariate. Multiple variable regression examined relationships among ABP_{ACUTE} and ABP_{CHRONIC}. **RESULTS:** Subjects were middle-aged (52.3 ± 10.8 y), physically inactive adults with hypertension ($136.3\pm 10.7 / 85.2\pm 8.9$ mmHg). Following the GEST, ABP_{ACUTE} (ASBP/ADBP) were lower -5.9 ± 5.7 mmHg / -2.9 ± 4.1 mmHg than CONTROL (ps<0.006). Following 12wk of aerobic exercise training, post-training ABP CONTROL ($137.9\pm 11.0 / 81.7\pm 6.5$ mmHg) was not different than pre-training ABP CONTROL ($137.5\pm 6.6 / 80.5\pm 5.7$; ps>0.404). Multivariable regression analysis revealed that resting SBP, body mass index (BMI), and ASBP_{ACUTE} explained ~40% of the variance in ASBP_{CHRONIC}, with ASBP_{ACUTE} explaining ~17% of the variance in ASBP_{CHRONIC} (p=0.03). Similarly, resting DBP, BMI, and ADBP_{ACUTE} explained ~40% of the variance in ADBP_{CHRONIC}, while DBP_{ACUTE} explained ~11% of the variance to DBP_{CHRONIC} (p=0.06). **CONCLUSION:** ABP_{ACUTE} explained ~11-17% of the variability in exercise training-induced changes in ABP_{CHRONIC}. The magnitude of the correlations we observed between ABP_{ACUTE} and ABP_{CHRONIC} under ambulatory conditions appear to be less than those reported previously in the laboratory and merit further investigation.

2615 Board #76 May 29 10:30 AM - 12:00 PM
Abstract Withdrawn

2616 Board #77 May 29 10:30 AM - 12:00 PM
Post-exercise Cardiac Autonomic Modulation: Comparison Between Triathlon And High-intensity Functional Training Athletes.

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PURPOSE: To verify if athletes submitted to volume overload display differences in the cardiac autonomic function throughout the post-exercise recovery phase comparatively to athletes submitted to resistance overload.

METHODS: 30 men were divided into three equal groups (p>0,05): non-athlete group (n=10 30.8±3.0 year, BMI: 24.6±2.7 kg/m²), high-intensity functional training athletes (n=10, 31.4±2.9 year, BMI: 31.4±2.2 kg/m²), and triathlon athletes (n=10, 31.2±2.8 year, BMI: 23.1±1.8 kg/m²). Participants underwent a maximal graded treadmill exercise test followed by a five-minute of active recovery protocol (2,4km/h 2,5%). During the post-exercise recovery phase, a valid R-R intervals series were recorded (5min) using a valid and reliable heart rate monitor. The data were processed off-line using the Kubios HRV - Heart Rate Variability Software. A Kruskal-Wallis test was used to determine differences in SD1 and SD2 indices between all groups. The SD1 and SD2 indices were used to assess the degree of parasympathetic reactivation and global cardiac modulation, respectively over the recovery phase. Heart rate variability, by means, SD1 and SD2 indexes of Poincaré Plot were recorded during the 30s; 1stmin; 3rdmin and 5thmin of recovery to evaluate the cardiac autonomic function (CAF).

RESULTS: No significant differences were found in parasympathetic and global cardiac modulation between groups, There were no difference between 3 groups in SD1-30s (2.66-3.15; p = 0.29), SD1-1st min (2.52-3.24; p = 0.23), SD1-3rd min (2.87-3.72; p = 0.58), SD1-5th min (3.08-4.29; p = 0.44), SD2-30s (2.22-2.88; p = 0.21), SD2-1st min (2.57-2.92; p = 0.39), SD2-3rd min (4.36-5.78; p = 0.58), SD2-5th min (5.34-6.79; p = 0.53). Possibly, the magnitude of differences is small, which warrants a larger sample size than used in our study to detect statistical differences.

CONCLUSIONS: In our study, no significant differences in parasympathetic and global cardiac modulation were found between groups. These initials results show that individuals submitted to resistance and volume overload training have similar abilities of the autonomic branches (sympathetic and parasympathetic) on the modulation of the heart throughout the post-exercise recovery.

2617 Board #78 May 29 10:30 AM - 12:00 PM
Urinalysis Reveals Hemolysis In A World-Class Ultramarathon Runner: A Case Study

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PURPOSE: Ultra-endurance running, classified as any distance greater than a marathon (42.2km), is strenuous on the body. These extreme distances may include difficult weather conditions or terrain (e.g., heat, cold, altitude, trails, etc.) and could lead to changes in urine biomarkers resulting from damage to essential organs (e.g., kidney, liver, and heart). The purpose of this study was to determine the effects of running a grueling 161.3km trail race on general characteristics, presence of blood, and other molecules in the urine of an elite ultra-endurance runner (EUR). **METHODS:** Urine specimens were collected from a 32y male EUR (170cm, 64.5kg, age-ranked 98.7%[ultrasignup.com]), before and after completing the Western States Endurance Run (WSER). Samples were analyzed using 11-parameter urinalysis strips (Med Lab Diagnostics, Laguna Beach, CA) one day pre-race and ~2h post-race. **RESULTS:** EUR finished the WSER in less than 16 hours. Main findings showed red blood cell (RBC) count increased from 0 to ≥ 200 cells/ μ l (indicated hemolysis), bilirubin increased from 0 to 17 mmol/L (biprodut of hemoglobin), and urobilinogen increased from 0 to 3.2 mmol/L (indicated RBC destruction) post-race. Urine proteins and ketone abundance increased while ascorbate decreased post-race. **CONCLUSIONS:** Elevated urinary levels of red blood cell derivatives post-WSER highlight the formidable hematologic implications of ultramarathon running. Modalities to mitigate this phenomenon as well as an improved understanding of the systemic consequences of and time to recover from this exercise-induced hemolysis are of interest.

E-27 Free Communication/Poster - Cardiac Rehabilitation

Friday, May 29, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

2618 Board #79 May 29 10:30 AM - 12:00 PM

Cardiac Adaptations To Exercise Training In Hypertensive Women Depend On Exercise Mode

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Exercise training has been demonstrated to cause beneficial cardiac adaptations in different patient groups. However, comparative studies on different exercise training modes are sparse in sedentary women diagnosed with arterial hypertension. **PURPOSE:** To examine effects of 15 weeks of soccer training versus low volume high intensity interval swim training and prolonged continuous moderate intensity swim training on cardiac structure and function in middle-aged, sedentary, hypertensive women. **METHODS:** Sedentary, premenopausal women with mild-moderate arterial hypertension ($n = 73$) with average (\pm SD) age, height, weight and body fat of 45 ± 6 yrs, 165 ± 6 cm, 80.0 ± 14.1 kg and $42.6 \pm 5.7\%$ were randomized into a soccer training (SOC; $n=19$), moderate intensity swimming (MOS; $n=18$), high intensity interval swimming (HIS; $n=17$) and control (CON; $n=19$) groups. SOC completed a total of 45 ± 3 training sessions over the 15-week intervention period. SOC completed 1-h sessions consisting of small-sided soccer games (4v4 to 6v6). MOS completed 1 h sessions of continuous front-crawl swimming, with the participants encouraged to swim as far as possible during each session, while HIS performed 6-10x30-s all-out front-crawl swimming intervals interspersed with 2 min of passive recovery; thus, 3-5 min of effective swimming time. Cardiac measures were evaluated by echocardiography. **RESULTS:** Left ventricular mass increased ($p<0.05$) by 11.5 ± 14.1 and 8.7 ± 16.5 g in SOC and HIS with no change in MOS and CON. Left ventricular diastolic properties (as the ratio of early to late mitral inflow velocities, E/A ratio) improved ($p<0.05$) by 38.5 ± 46.9 , 24.6 ± 25.4 and $26.6 \pm 48.2\%$ in SOC, MOS and HIS, respectively, with no change in CON. Right ventricular function determined by tricuspid annular plane systolic excursion was improved by $8.9 \pm 13.7\%$ in SOC only. When data from the three training groups were pooled together left ventricular mass rose by $8.0 \pm 11.3\%$, with greater change-scores compared to CON ($2.2 \pm 11.0\%$). **CONCLUSION:** Exercise training improves cardiac structure and diastolic function in hypertensive women with superior effects of a hybrid training mode like soccer compared both to endurance training and high intensity interval training alone.

2619 Board #80 May 29 10:30 AM - 12:00 PM

Extended Cardiac Rehabilitation Does Not Improve Exercise Adherence More Than Usual Care

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PURPOSE: Exercise adherence is in general poor after cardiac rehabilitation (CR). In Norway, standard exercise-based CR typically offers 12 weeks of hospital-based supervised exercise at moderate or high intensity. The use of high-intensity interval training (HIT) in CR expands; however, it is still unclear how HIT affects exercise adherence. The purpose of this study was to assess the effect of an extended community-based or home-based CR program on long-term exercise adherence. **METHODS:** Between August 2014 and June 2017, 161 persons (27 women, age 62.3 (8.7)/134 men, age 60.1 (8.9)) were recruited. All had completed a HIT-based CR at St. Olav's Hospital in Trondheim, Norway. They were randomized in a 1:1:1 ratio to an extended supervised community-based CR (ExCR), a home-based CR (HCR) or a control group (CG). The extended CRs (ExCR and HCR) consisted of one HIT session and two additional sessions a week for eight weeks. The ExCR got a follow-up session every third month until one year after inclusion. The CG received usual care (standard advice for exercise and life style). Measurements were performed at baseline (T1), at 1 year (T2) and 2 years (T3) after inclusion. Primary outcome was peak oxygen uptake (VO2peak) at 2 years. Secondary outcome was achievement of current guidelines in regard of physical activity (PA) at moderate (MPA) and vigorous (VPA) intensity, measured with accelerometer. Data are analyzed with mixed linear model.

RESULTS: Out of 161 participants, 144 (89%) completed the 2 year follow-up. VO2peak (ml/kg/min) was not significantly different between groups ($p=0.777$) at T1 (33.1 (7.7), 33.6 (8.5), 34.0 (7.2)), T2 (33.1 (7.9), 33.1 (8.4), 33.9 (7.4)) or T3 (30.9 (7.5), 32.2 (8.6) and 32.0 (7.3) for ExCR, HCR and CG, respectively). The decrease in VO2peak over time was significant from T2 to T3 ($p=0.024$). Daily average of minutes in MPA and VPA were not significantly different between groups ($p=0.441$ and $p=0.557$ respectively) at any time. There was a significant reduction from T1 to T2 in both MPA (107 (61) min to 100 (59) min, $p=0.043$) and VPA (14 (19) min to 11 (18) min, $p=0.007$).

CONCLUSIONS: Extended cardiac rehabilitation did not enhance exercise adherence compared to usual care after a HIT-based CR program. Despite a decrease in VO2peak over two years, the amount of physical activity met the current guidelines.

2620 Board #81 May 29 10:30 AM - 12:00 PM
POSTURAL ORTHOSTATIC TACHYCARDIA SYNDROME (POTS) AND CARDIAC REHABILITATION: CLINICAL SUCCESSES AND CHALLENGES.

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Postural Orthostatic Tachycardia Syndrome (POTS) is a chronic debilitating form of dysautonomia most prevalent in premenopausal women. POTS continues to be poorly understood, however evidence suggests exercise and lifestyle interventions may ameliorate symptoms such as fatigue pre-syncope, and exercise intolerance and may in some patients induce remission. A recent position statement on POTS recommends exercise and lifestyle modification as a first line non-pharmacological strategy and cardiac rehabilitation (CR) is increasingly prescribed for this purpose. **PURPOSE:** To describe the experience of a gender-specialized CR program for patients with POTS. **METHODS:** A retrospective case review was undertaken to describe the demographics and outcomes of women living with POTS who attended CR from 2016-2019. **RESULTS:** Baseline characteristics showed 42 women aged 18-62 years (mean \pm SD, 35 ± 13.02), 62% unemployed and 68% exhibiting below average age-predicted fitness in Metabolic Equivalents (METS ml/min/kg, 9.7 ± 10.42) and poor function on the Duke Activity Status Index (9.7 ± 10.4). Quality of life as measured by the Short Form 36 physical component score (27.7 ± 6.6) were significantly lower than expected while the mental component score was average (45.0 ± 7.7). 50% of participants had mild depression while 31% had moderate to severe depression on the Beck Depression Inventory (15.9 ± 9.0). Of those, 62% ($n=26$) of participants attended onsite CR, 33% ($n=14$) of patients opted for an exercise consult or a home program. Despite personalized programs with recumbent aerobic exercise, lifestyle education, young women's peer support, dietitian and pharmacy counseling, completing CR was challenging. Adherence rates to the weekly onsite CR sessions were low due to ongoing symptoms of postural intolerance, however, only a small number who elected to participate did not complete the CR program ($n=2$). **CONCLUSIONS:** Patients with POTS have impaired quality of life with low fitness, high levels of unemployment and depression. There is early evidence that a traditional CR model may be more of a challenge in women with POTS and a needs assessment is warranted. Additional components of CR such as peer support, stress management, and self-care strategies may be important to enhance the therapeutic efficacy of this intervention.

2621 Board #82 May 29 10:30 AM - 12:00 PM
STRATEGIES TO MANAGE POSTURAL ORTHOSTATIC TACHYCARDIA SYNDROME (POTS) IN A CARDIAC REHABILITATION MODEL.

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Postural Orthostatic Tachycardia Syndrome (POTS) is a form of dysautonomia and a clinical syndrome of orthostatic intolerance. This chronic debilitating condition most prevalent in premenopausal women is characterized by both cardiac and non-cardiac symptoms, including exercise intolerance. Patients may benefit from a multidisciplinary approach to assist with non-pharmacological management, such as lifestyle modification and exercise, the only intervention currently shown to induce clinical remission. A cardiac rehabilitation (CR) program has supported these patients as part of their current model of care. A traditional CR setting has been challenging and there is a need to develop novel and effective ways to support these patients. **PURPOSE:** To describe the creation of a self-management intervention tailored to the needs of women living with POTS. **METHODS:** Retrospective chart reviews, literature review, patient surveys and staff feedback were completed and integrated with evidence-based guidelines to inform the creation of a program focusing on best practice and patient needs. **RESULTS:**

Between 2016-2019, 42 women aged 18-62 years (mean=35 ± 13.02) were referred to CR with 68% exhibiting below average age-predicted fitness in Metabolic Equivalents (METS ml/min/kg, (9.7 ± 10.42). 62% of participants attended onsite CR while 33% of patients opted for a home program. A multidisciplinary team developed content and selected outcome measures better suited to evaluate this population. Based on the literature, recumbent aerobic exercise, resistance training and counter pressure maneuvers are important components to physical activity participation. Strategies to manage postural intolerance such as pacing, hydration, salt intake and compression garments are included to promote first line non-pharmacological approaches to POTS management. Based on feedback from past participants in the traditional CR model, peer-support and stress/anxiety management are highly valued and therapeutic. **CONCLUSIONS:** The self-management and peer support model for POTS was developed with up-to-date recommendations and non-pharmacologic interventions. Effectiveness and feasibility of this new model of care will be evaluated. Future developments in virtual care will be explored to enhance access to the program.

2622 Board #83 May 29 10:30 AM - 12:00 PM

Achievement Of Current Guideline Levels Regarding Cardiovascular Risk Factors After Cardiac Rehabilitation

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Studies conducted both in Norway and Europe have found low achievement of current guidelines regarding cardiovascular risk factors. Physical activity (PA) positively affects several risk factors of coronary heart disease (CHD). Extended cardiac rehabilitation (CR) increases maintenance of PA-level. **PURPOSE:** To explore whether extended CR had an additional effect on the lipid profile in patients with CHD, and further to investigate the achievement of current guidelines in regards of PA. **METHODS:** A randomised controlled study. Participants (112 men/22 women) who had completed standard CR were randomly assigned to either extended CR run by municipality (MBG), home-based extended CR (HBG) or a control group (CG). The extended CR groups (MBG and HBG) completed 1 session of interval training (4 times 4 minutes) for 8 weeks and were encouraged to two optional additional exercises per week. After 8 weeks the MBG got a follow-up session every third month until 1 year after inclusion. The CG received standard lifestyle advice at baseline and had no follow-up throughout the year. **RESULTS:** Results are presented in Table I. At 1-year follow up 50% of all participants and 56% of participants on high-intensive statin therapy (HIST) achieved low-density lipoprotein cholesterol levels below 1.8 mmol/L. 73 (88%) participants were found adherent to their lipid lowering therapy. The majority of participants (97% and 91.5%) met the recommended target for both triglycerides and weekly level of moderate PA, respectively. **CONCLUSIONS:** Our findings suggest that current lipid lowering therapy in patients with CHD is inadequate. We suggest that a larger proportion of patients should be using HIST, Ezetimibe combined with statins or PCSK9 inhibitors. Further, extended CR was not found to have any additional effect on the lipid profile. The majority of participants reached recommended PA-levels at both baseline and 1-year, suggesting that extended CR does not lead to higher PA-levels.

Table I. Outcome measures of lipids, HbA1c and body mass index at baseline and 1-year follow-up according to intervention groups.

	MBG (n=44)			HBG (n=45)			CG (n=45)			ANCOVA
	Baseline	1 year	Paired samples T-test	Baseline	1 year	Paired samples T-test	Baseline	1 year	Paired samples T-test	
TC	3.62 ± 0.63	3.65 ± 0.73	0.449	3.64 ± 0.70	3.74 ± 0.74	0.001	3.70 ± 0.79	3.82 ± 0.89	0.003	0.058
LDL-C	1.93 ± 0.55	1.94 ± 0.57	0.676	1.99 ± 0.55	2.06 ± 0.60	0.008	1.98 ± 0.70	2.05 ± 0.79	0.033	0.114
HDL-C	1.39 ± 0.37	1.36 ± 0.41	0.026	1.31 ± 0.29	1.28 ± 0.28	0.023	1.41 ± 0.43	1.41 ± 0.45	0.970	0.040
TG	1.09 ± 0.63	0.99 ± 0.48	0.000	1.09 ± 0.45	1.09 ± 0.47	0.823	0.98 ± 0.36	0.97 ± 0.36	0.814	0.001
HbA1c	5.61 ± 0.50	5.54 ± 0.64	0.002	5.72 ± 0.78	5.72 ± 0.72	0.975	5.62 ± 0.58	5.57 ± 0.52	0.024	0.013
BMI	27.10 ± 4.26	27.33 ± 4.46	0.089	26.77 ± 3.93	27.29 ± 4.37	0.000	26.03 ± 3.11	26.39 ± 3.41	0.029	0.281

MBG; municipality-based group, HBG; home-based group, CG; control group. ANCOVA; analysis of covariance, TC; total cholesterol (mmol/L), LDL-C; low density lipoprotein cholesterol (mmol/L), HDL-C; high density lipoprotein cholesterol (mmol/L), TG; triglycerides (mmol/L), BMI; body mass index (kg/m²). Data are presented as mean ± standard deviation.

2623 Board #84 May 29 10:30 AM - 12:00 PM

Skeletal Muscle Adaptation In Cardiac Rehabilitation Patients Undertaking Traditional Or Higher Intensity Stair-climbing Exercise

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Exercise-based cardiac rehabilitation is associated with reduced secondary events in coronary artery disease (CAD) patients. Despite this evidence, the rate of participation

in cardiac rehabilitation exercise is low. There is a lack of information evaluating how both traditional and time-reduced higher intensity protocols affect muscle metabolism in this population, even though CAD exacerbates skeletal muscle defects that contribute to the poor metabolic phenotype.

PURPOSE: To determine the effect of a traditional cardiac rehabilitation exercise program and an alternative stair climbing-based high-intensity interval training program on the skeletal muscle phenotype in CAD patients. **METHODS:** 16 participants (15M, 1F) were randomly assigned to either traditional moderate-intensity exercise (7M, TRAD) or brief but higher-intensity interval stair climbing exercise (8M, 1F, STAIR). Both programs were 12 weeks (3d/w) in duration, each TRAD exercise session consisted of 45 minutes of moderate-intensity aerobic exercise, and each STAIR session consisted of 3 bouts x 6 flights of high-intensity stair climbing. Muscle biopsies were collected from the *vastus lateralis* at baseline and after 12 weeks of training. Immunofluorescent staining of muscle cross sections was completed to determine fiber size, capillarization, satellite cell (SC) and myonuclear content. **RESULTS:** There were no differences in the cross-sectional area and myonuclear domain of type I or II fibers following 12 weeks of either TRAD or STAIR training (p>0.05). Following 12 weeks, both exercise programs resulted in increases in, myonuclear content (type I: TRAD Δ0.4±0.5, STAIR Δ0.3±0.6, p=0.012; type II: TRAD Δ0.8±0.7, STAIR Δ0.4±0.7, p=0.006), capillary contacts (type I: TRAD Δ0.5±0.5, STAIR Δ0.2±0.7, p=0.038; type II: TRAD Δ1.2±0.6, STAIR Δ0.7±0.4, p<0.001), capillary-to-fiber perimeter exchange index (type I: TRAD Δ1.6±1.8, STAIR Δ0.4±0.8, p=0.01; type II: TRAD Δ1.8±1.7, STAIR Δ0.7±0.8, p=0.002), and capillary to fiber ratio (type II: TRAD Δ0.5±0.3, STAIR: Δ0.3±0.2, p<0.001). **CONCLUSION:** Both brief stair climbing-based high-intensity interval training and traditional cardiac rehabilitation exercise result in improvements in variables associated with skeletal muscle health in CAD patients.

2624 Board #85 May 29 10:30 AM - 12:00 PM

Improvements In Walking Speed And Timed-up-and-go Performance Times In Cardiac Rehabilitation

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PURPOSE: To determine the effects of 36 exercise-based cardiac rehabilitation (CR) sessions on walking speed, performance times and hemodynamic variables in cardiac patients. A second aim was to determine the reliability of the timed-up-and-go (TUG) test in CR patients. **METHODS:** Forty-seven patients (age = 58.2 ± 11.6 yr., height = 168.6 ± 8.0 cm, weight = 80.3 ± 12.8 kg, BMI = 28.3 ± 4.5 kg/m²) were measured on heart rate (HR), systolic (SBP) and diastolic (DBP) blood pressure, 6-min walking test (6MWT), and TUG at baseline (B), and following T4 (T24) and T6 (T36) CR sessions. The TUG was performed twice interspersed with a 2-min seated rest. One-way repeated measures ANOVA and Fisher's LSD post hoc test identified significant mean differences. The intraclass correlation coefficient (ICC) and 95% confidence intervals (95%CI) were used to determine the reliability of TUG at B, T24, and T36. Relative change (Δ%) from B to T24 and T36 and from T24 to T36 were computed for TUG and 6MWT. **RESULTS:** 6MWT distance improved from B (466.4 ± 72.8 m) to T24 (538.3 ± 67.2 m, p ≤ 0.001), and T36 (554.5 ± 69.1 m, p ≤ 0.001), and from T24 to T36 (p = 0.012). 6MWT walking speed improved from B (4.7 ± 0.7 km/h) to T24 (5.4 ± 0.7 km/h, p ≤ 0.001), and T36 (5.6 ± 0.7 km/h, p ≤ 0.001), and from T24 to T36 (p = 0.012). Exertional HR improved from B (100.1 ± 16.7 bpm) to T24 (106.7 ± 20.4 bpm, p ≤ 0.011), and T36 (108.2 ± 18.6 bpm, p = 0.003). Exertional SBP improved from B to T36 (123.6 ± 20.6 vs. 130.8 ± 19.5 mmHg, p = 0.006). TUG performance times improved from B (5.5 ± 1.2 s) to T24 (5.1 ± 0.9 s, p = 0.003), and T36 sessions (4.9 ± 0.7 s, p ≤ 0.001), and from T24 to T36 (p = 0.015, η² = 25.6). TUG performance speed improved from B (4.1 ± 0.8 km/h) to T24 (4.4 ± 0.7 km/h, p = 0.011), and T36 (4.5 ± 0.6 km/h, p ≤ 0.001), and from T24 to T36 (p = 0.033). Significant reliability coefficients were observed on the TUG (trial 1 vs. trial 2) on time at B (r = 0.91, p ≤ 0.001, 95%CI = 0.83 to 0.95), T24 (r = 0.94, p ≤ 0.001, 95%CI = 0.90 to 0.97) and T36 (r = 0.88, p ≤ 0.001, 95%CI = 0.79 to 0.94). The biggest Δ% in 6MWT occurred from B to T36 (Δ = 20.2 ± 13.4%, p ≤ 0.001), followed by B to T24 (16.8 ± 13.7%, p = 0.015), and from T24 to T36 (3.3 ± 7.9%, p ≤ 0.001). **CONCLUSION:** CR patients improved walking speed, TUG performance, exertional HR and SBP following 36 exercise-based CR sessions. A learning effect was observed on the second trial of the TUG.

2625 Board #88 May 29 10:30 AM - 12:00 PM
Cardiac Rehabilitation Combined Training Improves Lower Limb Strength After 12 Sessions In Elderly Patients

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Increased quadriceps muscle strength has shown to decrease the risk of cardiovascular mortality by 34% in patients with coronary heart disease. Muscle mass and strength declines progressively in the elderly and training effects have been generally reported after 12 weeks. Adherence to cardiac rehabilitation programs is usually low, with less than 50% of patients completing 36 sessions in 12 weeks. There is still no consistent evidence that muscle strength in elderly patients can be improved after just 12 sessions of cardiac rehabilitation. **PURPOSE:** To evaluate the effect of 12 sessions of combined training on lower limb strength, in elderly patients attending a cardiac rehabilitation program 2-3 times per week. **METHODS:** Patients included eighty-four elderly (>60 yrs) (21 women, age 67 ± 6 yrs; 63 male, age 70 ± 7 yrs) attending a cardiac rehabilitation program in a university hospital in Bogotá city, Colombia. They were evaluated from January to September 2019 before and after 12 training sessions 2-3 times per week, which included 30 minutes of cardiovascular aerobic and 15 minutes of multifunctional strength training. Aerobic training was performed at 60 - 85% of the estimated maximal heart rate. Progressive resistance strength training included 3 sets of 10-15 repetitions of major muscle groups with 50 - 70% estimated 1-repetition maximum (1-RM) including elastic bands, cuff weights, free weights and gym machines.

Baseline and follow up evaluation at the 12th session were performed by a horizontal leg press machine with 1-RM estimation according to Brzycki formula: (1-RM: 100* load repetition / (102.78 - 2.78 *rep). Pre/post training changes were assessed by paired t tests.

RESULTS: After 12 training sessions a significant maximum strength increase was found, both for men (189.6 ± 42.6 vs 203.0 ± 47.4; p = 0.000), and women (116.1 ± 18.8 vs 140.6 ± 31.0; p = 0.000).

CONCLUSIONS: This study showed that twelve sessions of combined training in elderly patients attending a cardiac rehabilitation program, improved lower limb strength in less time than usually reported. This finding supports the importance and feasibility of including strength in addition to aerobic training to reduce cardiovascular risk in this growing population.

E-28 Free Communication/Poster - Disability

Friday, May 29, 2020, 9:30 AM - 12:00 PM

Room: CC-Exhibit Hall

2626 Board #87 May 29 10:30 AM - 12:00 PM
Chronotropic Index And Heart Rate Recovery After Exercise In Adolescents With Down Syndrome

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(No relevant relationships reported)

Individuals with Down syndrome (DS) have a reduced heart rate (HR) response to exercise which is the main contributor to low cardiorespiratory fitness in this population. A previous study has shown delayed heart rate recovery (HRR) in adults with DS performing exercise testing, however there is still a gap regarding the HRR response and chronotropic index in adolescents with DS. **PURPOSE:** To evaluate heart rate response treadmill exercise test and its impact on exercise in adolescents with DS compared to non-DS. **METHODS:** Eleven adolescents with DS (7 girls, 4 boys; age 14.1 ± 1.04 years) and 10 non-DS (6 girls, 4 boys; age 13.7 ± 1.2 years) performed peak treadmill test with heart rate measurements. HRR was defined as the reduction in heart rate from the rate at peak exercise to the rate at 1 and 2 minutes after the cessation of exercise. Chronotropic index was calculated by a formula [(peak HR - resting HR) / (220 - age - resting HR)] * 100. For comparisons between groups, the independent t test was used. **RESULTS:** Compared to control group, adolescents with DS presented lower peak HR, loading time (s) and distance (m) (p < 0.05). In contrast, adolescents with DS had resting HR values similar to those non-DS. Participants with DS showed slower HRR than non-DS at 1 minute (DS: 21.1 ± 6.95 beats / min; controls: 47.1 ± 6.99 beats / min) and 2 minutes (DS: 28.5 ± 7.38 beats / min; controls:

49.4 ± 6.39 beats / min) of recovery (p < 0.05). In addition, adolescents with DS have a lower CI (0.84 ± 0.09 vs 0.66 ± 0.09, p = 0.0001) when compared to their peers.

CONCLUSION: Adolescents with DS had attenuated post-exercise HRR that may be related to lower chronotropic response at peak intensities.

2627 Board #88 May 29 10:30 AM - 12:00 PM
Influence Of Traumatic Lower-limb Amputation Severity On Biomarkers Of Cardiometabolic Health In British Military Personnel

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(No relevant relationships reported)

Severe injuries sustained during military combat result in exceptional long-term healthcare and rehabilitation needs. It is unclear if previously physically active military personnel with lower-limb amputation(s) (LLA) have compromised cardiometabolic health following prolonged rehabilitation.

PURPOSE: To determine within and between group differences in biomarkers of cardiometabolic health in UK military personnel with unilateral (UNI) and bilateral (BI) LLA, nearing the end of their rehabilitation care pathway, compared to non-injured controls (CON).

METHODS: Sixteen UK military personnel with traumatic LLA (8 UNI, mean age 30±5yrs and 8 BI, mean age 29±3yrs) attended two 4-week inpatient rehabilitation admissions, separated by two 6-week home-based periods. Thirteen active age-matched males (28±5 yrs) acted as CON. Fasted blood samples (lipid profile) were taken prior to determining the insulin and glucose response to a 75g oral glucose load at baseline and 20 weeks. Data were analysed using 2-way mixed model ANOVA (group x time).

RESULTS: No significant interaction effects were observed for any biomarkers (Table 1). Biomarkers of cardiovascular and metabolic health were comparable between UNI LLA and CON (p>0.05). BI LLA demonstrated significantly elevated cardiovascular health risk (Total:HDL cholesterol ratio, p<0.001; triglyceride, p=0.001; and CRP, p=0.002), insulin resistance (HOMA2-β (p=0.030), and reduced insulin sensitivity (p=0.005) compared to CON.

CONCLUSIONS: Cardiometabolic health risk is comparable between UNI LLA and CON, but elevated in BI LLA. Further strategies to improve and support the long-term management of cardiometabolic health risk in BI LLA are warranted.

2628 Board #89 May 29 10:30 AM - 12:00 PM
Oxygen Pulse Is Reduced In Individuals With Down Syndrome

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Abstract

Individuals with Down syndrome (DS) have lower peak oxygen uptake (VO_{2peak}) in comparison to individuals without DS. This is partly explained by autonomic dysfunction with lower peak heart rates observed during maximal exercise in DS compared to controls. Oxygen (O_2) pulse is the measure of oxygen uptake per heartbeat and is a product of stroke volume and arterial-venous difference. As such, it is widely used as an indicator of deconditioning and could provide unique information about exercise intolerance in individuals with DS. **Purpose:** To compare O_2 pulse between individuals with DS and a sex- and age-matched control group. **Methods:** Individuals with DS (n=17; male n=11; age (mean± standard deviation) = 25 ± 4 years) and controls (n=17; male, n=11; age 24 ± 3 years) completed a maximal exercise treadmill test with a previously validated protocol. Heart rate and oxygen uptake were averaged over 15-second intervals. O_2 pulse was calculated by dividing peak oxygen uptake by peak heart rate. Group differences were analyzed with independent t-tests. **Results:** Individuals with DS had lower height, absolute VO_{2peak} (p<.001), relative VO_{2peak} (p<0.001), peak heart rate (p<0.001), and O_2 pulse (p= 0.017) compared to controls. **Conclusion:** Individuals with DS demonstrated lower O_2 pulse in comparison to individuals without DS, potentially explained by deconditioning or population-specific physiologic limitations.

This research is partly supported by NIH K99R01 HD092606-01.

	DS (n=17)	Control (n=17)
Age (yrs)	25 ± 4	24 ± 3
Height (m) *	1.58 ± .08	1.74 ± .07
Weight (kg)	69.7 ± 17.5	70.8 ± 17.0
BMI (kg/m ²)	44.1 ± 10.3	40.5 ± 9.0
RER (L/min) *	1.03 ± .07	1.14 ± .09

HR (bpm) *	157 ± 23	188 ± 15
Absolute VO ₂ (L/min) Peak*	1.68 ± .5	2.71 ± .7
Relative VO ₂ (mL/kg/min) Peak*	25.3 ± 9.0	38.6 ± 7.4
O ₂ Pulse (mL/kg/bpm) *	.16 ± .05	.21 ± .05

Data presented as mean ± standard deviation. BMI: Body Mass Index, RER: Respiratory Exchange Ratio, HR: Heart Rate, VO₂: Oxygen Uptake
* p < 0.05

E-29 Free Communication/Poster - Running

Friday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

2629 Board #90 May 29 9:30 AM - 11:00 AM
Abstract Withdrawn

2630 Board #91 May 29 9:30 AM - 11:00 AM
The Association Of Ground Reaction Forces With The Five Most Common Running Injuries

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(No relevant relationships reported)

Inconsistent associations have been reported for ground reaction force (GRF) variables and running injuries when grouping all injuries together. However, previous work has shown more consistent associations when focusing on specific injuries. **PURPOSE:** To establish general and injury-specific associations between GRFs and five common running injuries. **METHODS:** 126 runners presenting with patellofemoral pain (PFP), tibial bone stress injury (TBSI), plantar fasciitis (PF), Achilles tendinitis, or iliotibial band syndrome and 70 healthy controls (CON) completed an instrumented treadmill assessment at a self-selected speed. All were rearfoot strikers. Injured/control groups were matched for gender and running speed. Vertical average and instantaneous load rates (VALR, VILR) were calculated over the first 15% of stance. Peak vertical, posterior, medial (mGRF), and lateral forces were calculated over all of stance. Mean comparisons were made between the general injury (INJ) and CON groups, and specific injuries and CON. Further, optimal cutoff values were established for variables using ROC curves. Area under the curve (AUC) and odds ratios (ORs) were used to evaluate their diagnostic value. **RESULTS:** Mean differences for variables between CON and injury groups are presented below. Only VALR, VILR and mGRF showed significant differences between groups (p<0.05). Cutoffs for VALR had superior diagnostic value for PFP and PF (OR=5.8-10.6, AUC=0.70-0.73) compared to INJ (OR=3.8, AUC=0.65). This trend held for VILR (PFP: OR=5.1, AUC=0.72; INJ: OR=3.5, AUC=0.64) and mGRF (TBSI: OR=8.8, AUC=0.74; INJ: OR=3.0, AUC=0.60). **CONCLUSION:** VALR, VILR and mGRF variables showed significant associations with running injury, even when grouped across injuries. However, associations were driven by PFP, PF and TBSI. Diagnostic value of variables was greatly improved when separating specific from general injuries.

	VALR (Mean ± SD)	p	VILR (Mean ± SD)	p	mGRF (Mean ± SD)	p
Controls (n=70)	55.77±19.47		64.54 ±21.36		0.109 ±0.033	
Injured (n=126)	64.55±17.85	<0.01	74.13 ±19.33	<0.01	0.098 ±0.033	0.019
Patellofemoral pain (n=31)	70.91±18.35	<0.01	80.48 ±19.71	<0.01	0.104 ±0.029	1.00
Tibial bone stress injury (n=23)	61.18±19.60	1.00	70.78 ±21.55	1.00	0.083 ±0.023	<0.01
Plantar fasciitis (n=22)	66.77±15.41	0.03	75.67 ±16.26	0.06	0.101 ±0.037	0.72
Achilles tendinitis (n=21)	62.55±17.83	0.45	72.46 ±19.44	0.49	0.111 ±0.042	1.00
Iliotibial band syndrome (n=29)	60.17±16.54	0.72	70.04 ±18.52	0.66	0.094 ±0.029	0.29

• Bonferroni-adjusted p-values shown for specific injuries

2631 Board #92 May 29 9:30 AM - 11:00 AM

Sex-specific Knee Biomechanics Associated With Patellofemoral Pain In Amateur Runners During Running

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Patellofemoral Pain (PFP) is a common injury among runners. The mechanisms of sex differences associated with lower extremity biomechanics in PFP are still unclear.

PURPOSE: To determine the differences in knee biomechanics between male and female amateur runners with PFP and without PFP in running task. Further, to determine the sex-specific biomechanical factors associated with the development of PFP.

METHODS: 15 male and 10 female amateur runners aged 18 to 40 years with PFP were screened and enrolled in PFP group, 25 healthy amateur runners matched with the PFP group in sex, age, and running experience were recruited as control group. PFP group was tested running with and without knee pain (PFP with pain and PFP without pain groups), while control group performed one running test (running speed = 4.0 ± 0.3 m/s). Knee pain in PFP group was eliminated by decreasing the volume of running. Knee kinematics and kinetics during landing phase of running were reduced from reflective marker coordinates and ground reaction force data, as well as compared among groups and between sexes.

RESULTS: Peak knee valgus angle of running in PFP group with pain (male: 3.2 ± 4.2°, female: 4.8 ± 4.9°, P = 0.001) and control group (male: 1.9 ± 2.7°, female: 3.8 ± 3.0°, P = 0.001) were significantly lower compared to PFP group without pain (male: 4.5 ± 4.3°, female: 7.9 ± 3.1°). Peak knee external rotation moment of running in PFP group with pain (male: 0.021 ± 0.008 BW × BH, female: 0.019 ± 0.006 BW × BH, P = 0.019) and control group (male: 0.020 ± 0.006 BW × BH, female: 0.017 ± 0.006 BW × BH, P = 0.001) were significantly lower compared to PFP group without pain (male: 0.024 ± 0.009 BW × BH, female: 0.022 ± 0.008 BW × BH). Peak knee flexion angle of running in PFP group without pain (48.8 ± 5.6°) was significantly greater compared to control group for male participants (46.0 ± 3.6°, P = 0.008).

CONCLUSIONS: Decreased knee valgus angle and external rotation moment in running appeared to be compensations to avoid pain when amateur runners with PFP were running with pain, and increased knee valgus angle and external rotation moment might be biomechanical factors associated with the development of PFP. Increased knee flexion angle in running may be another critical biomechanical factor associated with the development of PFP for male amateur runners.

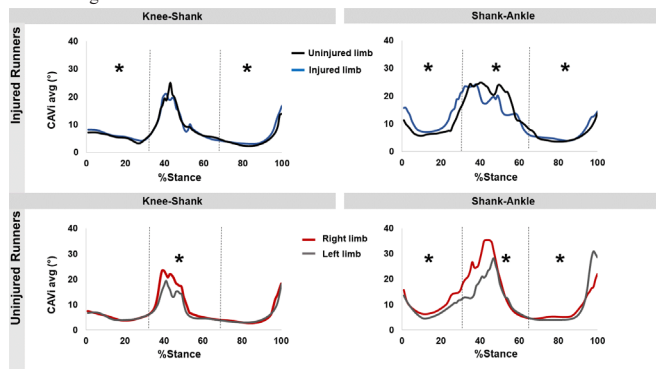
2632 Board #93 May 29 9:30 AM - 11:00 AM

Assessing Between-limb Differences In Prospectively Injured And Uninjured Runners Using Dynamical Measures Of Gait

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Between limb differences in the dynamic interactions of leg joints and segments may reflect rotational stresses and soft tissue strain experienced during gait, leading

to greater insight of running related injury mechanisms than discrete measures. **PURPOSE.** Determine between limb differences in coordinative variability (CAV) in prospectively injured and uninjured runners. **METHODS.** Over ground running (4.0 m/s ± 5%) was recorded with motion capture at enrollment. An injury was any running related pain that caused modified training for ≥1 day. Coupling angles between sagittal knee, transverse shank and frontal ankle angles were calculated via vector coding. Mean CAV was calculated for each couple within each third of stance (initial, mid, late). Asymmetry was quantified as the percent difference in CAV between legs. Wilcoxon Signed Rank Tests were used to compare CAV between legs within each group and between-group differences in CAV asymmetry were assessed with Mann-Whitney U Tests. **RESULTS.** Injured (n=16) runners had significantly greater shank-ankle and knee-shank CAV in the injured leg in initial and late stance but lower shank-ankle CAV in mid stance (P<0.05; Fig. 1). Uninjured (n=15) runners had significantly greater shank-ankle CAV in the right leg in initial and mid stance but in the left leg in late stance, and greater knee-shank CAV in the right leg in mid-stance (P<0.05). CAV asymmetry was similar between groups. **CONCLUSION.** We recommend comparing injured legs of injured runners to the matched leg of uninjured runners, rather than randomly selecting legs from the uninjured group. Greater knee-shank CAV in initial and late stance may influence prospective injury risk. **Fig 1.** Group mean CAV across stance for the injured and uninjured legs in the injured runners (top row) and between right and left legs in the uninjured runners (bottom row). Vertical dashed lines demarcate initial, mid and late stance. *p<0.05 indicates significant differences in CAV between legs.



2633 Board #94 May 29 9:30 AM - 11:00 AM
Dynamic Stability In Runners With Plantar Fasciitis
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 (No relevant relationships reported)

Plantar fasciitis (PF) is a common running injury associated with low arch height, and excessive loading and pronation. Research has shown gait alterations in individuals with PF including increased rearfoot eversion, forefoot plantarflexion, and MTPJ dorsiflexion, and reduced center of pressure (COP) duration at the heel. Changes in kinematics and COP trajectory may affect dynamic stability. Therefore, dynamic stability as measured by time to contact (TtC) may be reduced in runners with PF. **PURPOSE:** To determine differences in dynamic stability during the stance phase of running in individuals with PF. **METHODS:** Twenty runners were separated into two groups based on injury status (1: PF; 2: healthy). Kinematic and kinetic data were collected at 200 and 1000 Hz, respectively, as participants ran at 3.5 m/s ±5%. TtC of the COP to the medial and anterior boundaries of the base of support were calculated over the stance phase. Minimum TtC values were determined for each portion of stance per trial, averaged across five trials per participant and across participants per group. Differences in TtC between groups during early, middle, and late stance were determined using one-way ANOVAs with alpha level set at 0.05. **RESULTS:** Group demographics were similar. TtC was similar between groups during early and late stance and different during mid-stance (Table 1). **CONCLUSION:** TtC was similar between runners with and without PF during early and late stance which may be related to inherent instability in transition phases. Runners with PF had reduced TtC during mid-stance suggesting a more rigid control strategy reflecting the injured state and increased potential for loss of balance. **Table 1.** Results for demographics and time to contact (TtC) for runners with and without plantar fasciitis (PF). * = significant difference (α=0.05).

	PF	Healthy	p-value
Age (years)	42.90 (10.76)	38.20 (10.94)	0.35
Height (m)	1.660 (0.090)	1.660 (0.080)	0.90
Mass (kg)	67.73 (12.89)	64.99 (10.52)	0.61
TtC Medial Early Stance (s)	0.021 (0.018)	0.026 (0.024)	0.59
TtC Medial Mid-Stance (s)	0.099 (0.076)	0.185 (0.098)	0.04*
TtC Medial Late Stance (s)	0.041 (0.034)	0.064 (0.037)	0.15
TtC Anterior Early Stance (s)	0.074 (0.034)	0.104 (0.032)	0.05
TtC Anterior Mid-Stance (s)	0.172 (0.157)	0.392 (0.228)	0.02*
TtC Anterior Late Stance (s)	0.061 (0.091)	0.141 (0.097)	0.07

2634 Board #95 May 29 9:30 AM - 11:00 AM
No Difference In Muscle Excitation Between Runners With And Without Patellofemoral Pain During Prolonged Run
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PURPOSE: To determine if muscle excitation amplitudes differed from beginning, middle, and end of a prolonged run in runners with and without patellofemoral pain. **METHODS:** Five recreationally active female runners with history of running with patellofemoral pain (PFP) were matched to five female runners without lower extremity pain (CON) (PFP: age = 21.2±2.68 years, ht = 1.62±0.10m, mass = 67.45±6.10kg; CON: age = 21.2±1.30 years, ht = 1.66±0.12m, mass = 67.45±7.26kg). Wireless EMG surface electrodes were placed bilaterally on the rectus femoris (RF), vastus medialis oblique (VMO), biceps femoris (BF), and gluteus medius (GMED). EMG data was sampled at 2000Hz. Participants ran at a self-selected pace on a treadmill until they met exertion or pain criteria. EMG signals were passed through a 4th order, zero lag, Butterworth high-pass filter with cut-off at 10Hz, low-pass filter with cut-off at 350Hz, and full wave rectified. Average maximum EMG amplitude for 20 steps from 3 time points (beginning, middle, end) of the run were compared for each group using separate paired samples t-tests for each muscle and group. Alpha level was set at p<0.05. **RESULTS:** No statistically significant differences were observed in EMG amplitude of any muscle for either group when comparing amplitude between participants' first, middle and last trial of the run (PFP: Max_RF: 0.136mV, 0.117mV, 0.100mV, p>0.05; Max_VMO: 0.506mV, 0.464mV, 0.519mV, p>0.05; Max_BF: 0.273mV, 0.273mV, 0.274mV, p>0.05; Max_GMED: 0.121mV, 0.101mV, 0.096mV, p>0.05; CON: Max_RF: 0.103mV, 0.068mV, 0.073mV, p>0.05; Max_VMO: 0.051mV, 0.464mV, 0.052mV, p>0.05; Max_BF: 0.146mV, 0.151mV, 0.149mV, p>0.05; Max_GMED: 0.102mV, 0.086mV, 0.078mV, p>0.05). **CONCLUSION:** Neither groups of runners experienced a significant change in EMG amplitude from beginning, middle and end of a prolonged run. Running with active patellofemoral pain does not appear to change muscle excitation amplitude of the RF, VMO, BF, or GMED during a prolonged run.

2635 Board #96 May 29 9:30 AM - 11:00 AM
Whipping Or Tearing? Mechanisms For The Development Of Achilles Tendinopathy In Runners
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 (No relevant relationships reported)

Achilles tendinopathy is a common running injury that affects up to 13% of runners. A "whipping" mechanism, in which abnormal rearfoot eversion causes asymmetrical loading of the tendon, has been proposed for the development of Achilles tendinopathy in runners. A second "tearing" mechanism, in which eccentric plantar flexor contractions cause microtears in the Achilles tendon, has also been proposed. However, a clear link between these mechanisms and Achilles tendinopathy has not been demonstrated. **PURPOSE:** To determine if peak rearfoot eversion, duration of rearfoot eversion, peak sagittal plane ankle power absorption, and peak dorsiflexion moment are different between runners with and without a history of Achilles tendinopathy. **METHODS:** 10 male, rearfoot strike runners (34±10 years; 1.79 ± 0.07 m; 81.3 ± 12.6 kg) participated. Five participants had previous or current Achilles tendinopathy and five had no history of Achilles tendon pain. Reflective markers were placed on the trunk, pelvis, legs, and feet. A motion capture system recorded five good trials for each participant running at 3.7 m/s. Variables of interest and effect sizes (r) were calculated to compare groups. **RESULTS:** There was a small effect for peak rearfoot eversion, with previously injured runners exhibiting higher peak rearfoot eversion angles (Table

1). There was also a small effect for the duration of rearfoot eversion, with injured runners remaining in an everted position for longer than the control group. There were no differences between groups in peak power absorption or peak dorsiflexion moment. **CONCLUSION:** In this preliminary study runners with and without Achilles tendinopathy exhibited gait characteristics that provide partial support for the whipping mechanism of injury proposed for Achilles tendinopathy in runners. However, these findings were not consistent with the proposed tearing mechanism of injury.

	Controls Median (IQR)	Previous Injury Median (IQR)	Effect Size (r)
Peak Eversion (°)	8.6 (13)	11.4 (11)	0.30
Duration of eversion (% stance)	71 (45)	87 (61)	0.26
Peak dorsiflexion moment (Nm/kg)	2.2 (0.5)	1.9 (0.8)	0.03
Peak power absorption (watts/kg)	3.8 (1.7)	4.0 (1.0)	0.12

2636 Board #97 May 29 9:30 AM - 11:00 AM
Changes In Coordination And Variability During Running As A Function Of Head Stability Demands
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 (No relevant relationships reported)

Stabilization of the head in space is important during running, but less is known about how individuals accomplish the head-in-space equilibrium through segmental and joint coordinative adaptations. **PURPOSE:** To identify changes in segment/joint coordination and its variability in running with increasing head stability requirements. **METHODS:** Fifteen strides from twelve recreational runners (29.67 ± 4.4 years; 1.73 ± 0.08 m; 72.1 ± 13.9 kg) while running on a treadmill at their preferred speed were collected. Head stability demands were manipulated through real-time visual feedback that required head-gaze orientation to maintain within boxes of different sizes, ranging from 21 to 3 degrees of visual angle with 3-degree decrements. Coordination patterns and variability were assessed between head and trunk segments, hip and knee joints, and knee and ankle joints in three cardinal planes, respectively. Mean phase angles and the standard deviation of the phase angles at each individual point of the stance phase were calculated using vector coding and circular statistics. A statistical analysis was performed to detect differences in coordination pattern frequency and waveform of coordination pattern and variability between visual conditions. **RESULTS:** As head stability demands increased, transverse plane head-trunk coordination was more anti-phase (i.e., segments rotating the opposite direction; 3.3%, $p=0.028$), and showed increased head-leading (1.7%, $p=0.001$) and decreased trunk-leading patterns (10.3%, $p=0.015$); for the lower extremity, there was increased in-phase (hip-knee: 5%, $p=0.015$; knee-ankle: 6.4%, $p=0.010$) and decreased anti-phase (hip-knee: 16.7%, $p=0.003$; knee-ankle: 10.8%, $p=0.001$) sagittal plane coordination during the second half of the stance phase. An increase in coordination variability was also observed for lower extremity couplings between the hip and knee and knee and ankle joints. **CONCLUSION:** Overall, the results provide evidence that coordinative adaptations to increasing head stability demands occur throughout the entire body (1) through more independent control of the head relative to the trunk, and (2) by increasing in-phase coordination and variability between lower extremity joints, contributing to the reduction of range of motion in vertical direction.

2637 Board #98 May 29 9:30 AM - 11:00 AM
Associations Between 24-Hour Dietary Intake And Biomechanical Changes During A Long Run: An Exploratory Study
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 (No relevant relationships reported)

Both nutrition and biomechanics play important roles for running and athletic performance. However, to date they have usually been studied separately and there is minimal literature evaluating effects of nutritional status or interventions on biomechanical outcomes. **PURPOSE:** This exploratory study evaluated relationships between nutritional status prior to a long hilly run and changes in running mechanics following the run. **METHODS:** Eight trail runners (5 M/3 F; weekly mileage: 27.6 ± 8.5 miles) ran a 10-mile hilly run which matched the elevation profile of a popular

local trail run. 3D kinematics and ground reaction forces were collected during five-minute level ground running sections prior to and following the run. Changes in spatial temporal parameters, ground reaction forces, and leg stiffness variables from pre to post run were computed for each participant's left leg using Visual3D. Pre-run 24-hour dietary recalls were analyzed for total caloric intake (Tkcals) and percent calories from carbohydrate (%CHO), protein (%PRO), and fat (%FAT). Pearson's correlations were used to assess associations between each nutritional variable and changes in biomechanical variables. **RESULTS:** There were significant associations between %PRO and changes in peak ground reaction force and changes in contact time such that runners with higher %PRO displayed smaller changes in biomechanics (Figure 1). Similar associations were observed between Tkcals and %FAT and changes in vertical center of mass displacement. **CONCLUSIONS:** This preliminary study suggests nutritional status prior to a long run may affect the changes in biomechanics a runner experiences during the run. These biomechanical effects have implications for both performance and injury, and highlight the importance of protein for long distance runners. Additional research is required to evaluate whether manipulating nutrition can be used to manage biomechanical changes associated with long duration running.

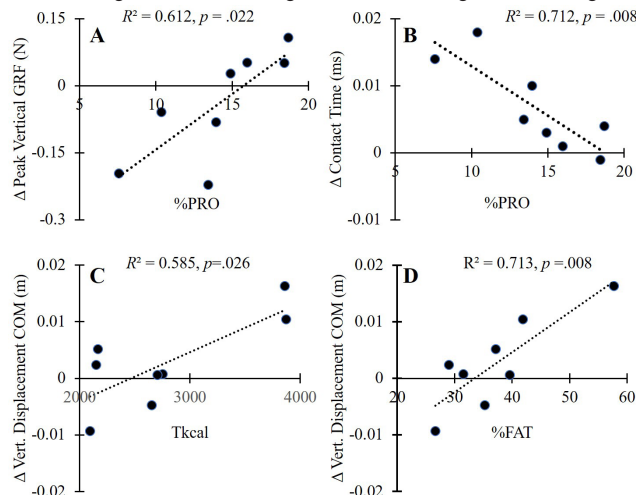


Figure 1. Correlations between % calories from protein (%PRO) and changes in peak vertical ground reaction force (A) and changes in contact time (B). C and D show correlations between total calories (Tkcals) and percent calories from fat (%FAT) and changes in vertical center of mass displacement.

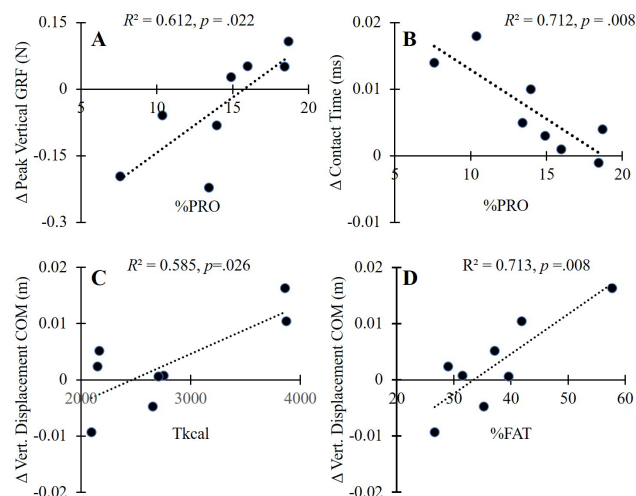


Figure 1. Correlations between % calories from protein (%PRO) and changes in peak vertical ground reaction force (A) and changes in contact time (B). C and D show correlations between total calories (Tkcals) and percent calories from fat (%FAT) and changes in vertical center of mass displacement.

2638 Board #99 May 29 9:30 AM - 11:00 AM
The Relationship Between Forefoot Stiffness And Angular Kinematics During The Early Stance Phase Of Running.

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 (No relevant relationships reported)

PURPOSE: The purpose of this study was to determine if a relationship between forefoot stiffness and intersegmental foot kinematics exists. We hypothesized runners with high stiffness values would exhibit decrease foot motion. **METHODS:** A convenience sample of 20 asymptomatic recreational runners participated in this study. At the completion of a warm-up protocol, subjects underwent a measurement of their non-weight bearing midfoot torsional stiffness using a foot torsion measurement device. Retroreflective markers were placed over select bony landmarks located on the subject's lower legs and feet and then recorded using an 18-camera motion analysis system sampling at 240 Hz while running at their self-selected speed. Data analysis: Torsion-angle curves were fit with a one-degree polynomial and the intercepts and first term coefficients (FTC) recorded. The rearfoot and forefoot three-dimensional angular kinematics of the first third of the stance phase of the running trials were obtained for each subject. A linear regression model was used to assess the relationship between the maximum eversion and inversion rearfoot and forefoot angles and the FTC. The statistical level of significance for this study was set at the $p = .05$ level.

RESULTS: The mean eversion and inversion FTC were -0.44 ± 0.44 and -0.08 ± 0.20 Nm/degree. The mean maximum rearfoot eversion and inversion angles were 2.0 ± 2.1 and 1 ± 2.3 degrees, respectively. The mean maximum forefoot inversion and eversion angles were 1.0 ± 2.4 and 1.0 ± 2.3 degrees, respectively. The regression model did not reveal a significant relationship ($p > .05$) between the eversion and inversion FTC and the kinematic variables.

CONCLUSIONS: During the first third of the stance phase of running passive stiffness of the foot does not appear to be related to dynamic motion.

2639 Board #100 May 29 9:30 AM - 11:00 AM
Persistence Of Altered Kinematics Following A Typical Training Run At 24hrs

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Running participation has increased since the 1970's, concomitant with the rise in popularity has been the rise in running related injuries. Epidemiological studies have reported 2.5 to 33.0 injuries for every 1000 hours of running, with most common injuries being overuse knee injuries. There is a common consensus that altered hip and knee kinematics are risk factors for developing overuse injuries. Previously we demonstrated altered gait kinematics as result of fatigue following a high intensity interval training run (HIIT). These fatigue induced alterations in kinematics could place runners at greater risk of developing an overuse injury. To date, the time course of recovery for gait kinematics is unknown. If these gait changes remain at the onset of the next training run this could be a precursor to overuse injury. **PURPOSE:** To examine the time course of kinematic changes immediately after and 24hr post HIIT. **METHODS:** Twenty (10F, 10M) healthy recreational runners performed a HIIT session consisting of six repetitions of 800 meters, each run at $1\text{km}\cdot\text{h}^{-1}$ under the speed at V_{O_2} max, with a 1:1 work: rest ratio. Kinematics were examined during a 6-minute, medium intensity run, performed at halfway between the speeds at lactate threshold and lactate turnpoint. The 6-min run was performed pre, post, and 24hr post HIIT. Maximum angle and range of motion (RoM) of the hip and knee during ground contact were analysed in sagittal and frontal planes. One way repeated measures ANOVA was performed to assess changes over time. **RESULTS:** Hip frontal angles were significantly increased with time for both maximum angles ($P < 0.001$) and RoM ($P = 0.001$). Post hoc analysis revealed a significant increase in maximum hip adduction angle immediately post ($P < 0.001$, $d = 0.91$) and at 24hr post ($P < 0.001$, $d = 0.86$) compared to pre. Hip frontal RoM was also increased significantly at post ($P < 0.001$, $d = 0.85$) and at 24hr ($P < 0.001$, $d = 0.74$). Knee kinematics were affected by time for maximum angle of knee frontal plane ($P = 0.046$) and sagittal plane knee RoM ($P = 0.015$). However, there was no presence of altered knee kinematics at 24hr. **CONCLUSION:** The HIIT session induced kinematic alterations to the hip frontal angles. In some runners these alterations were still present 24 hours after HIIT. For these runners, this could increase the risk of developing overuse injuries.

2640 Board #101 May 29 9:30 AM - 11:00 AM
Effects Of Foot Rotation On Knee Joint Reaction Forces During Running

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PURPOSE: The purpose of this study was to examine the effects of internal and external foot rotation on knee joint reaction forces during running.

METHODS: Motion capture and force data were recorded on nineteen healthy adult runners (22.3 ± 4.0 years, 67.99 ± 10.27 kg, and 1.77 ± 0.10 m) running at 3.5 m/s with normal and maximal comfortable external (EXT) and internal (INT) foot rotation. Musculoskeletal simulations were performed using the Rajagopal 2015 model and OpenSim (SimTK). All data were low pass filtered at 10 Hz and normalized to a full stride (stance: 0-36% & swing: 37-100% stride). Models were scaled to each subject's anthropometric parameters. Inverse dynamics were derived by combining inverse kinematics and force data. Muscle excitations were derived using Static Optimization, including muscle physiology parameters. Joint Reaction Forces were obtained by combining inverse kinematics, force data, and muscle excitations. Within-subjects ANOVAs via Statistical Parametric Mapping were used to determine differences in resultant knee joint reaction force waveforms.

RESULTS: The EXT condition decreased early stance (0-2% stride) and late swing (92-100% stride) phase forces, but increased forces during early swing (44-46% phase) compared to normal. The INT condition reduced forces during very late swing phase (92-94% stride). The EXT reduced forces during early stance (0-1% stride) and late swing (97-100% stride) compared to INT.

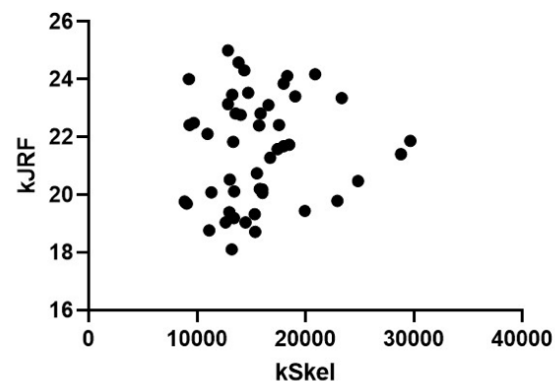
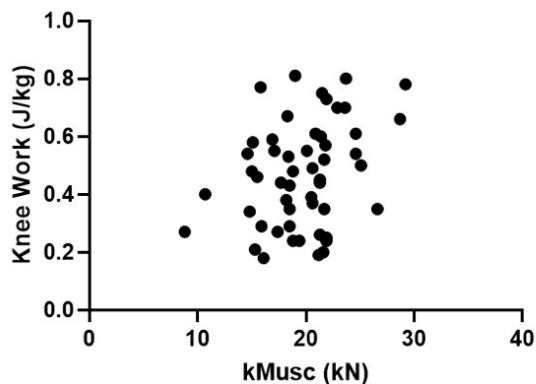
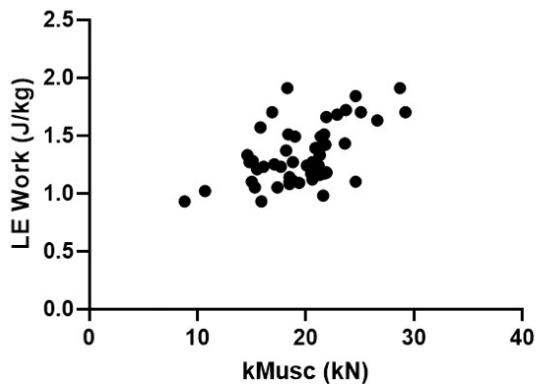
CONCLUSIONS: Despite the known success of altered foot rotation on reducing external knee abduction moments during walking and running, knee forces were only reduced during low-loading portions of running strides. Thus, it appears altered foot rotations does not improve knee loading during running.

2641 Board #102 May 29 9:30 AM - 11:00 AM
Muscular Not Skeletal Components Of Leg Stiffness Are Significantly Correlated With Associated Biomechanical Variables During Running

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 (No relevant relationships reported)

Muscular (kMusc) and skeletal (kSkel) components of leg stiffness have been previously related to injury patterns in runners [1]. Though these components mirror proposed injury mechanisms in runners, their relationship to underlying biomechanical variables remains unclear. **PURPOSE:** to evaluate the association between components of leg stiffness (kMusc & kSkel) with common biomechanical variables of muscular (joint work) and skeletal loading (joint reaction forces) during a running task. **METHODS:** Thirteen recreational runners (8 male, 5 female) performed ten over ground running trials at 3.35 m/s ($\pm 5\%$) in each of four conditions with varying shoe and strike patterns. Kinematics and ground reaction forces (GRFs) were recorded using an 8-camera motion capture system (240 Hz, Qualisys) and force platform (1200 Hz, OR-7, AMTI). Visual3D (C-Motion) was used to calculate joint powers and compressive joint reaction forces (JRFs). MATLAB was used to calculate negative joint work values and stiffness variables. kMusc and kSkel were calculated as previously reported [1]. Prism 8.0 (GraphPad) was used to perform correlation analyses between muscular and skeletal contributions to load attenuation. **RESULTS:** kMusc had moderate and weak relationships with lower extremity work ($p < 0.01$; $r = 0.55$) and knee joint work ($p = 0.01$; $r = 0.32$). Weak correlations existed between kSkel and ankle ($p = 0.25$; $r = -0.10$), knee ($p = 0.17$; $r = 0.14$) and hip joint reaction forces ($p = 0.46$; $r = 0.01$). **CONCLUSIONS:** These data revealed moderate associations between kMusc and negative work values suggesting that kMusc is proportional to muscular contributions to load attenuation. JRFs had weak associations with kSkel, suggesting kSkel may not represent skeletal loading. These findings suggest this simplistic model may be insufficient to describe muscular and skeletal contributions to load attenuation.

[1] Powell, Paquette & Williams, 2017.



in the running group ran at least 15 miles/week, while participants in the resistance training and cycling/swimming group ran at least 3 miles/week. Running kinematics were captured using a 10-camera motion capture system while participants ran at a controlled pace of 3.5 m/s ($\pm 5\%$) over a 10-m runway with force platforms collecting kinetic data. Five successful trials were chosen for analysis. A one-way ANOVA assessed differences in mean kinematic and kinetic variables of interest between physical activity groups ($\alpha < 0.05$). **RESULTS:** Mean values for gait variables during the stance phase are shown in Table 2. **CONCLUSION:** Preliminary data shows no differences between activity groups, suggesting that participation in physical activity helps maintain healthy movement patterns in older adults. As the study continues we will be able to ascertain whether this lack of difference is a result of our small current sample size or reflective of the participants' primary form of physical activity.

Table 1: Participant demographics.

	Running	Resistance Training	Cycling/Swimming
Age	54.20 \pm 5.81	48.40 \pm 3.91	56.40 \pm 6.69
Height (m)	1.76 \pm 0.11	1.69 \pm 0.11	1.69 \pm 0.15
Mass (kg)	71.69 \pm 12.88	67.97 \pm 11.01	74.69 \pm 17.54
BMI (kg/m ²)	22.84 \pm 1.76	23.80 \pm 2.33	26.24 \pm 5.10
PBF (%)	21.40 \pm 5.80	20.10 \pm 4.54	27.86 \pm 16.46
Days/week	5.00 \pm 1.22	4.80 \pm 1.10	4.60 \pm 0.89
Miles/week	41.00 \pm 14.32	6.20 \pm 4.49	9.20 \pm 4.09

Mean \pm standard deviation; m: meters, kg: kilogram; BMI: body mass index; PBF: percent body fat; days/week: number of days participating in respective primary activity.

Table 2: Kinematics and kinetics during the stance phase of gait.

	Running	Resistance Training	Cycling/Swimming
Ankle ROM ($^{\circ}$)	20.66 \pm 2.31	17.18 \pm 4.85	20.02 \pm 5.63
Knee ROM ($^{\circ}$)	20.99 \pm 1.11	24.29 \pm 4.15	27.25 \pm 7.29
Hip ROM ($^{\circ}$)	39.41 \pm 6.27	43.91 \pm 3.71	39.25 \pm 6.74
Ankle angle at IC ($^{\circ}$)	0.480 \pm 2.21	4.17 \pm 7.03	.6960 \pm 3.66
Knee angle at IC ($^{\circ}$)	18.61 \pm 5.07	16.65 \pm 2.79	15.11 \pm 1.35
Hip angle at IC ($^{\circ}$)	38.27 \pm 11.89	42.14 \pm 5.71	38.83 \pm 4.47
Peak vGRF (N)	1731.11 \pm 464.75	1707.46 \pm 221.99	1731.27 \pm 326.91
Peak PF moment (Nm)	-185.11 \pm 56.69	-174.42 \pm 21.71	-190.64 \pm 50.38
Peak KE moment (Nm)	160.41 \pm 32.21	162.94 \pm 27.49	180.46 \pm 43.87
Peak HE moment (Nm)	-230.48 \pm 53.42	-189.35 \pm 16.24	-198.53 \pm 42.09

Mean \pm standard deviation for kinematic and kinetics during the stance phase of gait. N: newtons; ROM: range of motion; IC: initial contact; $^{\circ}$: degrees; vGRF: vertical ground reaction force; PF: plantarflexion; KE: knee extension; HE: hip extension; Nm: newton meter.

2642 Board #103 May 29 9:30 AM - 11:00 AM
Exercise Modality And Age-related Declines Observed During Running
 Brianne Borgia, Julia Freedman Silvernail. *University of Nevada, Las Vegas, Las Vegas, NV.* (Sponsor: Janet Dufek, FACSM)
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 (No relevant relationships reported)

Exercise modality and age-related declines observed during running. Brianne Borgia¹ and Julia Freedman Silvernail¹
¹University of Nevada, Las Vegas, Las Vegas, NV
 With the increase in participation by older adults in endurance events, research is needed to evaluate how exercising throughout the lifespan can affect the aging process and the risk of injury in these individuals. **PURPOSE:** The purpose of this study was to determine how the type of exercise modality one participates in will affect age-related declines observed during running. **METHODS:** Fifteen individuals who considered running, resistance training or cycling/swimming as their primary form of activity participated in this preliminary investigation (Table 1). Participants

2643 Board #104 May 29 9:30 AM - 11:00 AM
Normalizing Running Power By Muscle CSA Increases Variance Explained Compared To Metabolic Power
 Mason J. Coppi, Scott Murr, Eric Sobolewski, Randolph E. Hutchison, Alec Whyte, Jake T. Ogden, Frank Lara, Trent Mandato. *Furman University, Greenville, SC.* (Sponsor: Anthony Caterisano, FACSM)
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 (No relevant relationships reported)

Running pace is one of the primary measures of running intensity, however, variations in grade limit quantifying intensity solely based on pace. Cross sectional area (CSA) of the vastus lateralis is a key determinant in running pace. With the advent of wearable running power meters, runners can assess the metabolic demand inclusive of pace and grade. The research of CSA on metabolic demand in running with wearables is currently limited. **PURPOSE:** The purpose of this study was to compare running power to metabolic power of running submaximally at various speeds and inclinations. Additionally, correlations were compared at a group level with and without normalization to CSA. **METHODS:** Four collegiate cross-country runners

(male n=1, age=22yrs, weight=72.6 kg, height=183 cm; female n=3, age=19.67±0.58 yrs, weight=54.07±2.29 kg, height=164.33±10.26 cm) participated in 10 trials of steady-state, submaximal running at different speeds and inclinations. The CSA of the subject's vastus lateralis and rectus femoris was measured by use of ultrasound (GE LOGIQ e Series). Ventilatory measures and heart rate (HR) were measured with a portable breath by breath analyzer (COSMED K5). Running speed was paced by a cyclist using a speedometer. Pearson Correlation Coefficients between metabolic and running power (normalized by total CSA) were calculated for all subjects, individually as well as combined.

RESULTS: There were statistically significant, strong positive correlations between metabolic power and running power (normalized and non-normalized) for the collegiate cross country runners, both individual (Table 1) and as a group, ($r_{p,CSA} = .910$ $P < 0.001$, $r_s = .602$ $P < 0.001$).

CONCLUSIONS: The results support that predicted running power is positively related to metabolic power, which indicates a strong relationship with running intensity. Additionally, normalizing running power to CSA improves correlation and increases the explanation of variability (r^2) from 36% to 83%.

Subject	Correlation Coefficient (r)	Significance
1	0.83	P<0.01
2	0.99	P<0.001
3	0.99	P<0.001
4	0.93	P<0.001
Combined, non-normalized	0.60	P<0.001
Combined, CSA-normalized	0.91	P<0.001

2644 Board #105 May 29 9:30 AM - 11:00 AM
Characterization Of Fatigue In A Short Bout Of Running

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(No relevant relationships reported)

All runners experience physiological fatigue during a run. Research shows physiological stress induced by fatigue influences changes in running biomechanics. However, past studies have focused on a limited number of kinematic variables during fatigue. To understand the interrelationship between a plurality of kinematic variables, a study was conducted to observe changes in stride length (SL), ground contact time (GCT), foot strike angle (FSA), and cadence (CAD). It was hypothesized fatigue would yield a decreased CAD, increased GCT and SL, and shift subjects to a more rear-foot FSA. **PURPOSE:** To examine the influence of physiological fatigue on running biomechanics during a short bout of high-intensity running. **METHODS:** Male and female athletes of all levels (n=36; 15 female; 33 ± 9 years; 70.11 ± 13.66 kg; 171.37 ± 9.75 cm) participated in a 20-minute treadmill fatiguing protocol. Subjects first ran 5 minutes at their preferred pace (speed one), followed by ten minutes at a fatiguing pace (speed two), and ended with five minutes at speed one. Speed two was .67-.89 m/s faster than speed one, near estimated vVO_{2max} . Kinematic time series data from a shoe embedded accelerometer was collected for the following metrics: CAD, SL, GCT, and FSA. The first 30 seconds of speed two (fatigue start) was analyzed and compared to the last 30 seconds of speed two (fatigue end). Subjects were considered fatigued when heart rate met or exceeded 90% age predicted max and RPE ≥ 17. Significant differences between fatigue start and fatigue end were tested with a varied samples t-test. **RESULTS:** Significant differences were identified between fatigue start and fatigue end for CAD (173.36±13.91 vs 169.92±11.99 steps/min, $p < 0.001$), SL (2.45±0.34 vs 2.50±0.34 meters, $p = 0.003$), and GCT (279.61±44.25 vs 285.25±44.44 ms, $p = 0.004$). CAD decreased while SL and GCT increased. No significant difference was observed for FSA. **CONCLUSION:** This study demonstrated biomechanical changes in running form from the beginning to the end of a short, high-intensity fatiguing run. The direction of change for cadence, stride length, and ground contact time confirmed the hypothesis. Changes in foot strike angle were not confirmed.

2645 Board #106 May 29 9:30 AM - 11:00 AM
Anthropometric And Kinematic Predictors Of Base Of Gait During Running

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A narrow base of gait (BOG) during running, such that the foot crosses contralateral to the body's line of gravity, has been implicated as a cause of iliotibial band syndrome and patellofemoral pain. BOG has been shown to vary by sex and running speed, but

it is unknown if body anthropometric and running kinematic measures predict BOG. Determining predictors of BOG will clarify if BOG is a result of non-modifiable anthropometric factors or biomechanical factors, which could be modified using targeted interventions. **PURPOSE:** To determine if BOG at midstance during running can be predicted by anthropometric or kinematic measures. **METHODS:** Whole body kinematics were obtained for 71 Division I cross country runners (30 males) during treadmill running at preferred speed. Athletes were healthy with no history of stress fracture 3 months before testing or any history of lower extremity surgery. Anthropometric measures from each athlete were obtained from whole body dual-energy X-ray absorptiometry scans: greater trochanteric (GTR) and hip joint center width; leg and femur length. Kinematic measures during stance phase included: peak lateral pelvic drop, hip adduction (H_{ADD}), knee flexion (K_{FLEX}); vertical excursion of center of mass ($vCOM$); anterior-posterior distance from heel to COM at initial contact. Correlations between predictors and BOG were calculated, with variables moderately correlated or better ($|r| \geq 0.3$) included in subsequent analyses. Data from both limbs were included in a forward, stepwise regression to determine predictors of BOG, controlling for sex and speed. **RESULTS:** Stride length, $vCOM$, peak K_{FLEX} and H_{ADD} , GTR width, and leg and femur length ($|r| = 0.32 - 0.51$) were entered into the model. The model with the best overall fit included all predictors except leg length ($R^2 = 0.383$, BIC: -32.1). The strongest predictors were GTR width ($\beta = -0.27$), $vCOM$, ($\beta = -0.18$), and peak H_{ADD} ($\beta = -0.17$). **CONCLUSIONS:** Biomechanical and anthropometric measures explain less than 40% of the variance in BOG. Given that GTR width is the strongest predictor of BOG and is non-modifiable, BOG appears to be largely influenced by an individual's anthropometrics. Conversely, $vCOM$ and peak HADD are modifiable through gait retraining strategies such as step rate modification and may be targeted in those where narrow BOG is a concern.

2646 Board #107 May 29 9:30 AM - 11:00 AM
Cost Of Transport In Ultra-runners Utilizing Hand Bottle Vs. Hydration Pack

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(No relevant relationships reported)

Over the last 10 years, ultra-marathon running events have become increasingly popular. For these longer distances, it is common for runners to carry hydration devices with them. How different water carrying devices impact cost of transport (CoT) during running is unknown.

PURPOSE: To examine differences in CoT in trained ultrarunners utilizing two popular hydration devices filled with various amounts of water.

METHODS: Six ultra-marathon trained runners (5 males, 1 female) participated in this study after obtaining informed consent. Each subject completed six 10 min running trials at 15% below their lactate threshold over two days: one baseline trial (no water), two trials with a hand bottle (0.25 and 0.5 kg of water) and three trials with a hydration pack (0.5, 1.0 and 1.5 kg of water) on their back. Each subject's running trials were randomized utilizing a Latin Square design. For each trial, we analyzed VO_2 (ml/kg/min) and RER to obtain 2 minutes of steady state data to calculate CoT (J/kg/m). We used a linear mixed model to analyze the effects of water mass and hydration device on CoT.

RESULTS: We found a statistically significant effect of water mass on CoT: every 1 kg of additional water mass increases CoT by 0.09 J/kg/m (1.92%, $p = 0.03$), but hydration device had no significant effect on CoT ($p = 0.31$) (see Figure 1).

CONCLUSIONS: Our preliminary findings indicate that CoT increases by 1.92% for every additional 1 kg of water mass carried. This increase in CoT could have significant negative effects on ultramarathon running performance.

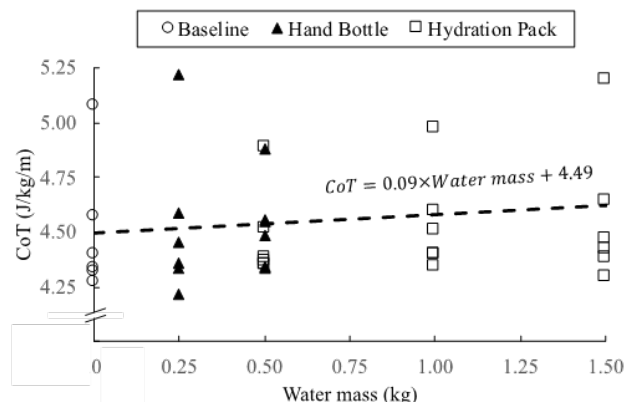


Figure 1. Cost of transport (CoT, J/kg/m) as a function of water mass (kg) carried. The regression line is calculated using a linear mixed model: each subject was classified as a random effect; water mass was classified as fixed-effect; and CoT as the outcome variable.

2647 Board #108 May 29 9:30 AM - 11:00 AM
Influence Of Leg Stiffness And Its Effect On Performance During Acceleration And Constant Speed Phases Of Sprinting

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 (No relevant relationships reported)

Evidence between leg stiffness and varying sprint speed remains inconclusive. Some studies indicate that with the increase speed, from low to medium, both vertical stiffness and leg stiffness increase which may lead to improved push-off force during a sprint. Others have shown that leg stiffness remains relatively unchanged with the increment of speed. Some recent evidence suggests that muscular strategies of high-speed sprinting may be different.

PURPOSE: The purposes of this study are to: (a) determine differences in leg stiffness during acceleration and constant speed phases in sprinting, (b) examine the association between leg stiffness and kinematic and kinetic characteristics during each phase of sprinting.

METHODS: 11 sprinters (Height 1.77 ± 0.05 cm; Weight 69 ± 0.55 kg; Personal Best 11.17 ± 0.23 s) from Shanghai University of Sport participated in the study. 12 cameras were used to capture the kinematic data (200HZ) and three force plates were placed in the runway to ascertain kinetic data (1000HZ). The starting line of sprinting was set 12 and 40 meters ahead of force plates allowing sufficient leadway for acceleration and constant speed phases when they reached the force plates. Paired samples t tests and correlation analyses were used to analyze leg stiffness and kinematic and kinetic data ascertained under each running phase.

RESULTS: There was a significant difference in leg stiffness between constant speed phase and acceleration phase of sprinting (15.11 ± 2.00 kN/m versus 12.54 ± 1.98 kN/m, $p = 0.001$). No difference was observed in vertical stiffness between the two phases. Leg stiffness during the constant speed phase was significantly correlated with vertical ground reaction force (normalized by body weight) and contact time ($r = -0.754$; $r = -0.751$). Similar results on leg stiffness were observed during the acceleration phase ($r = -0.849$; $r = -0.686$).

CONCLUSION: During the acceleration phase of sprinting, leg stiffness was more pronounced than constant speed phase. Leg stiffness in the two speed phases were correlated with contact time and vertical ground reaction force.

2648 Board #109 May 29 9:30 AM - 11:00 AM
The Influence Of Hamstring Muscle-tendon Stiffness On Isolated And Dynamic Velocity Based Parameters

Sean P. Langan, Jadeon D. Carreker, Thomas Murphy, George J. Davies, Bryan L. Riemann. *Georgia Southern University (Armstrong), Savannah, GA.*
 (No relevant relationships reported)

Previous research has demonstrated sex differences in active hamstring muscle-tendon stiffness as well as associations between stiffness and landing biomechanics and architectural tissue properties. Little is known whether active stiffness relates to other measures of muscle function (i.e., maximum voluntary isometric contraction [MVIC], isotonic dynamometry) and performance (i.e., sprinting).

PURPOSE: To conduct a pilot study examining the relationship between active hamstring muscle-tendon stiffness and isometric torque production, isotonic velocity development, and sprint velocity. A secondary research interest was to examine the relationship between the isotonic velocity parameters and sprint performance.

METHODS: Nine recreationally active and healthy subjects (7 males, 2 females) (24 ± 3 years) completed an MVIC for the hamstrings (30° knee flexion) followed by three 40m sprint trials using an infrared timing gate system (Brower, Draper, UT). At least 48 hours later, subjects completed a measure of hamstring muscle-tendon stiffness (damped oscillatory technique) and an isotonic knee flexion test on a fixed dynamometer (Biodex, Shirley, NY). The isotonic test began at 90° of knee flexion and was eccentric/concentric through a 90° arc of motion with subjects lying prone. Eccentric velocity was set at $180^\circ/s$ and concentric torque was set at 25% of MVIC. Bivariate correlations were conducted between stiffness, MVIC (normalized to body mass), sprint times, time to peak velocity, rate of velocity development (RVD, 0-100ms), and rebound time ($-50^\circ/s$ to $+50^\circ/s$).

RESULTS: Stiffness (24.3 ± 11.7 Nm/kg) was only significantly related ($r = .681$, $P = .043$) to MVIC (1.48 ± 0.23 Nm/kg). Stiffness was not significantly related to rebound time (0.076 ± 0.026 s) ($r = -.354$, $P = .350$), time to peak velocity (0.214 ± 0.034 s) ($r = -.285$, $P = .457$), RVD_{0-100} ($1314.64 \pm 222.30^\circ/s^2$) ($r = -.336$, $P = .377$), or sprint velocities (5.90 ± 0.56 m/s) ($r = .248$, $P = .521$). Rebound time ($r = -.535$, $P = .138$) and RVD_{0-100} ($r = -.436$, $P = .241$) were not significantly related to sprint times.

CONCLUSIONS: Although only the association between stiffness and normalized MVIC reached statistical significance, the magnitude of the other observed relationships provides impetus for further study with a larger sample size.

2649 Board #110 May 29 9:30 AM - 11:00 AM
Effects Of Minimal, Traditional, And Highly Cushioned Shoes On Injury-related Biomechanics In Rear And Non-rearfoot Strike Runners

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 (No relevant relationships reported)

Running barefoot, in minimal shoes, or traditional shoes alters certain injury-related biomechanical variables and these footwear effects can be influenced by foot strike pattern. It is unclear however how highly cushioned shoes might alter this interaction.

PURPOSE: Given the increasing popularity in highly cushioned footwear in runners, this study assessed the interaction of footwear and foot strike pattern on injury-related biomechanical variables in experienced runners. **METHODS:** Six rear (RFS) and seven non-rearfoot strike (NRFS) experienced runners completed five running trials at 3.5 m/s ($\pm 5\%$) in minimal (MSH), standard (SH) and high cushioned (HC) shoes. A mixed-design repeated measures ANOVA was used to test interaction effects for all injury-related variables. Paired t-tests were used to decipher any interaction effect and Cohen's *d* effect sizes were computed to assess mean difference magnitudes.

Given the preliminary nature of this work and the small sample size, alpha level was set to 0.1. **RESULTS:** Strike index confirmed the different strike patterns while running in SH between RFS ($15.2 \pm 3.1\%$) and NRFS ($10.2 \pm 11.8\%$) groups ($p < 0.001$). Interaction effects were not observed for any of the variables except for peak eversion velocity ($p = 0.1$) and instantaneous vertical loading rate (IVLR; $p = 0.1$) (Figure 1). Main footwear effects were observed for IVLR ($p = 0.004$) and peak eversion velocity ($p = 0.01$). Main foot strike effects were observed for step length ($p = 0.041$), strike index ($p = 0.00$), and IVLR ($p = 0.00$). **CONCLUSION:** Similar to prior research, these current preliminary findings suggest there might be an interaction between foot strike and footwear in experienced runners for peak eversion velocity and IVLR. Thus, if these biomechanical variables are of interest to scientists or clinicians, these findings suggest that footwear type and strike pattern should both be considered in research or return to running programs.

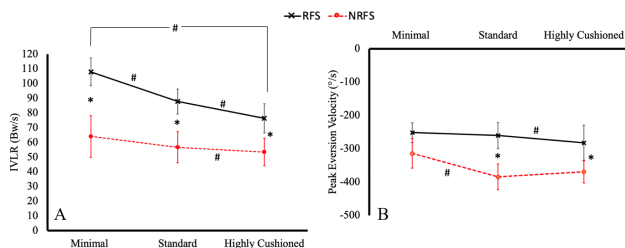


Figure 1. Instantaneous vertical loading rate (A: IVLR) and peak eversion velocity (B) in the three footwear conditions in rear (RFS; black) and non-rearfoot strike (NRFS; red) runners. *: foot strike group difference within footwear; #: footwear difference within foot strike group ($p < 0.1$).

2650 Board #111 May 29 9:30 AM - 11:00 AM
How Does Footwear Impact Stride Characteristics In Younger And Older Runners?

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How does footwear impact stride characteristics in younger and older runners?

Kelsey Klug, Brianne Borgia, Julia Freedman Silvernail
 University of Nevada, Las Vegas, Las Vegas, NV
 Running is an increasingly popular form of exercise among adults due to the positive influence exercise has on health. Currently, little is known about how different types of footwear effect gait mechanics in experienced runners. **PURPOSE:** The purpose of this study was to examine how different types of running footwear impacted stride characteristics in younger and older experienced runners. **METHODS:** Five older adults (Age: 56 ± 7.28 ; Mass: 77.96 ± 10.92 ; Height: 1.75 ± 0.09 ; PBF: 21.78 ± 5.13 ; Miles/week: 25 ± 5.77) and five younger adults (Age: 30.80 ± 3.32 ; PBF: 24.02 ± 3.31 ; Miles/week: 23 ± 6.08) participated in this investigation. Participants were provided with a neutral shoe and a maximal cushioning shoe in their self-reported size. The participants own running shoes served as a third footwear condition. Participants

ran at a controlled pace of 4.0 m/s ($\pm 5\%$) over a 10-m runway with force platforms collecting kinetic data. Initial contact and toe off were determined from the vertical GRF using a 30N threshold from which stance time, swing time, step width and stride length were calculated. Differences in mean stride characteristics were analyzed using a 2x3 (group x shoe) mixed analysis of variance ($\alpha < 0.05$). **RESULTS:** Mean values for variables of interest are shown in Table 1. No comparisons were significant, with all p-values greater than 0.05. **CONCLUSION:** There were not differences observed between groups or footwear condition suggesting participants maintained their preferred movement in all three shoes.

Table 1. Stride Characteristics

	Neutral Shoe		Maximal Shoe		Own Shoe	
	Young	Older	Young	Older	Young	Older
Stance time (s)	0.19 (0.01)	0.21(0.03)	0.19 (0.02)	0.21(0.02)	0.16(0.04)	0.20(0.02)
Swing time (s)	0.43(0.03)	0.44(0.03)	0.42(0.01)	0.43(0.04)	0.44(0.03)	0.42(0.02)
Step width (m)	0.07(0.02)	0.15(0.18)	0.06(0.02)	0.16(0.19)	0.08(0.01)	0.15(0.18)
Stride length (m)	2.92 (0.14)	2.90(0.20)	2.89(0.14)	2.83(0.26)	2.70(0.40)	2.92(0.23)

Mean (standard deviation) of stride characteristics during gait. s: seconds; m: meters.

2651 Board #112 May 29 9:30 AM - 11:00 AM
Locomotion Pattern Alters Apparent Joint Stiffness During Unloaded And Loaded Bipedal Ambulatory Tasks In Women

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Soldiers often perform bipedal ambulatory tasks with load carriage. During marching they are encouraged to use a walk pattern instead of running (RN) despite translating at a velocity above their gait transition (GTV), known as forced marching (FM). Apparent joint stiffness provides an opportunity to quantify the modulation of lower extremity elasticity during dynamic activity in regard to joint loading. Moreover, joint stiffness potentially has implications on mechanical efficiency. However, little is known how load magnitude and locomotion pattern affects joint stiffness at relative velocities. **PURPOSE:** To determine interactive effects of load magnitude and locomotion on lower extremity joint stiffness in women.

METHODS: Twelve healthy females (24.75 \pm 2.17 years, 60.98 \pm 9.74kg) completed 2 testing sessions collecting kinematic (100 Hz) and kinetic (1000 Hz) data. Subjects wore combat boots and a dual-sided weighted vest. Trials were conducted at body weight (BW) and loaded; +25%, +45%. At each load, 2 locomotion types (RN and FM) were performed at 10% above their GTV. Joint angles (θ) were relative and moments (M) normalized to system weight. Joint stiffness (K) [sagittal plane] calculated as $\Delta M_{joint} / \Delta \theta_{joint}$ during the braking portion of stance phase. Multifactorial RMANOVA, load by locomotion (3x2), were conducted on each K for each limb (dominant [DOM] & nondominant [NON]) separately. Bonferroni-corrected pairwise comparisons were conducted when necessary ($\alpha < 0.05$).

RESULTS: K_{ankle} had a main effect of locomotion (DOM: $p = .02$, NON: $p = .002$); RN (.81 \pm .22 Nm/kg/°) ~82.5% greater than FM (.14 \pm .04 Nm/kg/°) for both limbs. K_{knee} had a main effect of locomotion (DOM: $p < .001$, NON: $p < .001$); RN (.09 \pm .01 Nm/kg/°) ~80.5% greater than FM (.03 \pm .004 Nm/kg/°) for both limbs. For K_{hip} , had a main effect of load (NON: $p = .01$); +45% ~10% less than +25%.

CONCLUSIONS: Ankle and knee joint stiffness were not significantly altered by changes in load magnitude, demonstrating the importance of locomotion pattern on modulating apparent joint stiffness. Unlike the ankle and knee, the hip may only mediate lower extremity stiffness with the addition of load. Greater observed joint stiffness during RN may exhibit the greater elastic energy potential that can be leveraged for energy absorption and horizontal propulsion compared to FM.

E-30 Free Communication/Poster - Walking

Friday, May 29, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

2652 Board #113 May 29 9:30 AM - 11:00 AM

The Influence Of Maximal And Minimal Shoes On Walking Biomechanics In Older Individuals

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(No relevant relationships reported)

Older individuals frequently walk as a means for exercise and often wear running shoes during this activity. Recently there has been increased popularity in older individuals wearing maximal running shoes during walking. Maximal running shoes are unique because they are comprised of a highly cushioned midsole in both the rearfoot and forefoot that is supposed to improve shock attenuation. Minimal running shoes with little cushioning are also used in this population to improve proprioception and balance. Loading in the frontal plane is of particular interest for older individuals since it has been associated with increased risk of knee osteoarthritis. Little is currently known about how maximal and minimal shoes influence walking biomechanics in any age group.

PURPOSE: To examine the influence of maximal and minimal running shoes on walking biomechanics in older individuals. **METHODS:** Walking biomechanics were collected on 16 female participants (age range: 51 – 64 years) using an 8-camera Vicon motion capture system and two embedded force plates. 3D kinematics and kinetics were collected while subjects walked along a 10-meter runway in three different footwear conditions (MAX, MIN, TRAD). Variables of interest included the 1st and 2nd peak of the vertical ground reaction force (F_{z1} , F_{z2}), the instantaneous vertical loading rate (IVLR), peak ankle eversion and knee varus angles, and the peak external ankle eversion and knee varus moments. Differences were determined using a repeated measures ANOVA. **RESULTS:** The external knee varus moment was significantly higher in the maximal shoe compared to the traditional shoe (MAX: 0.55 \pm 0.16 Nm/kg, TRAD: 0.49 \pm 0.14 Nm/kg, $p = .005$). The IVLR was significantly higher in the minimal shoe compared to the traditional shoe (MIN: 30.4 \pm 3.4 BW/s, TRAD: 21.8 \pm 1.8 BW/s, $p < .001$). No other significant differences were found for the variables of interest. **CONCLUSION:** The maximal shoe was found to increase the external knee varus moment, which has been linked to increased pain and disease progression in knee osteoarthritis. The IVLR was significantly higher in the minimal shoe, which has also been linked to injury. Based on these findings, there are no clear advantages to wearing a maximal or minimal shoe during walking, and doing so may be detrimental to injury risk. No grant support was provided.

2653 Board #114 May 29 9:30 AM - 11:00 AM

Dual Task Interference During Walking After Ten Days Of Complete Physical Inactivity

Uros Marusic¹, Marco Narici², Rado Pisol¹. ¹Science and research centre Koper, Koper, Slovenia. ²University of Padua, Padua, Italy.
(No relevant relationships reported)

Prolonged physical inactivity or immobilization after sports injuries and/or surgery can lead to severe cognitive and motor disorders that prevent rapid recovery and lead to future falls. Previous studies have shown that gait control provides the demand for cognitive centers of the brain and that dual-task assessments may indicate an increased risk of falling or a protection strategy to prevent falls. **PURPOSE:** To determine to which extent walking and walking while texting ability deteriorates after prolonged physical inactivity. **METHODS:** Ten healthy young volunteers successfully completed 10 days of horizontal bed rest with 24h video and medical monitoring. Gait speed parameter was obtained with the 2D OptoGait system (Microgate, Italy, EU) under four different conditions in a random order: self-selected and fast paced walking condition with (dual-task) and without (single-task) typing on the smartphone. **RESULTS:** Ten days of horizontal bed rest had no significant impact on the self-selected gait speed in single- (-5.7%; $p = 0.190$) and dual-task conditions (-4.0%; $p = 0.339$). In contrast, bed rest significantly decreased gait speed in fast paced walking condition in single- (-9.9%; $p = 0.009$) and dual-task conditions (-10.3%; $p = 0.002$). **CONCLUSION:** Our results show that bed rest reduces gait performance and that the effects are greater for tasks that require more attentional resources - tasks with higher complexity. The results can be used for the future development of effective rehabilitation countermeasures. Supported by ASI, MARS-PRE Project, n. DC-VUM-2017-006.

2654 Board #115 May 29 9:30 AM - 11:00 AM
Walking Biomechanics Associated With Patellofemoral Pain In Sedentary And Active Emerging Adult Women

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 (No relevant relationships reported)

About 50% of emerging adults do not meet the national physical activity recommendations. Risk of injury, like patellofemoral pain (PFP) during walking, may be a barrier to meeting the physical activity recommendations for sedentary emerging adults. **PURPOSE:** To determine if sedentary emerging adult women had walking biomechanics related to PFP compared to active emerging adult women. **METHODS:** As part of a larger study, 26 (12 sedentary, 14 active) emerging adult women (age:22(3) years; height: 1.58(0.08) m; mass: 58.4(8.7) kg) participated in the study. Anatomical and tracking retro-reflective markers were placed on body segments to record movement. Participants completed 5 good walking trials at 1.4 m/s (\pm 5%). Three-dimensional gait analysis was performed using motion capture sampling at 200 Hz and force platforms sampling at 1000Hz. Joint angles were determined using the joint coordinate system and moment was determined using inverse dynamics. The variables of interest were peak knee flexion angle, peak internal knee extensor moment (PKEM), knee abduction and external rotation angles at PKEM, and hip adduction and internal rotation angles at PKEM. Independent t-tests compared variables between sedentary and active emerging adult women. Effect sizes (d) were calculated for each variable. **RESULTS:** Knee external rotation angle at PKEM was significantly larger in sedentary compared to active emerging adult women (Table 1). There were no other significant differences between the sedentary and active groups for the remaining variables of interest. **CONCLUSION:** A larger knee external rotation angle at PKEM suggests higher pressure on the lateral patella in the sedentary versus active group. According to the pathomechanical model for PFP, high lateral pressure and associated high cartilage stress is a mechanism for the develop of PFP. Therefore, sedentary women may be more at risk for developing PFP during walking for exercise compared to active women.

Table 1: hip and knee biomechanics during walking in sedentary and active emerging adult women

	Sedentary Mean (SD)	Active Mean (SD)	t	p-value	Effect size (d)
Peak knee flexion angle (°)	15.6 (4.8)	16.1 (5.1)	-0.3	0.78	0.1
Peak internal knee extensor moment (Nm/kg)	0.45 (0.20)	0.60 (0.21)	1.9	0.08	0.8
Knee abduction angle at peak internal knee extensor moment (°)	0.2 (2.4)	-0.2 (3.4)	-0.4	0.71	0.2
Knee external rotation angle at peak internal knee extensor moment (°)	9.1 (3.3)	3.7 (4.5)	3.5	<0.01*	1.4
Hip adduction angle at peak internal knee extensor moment (°)	9.6 (2.5)	8.6 (2.7)	-1.1	0.29	0.4
Hip internal rotation angle at peak internal knee extensor moment (°)	6.7 (4.3)	5.7 (4.6)	-0.6	0.58	0.2

* indicates significant difference: p<0.05

2655 Board #116 May 29 9:30 AM - 11:00 AM
Hallux Valgus And Walking Speed Influence Frontal Plane Net Joint Moments In Older Adults

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Hallux valgus (HV) is often comorbid with knee osteoarthritis (OA) in older adults. Both these conditions are known to adversely affect walking mechanics, but the biomechanical link between these conditions has not been established. Peak external knee adduction moment is a surrogate measure of knee OA severity and progression. However, this variable is sensitive to changes in walking speed. **PURPOSE:** To examine the effects of HV on peak external knee adduction moment while walking at controlled slow and fast speeds. **METHODS:** Nineteen older adults (65-80 years) with moderate-to-severe HV and 19 healthy older controls completed five walking trials at controlled slow (1.0 m·s⁻¹) and fast (1.3 m·s⁻¹) speeds. Three-dimensional lower extremity marker position and ground

reaction force data were collected at 100 and 1000 Hz, respectively. External knee adduction moment was calculated using an inverse dynamics approach. Peak moments were identified for the more affected leg for the HV group and dominant leg for the control group for each trial. Two-way mixed model ANOVAs were used to examine the effects of group (HV vs. control) and speed (1.0 vs. 1.3 m·s⁻¹) on peak external knee adduction moment.

RESULTS: For peak knee adduction moment a group x speed interaction (p=0.035) was observed. With increase in walking speed external knee adduction moment increased (p<0.001), however, the HV group had twice as much of an increase in net peak knee adduction moment (16.6% greater; 0.53 \pm 0.21 vs. 0.62 \pm 0.25 Nm/kg) as compared to the control group (8.6% greater; 0.51 \pm 0.13 vs. 0.56 \pm 0.13 Nm/kg).

CONCLUSIONS: Older adults with HV show altered knee joint mechanics at faster walking speeds. Knee adduction moment data suggest that older adults with HV may be at a greater risk for developing knee osteoarthritis.

2656 Board #117 May 29 9:30 AM - 11:00 AM
Increased Attentional Focus On Walking By Older Adults Limits Maximum Speed And Dynamic Stability Control

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Older adults with lower balance confidence demonstrate a reduced willingness to experience instability as the task of walking becomes more challenging. The specific reason why is not known. **PURPOSE:** To investigate the extent to which performance of a challenging walking task relates to the attentional requirements of walking. **METHODS:** Fourteen older participants were asked to walk on a treadmill at a range of speeds from 0.4 m/s, increasing 0.2 m/s, up to either 2.0 m/s or a speed they chose to stop. All walking trials included 60 steps. Kinematic data was collected and a measure of margin of stability in the anterior direction at heel strike (MOS_{AP}) was quantified. The timed up and go (TUG) and timed up and go dual task (TUG_{dual}) were performed. An automaticity index (TUG/TUG_{dual} *100) was calculated to evaluate the attentional resources. Individuals were grouped (n=7 in each group) based on whether they could (complete, 70 \pm 2.44 years) or could not (incomplete, 67 \pm 2.43 years) complete all walking trials. Comparisons between groups were made with Independent T-test and Mann-Whitney U test. Correlations were detected with Spearman rank correlation. **RESULTS:** Significant differences were detected in the maximum speeds achieved between groups as well as the range of gait stability (p<0.05). Those that could not complete all speeds had a lower automaticity score compared to other group (p=0.019). The fastest speed attempted was correlated with an average of MOS_{AP} (rho=-0.93, p<0.001) and the automaticity index (rho=0.61, p=0.022). The average of MOS_{AP} and the automatic gait index were significantly correlated (rho=-0.71, p=0.004, Fig 1). **CONCLUSION:** Older adults with lower automaticity of gait appeared to choose to stop limit walking trials before they became dynamically unstable, which may relate with the increased attentional demand required to maintain dynamic stability at higher walking speeds. This should be considered for an assessment to identify stability problems.

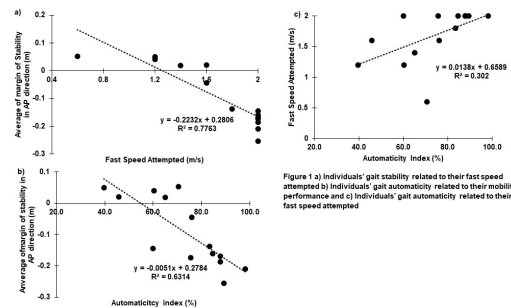


Figure 1 a) Individuals' gait stability related to their fast speed attempted b) Individuals' gait automaticity related to their mobility performance and c) Individuals' gait automaticity related to their fast speed attempted

2657 Board #118 May 29 9:30 AM - 11:00 AM
Walking To A Fractal-like Stimulus Does Not Affect Cardiorespiratory Function

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Gait complexity decreases with aging. Gait rehabilitation commonly uses step synchronization with external cues; yet, cues do not present variability in its structure. It has been recently suggested that cues should be presented in a fractal-like pattern (i.e., complexity). Yet, the effects of fractal-cueing on physiological outcomes remains poorly understood.

PURPOSE: To investigate the effect of synchronization of visual stimulus with different temporal structures on cardiorespiratory function.
METHODS: 14 male participants (23±4 yrs, 1.8±0.1 m, 70±9 kg) completed four 10-min treadmill walking trials at their preferred walking speed. First, self-paced walking (SPW) condition (no stimulus). Stride time from SPW was used to design individualized stimuli for 3 randomized cue conditions: periodic (PER), fractal (FRC), and random (RND). Detrended fluctuation analysis (DFA) was used to validate the temporal structure of the FRC and RND stimuli. The stimulus was provided via a moving horizontal bar projected on a screen. Heart rate (HR) and oxygen uptake (VO₂) were collected. An accelerometer, placed at the ankle, was used to determine gait events. DFA was used to determine the fractal-scaling exponent from inter-stride intervals (ISI_α). ANOVAs were conducted to assess differences between conditions for all dependent variables (p<0.05).
RESULTS: Descriptive statistics are shown in Table 1. ISI_α was significantly different between conditions (F_{2,44,31.70}=33.76, p<0.0001). FRC and SPW had greater ISI_α than PER and RND.
CONCLUSION: FRC and SPW displayed higher complexity (ISI_α) compared to PER and RND. Compared to SPW, only FRC maintained the complexity of the system. Participants maintained the structure of the stimuli. Notably, FRC appears a viable approach for gait training without altering the cardiorespiratory system, and likely improving gait complexity compared to the PER.

Table 1. Mean ± standard deviation of ISI_α, VO₂, and HR per condition

	FRC	PER	RND	SPW
ISI _α	0.82 ± 0.13	0.48 ± 0.12	0.60 ± 0.12	0.92 ± 0.15
VO ₂ (ml.kg ⁻¹ .min ⁻¹)	13.3 ± 1.7	13.3 ± 1.4	13.2 ± 1.6	13.4 ± 1.5
HR (bpm)	90 ± 11	91 ± 11	94 ± 12	91 ± 13

2658 Board #119 May 29 9:30 AM - 11:00 AM
Gait Metrics For Older Adults Using Different Walking Devices After A Six-week Walking Intervention

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 (No relevant relationships reported)

Falls have detrimental effects to older adults' physical and mental wellbeing and can even result in death. The medical system spends billions of dollars on treatment for falls every year. Measuring different aspects of gait, such as gait velocity, can help predict the risk for falling. **PURPOSE:** This study investigated how walking with no device, walking poles, or the gait trainer impacted gait metrics in older adults.
METHODS: Fourteen participants (3 men, 11 women, aged 77.53 ± 7.28 years) were randomized to one of three walking groups: Control (C) (n=4), Walking Poles (WP) (n=5), or Gait Trainer (GT) (n=5). The gait trainer is a new device aimed at preventing age-related gait decline. Assessments were performed at three separate times: prior to the intervention (Pre-test), immediately after the intervention (Post1), and six weeks after Post1 (Post2). Assessments included measurements of gait velocity, cadence, and left and right step lengths for the subjects' normal and fast gait speeds. For the six-week intervention, all participants walked three times per week for 30 minutes in their assigned walking group. **RESULTS:** An ANOVA showed there were no statistically significant differences between the groups at Pre-test for all metrics (p > 0.05). Between group measurements across time were analyzed using linear regression models for all metrics, with an alpha set at p < 0.05. The only statistically significant difference was found for left step length (L SL) for fast gait velocity between the C and WP groups from Pre-test to Post1 (p = 0.03). From Pre-test to Post1, L SL increased in C from 68.4 cm to 73.7 cm and decreased in WP from 73.0 cm to 70.6 cm. There were no statistically significant differences for all other metrics analyzed. **CONCLUSION:** The results from this study found that walking group did not impact gait velocity over time. Gait velocity is determined by step length and cadence, and can be used as a predictor of falls; therefore, walking group did not impact fall risk with the six-week walking intervention, despite the increase in L SL for the C group. The current sample

size was relatively high-functioning and did not show improvement; however, trends indicated a subset of lower functioning participants who have experienced notable age-related gait decline may benefit from the gait trainer.

2659 Board #120 May 29 9:30 AM - 11:00 AM
Lower Body Positive-pressure Walking Reduces Knee Extensor And Plantarflexor Muscle Activity In Obese Women

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Muscle contractile activity is a major determinant of oxygen consumption during walking. Obesity increases electromyography (EMG) activity of knee extensors and plantarflexors during walking. **PURPOSE:** To determine how reduced body weight affects lower extremity muscle activity in obese women. **Methods:** Eight obese females (Age: 37.5 ± 8.5y; BMI 36.3 ± 4.0 kg/m²) walked at a self-selected speed (2.3 ± 0.4 mph) on a lower body positive-pressure treadmill (LBPP) during four conditions; control (CON), 10% incline (INC), 25% body weight support (BWS), and BWS+INC. Surface EMG of the vastus lateralis (VL), vastus medialis (VM), semitendinosus (ST), and medial gastrocnemius (MG) were recorded at 1000Hz during the final 30s of each stage. Integrated EMG activity (iEMG), total spectral power (TSP), peak frequency (PF), and median frequency (MF) were calculated over 20 consecutive gait cycles for each subject. **Results:** Compared to CON, INC increased VL iEMG by 38% (p = 0.010) while BWS decreased VL iEMG by 28% (p = 0.037). VL iEMG was lower in BWS+INC compared to INC by 33% (p = 0.002), but was not significantly different from BWS alone (p = 0.133). A significant interaction (p = 0.029) between INC and BWS alone was noted for VM iEMG, but post-test revealed no significant differences among conditions. ST iEMG was not significantly different among conditions. Compared to CON, INC increased MG iEMG (35%, p = 0.015). BWS did not significantly affect MG iEMG compared to CON. MG iEMG was significantly lower in BWS+INC (23%, p < 0.001) compared to INC, but was not significantly different from BWS alone (p = 0.232). Compared to CON, TSP was higher in INC for the VL (232%, p < 0.001) and MG (47%, p < 0.001). BWS significantly decreased TSP compared to CON in MG (35%, p = 0.009), but not VL. TSP was not significantly different between BWS+INC compared to INC or BWS alone. There was a main effect for incline to increase PF of the VL (p = 0.035), but post-tests revealed no significant differences among conditions. MF was not significantly different among conditions in any muscle group. **Conclusion:** Reduced body weight lowers muscle activity of the VL and MG during level and incline walking without significantly affecting motor unit recruitment pools. Reduced VL and MG activity may explain reduced metabolic cost of transport following weight loss interventions.

2660 Board #121 May 29 9:30 AM - 11:00 AM
Effects Of Lower Body Positive-pressure Treadmill Walking On Joint Kinematics And Electromyography In Obese Women.

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Obesity reduces knee flexion and ankle plantarflexion concomitant with prolonged activation of quadriceps and gastrocnemii during walking. **PURPOSE:** To determine how reduced body weight, independent of changes in body segment volume, affects lower extremity joint kinematics and muscle recruitment during walking. **METHODS:** Eight apparently healthy, obese women (Age: 37.3 ± 8.5y; BMI: 36.3 ± 4.1 kg/m²) walked at a self-selected pace on a lower body positive-pressure treadmill (LBPP) under four conditions: 1) control (CON), 2) 10% incline (INC), 3) 25% body weight support (BWS), and 4) BWS + INC. Joint kinematics were measured through bi-axial wireless electrogoniometers and time-synchronized with surface electromyography (EMG) of the vastus lateralis (VL), vastus medialis (VM), semitendinosus (ST), and medial gastrocnemius (MG). The gait cycle was defined by swing, weight acceptance (WA), midstance (MS), and pushoff (PO) according to plantarflexion (PF) and dorsiflexion (DF). Statistical comparisons were made by two-way repeated measures ANOVA. **RESULTS:** Joint kinematics and EMG activity were unchanged throughout swing. At the knee joint, INC increased mean knee flexion during WA (28.3 ± 12.9 v 21.8 ± 14.2°, p < 0.001) and MS (25.3 ± 9.1 v 19.4 ± 12.0°, p = 0.044) compared to CON. BWS + INC reduced mean knee flexion during WA (23.8 ± 13.3, p < 0.001) and MS (21.1 ± 12.4°, p = 0.020) compared to INC. Similarly, mean PF was reduced during INC during WA (10.1 ± 1.7 v 13.6 ± 2.2°, p < 0.001) and MS (4.4 ± 5.3 v 8.0 ± 4.9°, p = 0.008) compared to CON. BWS + INC increased mean PF compared to INC during WA (12.3 ± 1.7°, p = 0.009) and MS (7.0 ± 5.5°, p = 0.006). During PO, both BWS (10.8 ± 4.8°) and BWS + INC (9.8 ± 5.4°) increased mean PF compared to CON (8.1 ± 4.6°) and INC (6.5 ± 6.1°). Compared to CON, INC increased mean VL EMG activity during WA (31.3 ± 10.1 v 17.8 ± 6.0 %MVIC) and MS (19.2 ± 5.2

v 9.5 ± 2.3 %MVIC), which was restored by BWS + INC (19.5 and 12.1 %MVIC). There was a main effect for body weight support to reduce mean MG EMG during MS. **CONCLUSIONS:** Weight loss, independent of changes in body segment volume reduces knee flexion during WA and MS phases of incline walking concomitant with reduced VL EMG activity. Weight loss increases PF throughout stance during incline walking despite reduced MG EMG activity.

2661 Board #122 May 29 9:30 AM - 11:00 AM
Relationships Between Muscle Quality, Maximal And Rapid Torque Characteristics, And Walking Speed In Elderly Females

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 (No relevant relationships reported)

The link between walking speed, rectus femoris (RF) muscle quality [echo intensity (EI)], and maximal and rapid strength in older adults is not well understood. **PURPOSE:** To examine the relationships between walking speed, RF EI, and maximal and rapid isometric torque characteristics of the leg extensors in elderly females. **METHODS:** Twenty elderly (67 ± 4 yrs.) females underwent one diagnostic ultrasound assessment followed by three isometric maximal voluntary contractions (MVC) of the leg extensors and a 6-min walk test. RF EI was measured on the right leg using a portable B-mode ultrasound imaging device and linear-array probe. Walking speed was determined as the average speed during the 6-min walk test. For each MVC, participants sat in an upright position and were instructed to push "as hard and fast as possible" against a load cell for 3-4 s. Isometric MVC peak torque (PT) was determined as the highest mean 500 ms epoch during the entire 3-4 s MVC plateau. Peak rate of torque development (RTD) was calculated during each MVC as the highest slope value for any 50 ms epoch that occurred over the initial 200 ms of the torque-time curve. Pearson correlation coefficients (r) were used to examine the relationships between walking speed, EI, PT, and RTD. A partial correlation was used to examine the relationship between walking speed and RTD when controlling for EI. **RESULTS:** There were significant relationships between walking speed and RTD ($r = 0.451$; $P = 0.046$) and EI ($r = -0.497$; $P = 0.026$). There was a significant negative relationship between EI and RTD ($r = -0.469$; $P = 0.037$). No relationships were observed between PT and walking speed ($r = 0.394$; $P = 0.085$) or EI ($r = -0.413$; $P = 0.071$). With EI as a control variable, there was no significant relationship between walking speed and RTD ($r = 0.285$; $P = 0.238$). **CONCLUSIONS:** We found a significant positive relationship between walking speed and RTD of the leg extensors in elderly females. Although the reason for this is uncertain, partial correlation analysis suggested that this relationship may be explained by the variance shared (collinearity) between walking speed and RF EI. From a functional standpoint, an age-related decrease in RTD due to its apparent collinearity with RF EI, may significantly impact the quality of life among older adults by impairing their walking speed performance abilities.

2662 Board #123 May 29 9:30 AM - 11:00 AM
Lower Extremity Joint Stiffness And Energy Generation In Gait Transitions

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Walk-to-run (WRT) or run-to-walk transitions (RWT) occur when walking at a constantly accelerated speed or running at a constantly decelerated speed. Lower extremity joint level kinetic patterns are related to gait transition mechanisms. Little is known about lower extremity joint stiffness, or mechanical work generation in the WRT and RWT processes.

PURPOSE: To identify ankle, knee and hip joint stiffness and mechanical work generation patterns in WRT and RWT processes. **METHODS:** Ten middle age healthy subjects (50.7 ± 6.0 years, 173.4 ± 11.4 cm, 69.7 ± 14.9 kg) participated in treadmill WRT (1.8 m/s - 2.4 m/s) and RWT (2.4 m/s - 1.8 m/s) tests, with acceleration and deceleration set to 0.1 m/s^2 and -0.1 m/s^2 , respectively. Five steps were selected for data analysis: transition step (S0); two steps before transition (S-2, S-1); two steps after transition (S1, S2). Joint stiffness (K_{joint}) was calculated as change in sagittal plane joint moment (ΔM_{joint}) divided by sagittal plane joint angular displacement ($\Delta \theta_{\text{joint}}$) in the braking phase of ground contact ($K_{\text{joint}} = \Delta M_{\text{joint}} / \Delta \theta_{\text{joint}}$). Stance phase joint positive mechanical work (W_{joint}^+) was calculated as the sum of all positive net joint power integrated over time. **RESULTS:** In WRT, K_{ankle} at S2 was higher than S-2 ($p = 0.0004$), S-1 ($p = 0.0007$) and S0 ($p = 0.0001$); K_{hip} at S1 was higher than S-2 ($p = 0.0002$) and S-1 ($p = 0.0001$). In RWT, K_{ankle} at S2 was lower than S-2 ($p = 0.0009$) and S-1 ($p = 0.0006$); K_{hip} at S-1 was higher than S1 ($p = 0.001$) and S2 ($p = 0.0003$). In WRT stance phase, W_{ankle}^+ and W_{knee}^+ were 34% and 60% higher, respectively at S0 compared with S-1; while for W_{hip}^+

there was a significant decrease ($p = 0.0006$) at S0 compared with S-1. In RWT stance phase, W_{ankle}^+ and W_{knee}^+ at S0 were 28% and 42% lower than S-1, respectively; while W_{hip}^+ at S0 was 78% higher than S-1.

CONCLUSIONS: Both WRT and RWT affected K_{ankle} and K_{hip} in the transition step and subsequent steps. Stance phase joint energy generation tended to transfer from proximal to distal during WRT, and vice versa during the RWT process. (Supported by Betty Foster McCue Scholarship.)

2663 Board #124 May 29 9:30 AM - 11:00 AM
Spatiotemporal Gait Asymmetry Distinguishes Fallers And Non-fallers In Below-knee Amputees

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 (No relevant relationships reported)

Introduction: Below-knee-amputees (BKA) are at a higher risk of falling compared to non-amputee controls. Gait patterns have been reported to be an important risk factor of falls: in particular, great disparity in asymmetry of kinematic parameters between lower limbs are observed in BKA. **Purpose:** To investigate differences between spatiotemporal symmetry gait patterns, functional mobility and balance confidence among unilateral BKA fallers and non-fallers. **Method:** Twenty-six unilateral BKA (14 fallers: 47.5 ± 8.6 yrs; $29.5 \pm 4.5 \text{ kg/m}^2$ and 12 non-fallers: 47.5 ± 8.6 yrs; $31.1 \pm 5.5 \text{ kg/m}^2$) completed 5 walking trials, at a self-selected pace, on a 4.3 m GaitRite system. Step length, swing time, and stance time for each limb was collected. Symmetry ratios between limbs were calculated. Self-reported falls within the past 12 months, Timed Up and Go (TUG) Test and the Activity-Specific Balance Confidence (ABC) questionnaire were also collected. Independent t-tests were performed to compare the fallers with the non-fallers. **Results:** The fallers had significantly lower functional mobility (12.1 ± 2.7 v. 8.5 ± 1.1 sec) and reported lower balance confidence (77.4 ± 10.9 v. 87.7 ± 13.7) than the non-fallers ($p < 0.05$). The fallers also had significantly larger step length (1.12 ± 0.05 v. 1.01 ± 0.05), stance time (10.6 ± 0.03 v. 1.02 ± 0.02) and swing time (1.11 ± 0.05 v. 1.04 ± 0.05) asymmetries ($p < 0.05$). **Discussion:** These results suggest that spatiotemporal asymmetry could be useful in distinguishing prospective fallers from non-fallers among BKA. BKA fallers had increased gait asymmetry compared to the non-fallers, which may be attributed to prosthetic alignment, as well as acquired gait changes because of pain, and diminished strength and range of motion. These findings should be used by clinicians to identify BKA at a greater risk of falling, and specific functional and psychological interventions should be considered for these individuals to improve gait asymmetry, functional mobility, and balance confidence.

2664 Board #125 May 29 9:30 AM - 11:00 AM
Calcaneal Eversion Affects Coupled Knee Rotation During Gait

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It has been suggested that ankle motion (specifically, subtalar (ST) and tibiotalar (TT) joints) may contribute to knee pathologies such as patellofemoral pain syndrome. Yet, in-depth understanding of knee and ankle joint coupling remains elusive due to challenges in accurately measuring three dimensional (3D) bone motion *in vivo*. **PURPOSE:** To determine coupled knee and ankle kinematics during the weight-bearing phase of gait in healthy adults. **METHODS:** Dynamic biplane radiography was used to measure coupled kinematics during walking in 12 ankles and knees from six healthy volunteers (ages 18 - 35 yrs.). Synchronized biplane radiographs were collected at 100hz over the entire support phase of gait, from foot-strike through toe-off. Next, CT scans were acquired and subject-specific models of each bone were generated and used to track the 3D bone motion during each trial using a validated technique with sub-millimeter and sub-degree accuracy. Six degrees of freedom ankle and knee kinematics were normalized to percent stance and divided into loading, mid-stance, and push-off phases. The coupled outcome kinematics were 1) ST inversion and knee internal rotation, and 2) TT dorsiflexion and knee flexion. Associations between ankle and knee coupled kinematics were evaluated using Spearman's rho with significance set at $p < 0.05$. **RESULTS:** During midstance, the knee internal rotation always accompanied ST inversion while external rotation accompanied eversion ($R^2 = 0.63$, $p = 0.085$) (Figure 1). During mid-stance TT plantar flexion always occurred with knee extension ($R^2 = 0.12$, $p = 0.71$). **CONCLUSIONS:** In healthy knees, ST inversion/eversion appears to play a role in knee internal rotation during the mid-stance of gait. This finding suggests assessing coupled motion between the knee and ankle may be beneficial for evaluating single joint pathology. This work was supported by NIH Grant: R44HD066831.

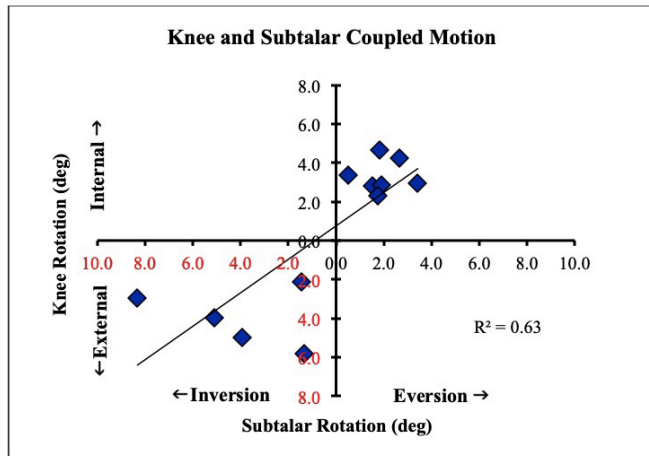


Figure 1. Chart showing coupled ST inversion and knee external rotation during mid stance of gait.

2665 Board #126 May 29 9:30 AM - 11:00 AM
Eight Week Gait Modification Intervention To Reduce Knee Adduction Moment: Randomized Controlled Trial: Preliminary Analysis

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Gait modifications (GM) have successfully reduced knee adduction moment (KAM) which is linked with medial compartment knee osteoarthritis (mKOA). Prior studies have largely relied on single-session designs with healthy participants. Experimental designs with mKOA patients are necessary to confirm these findings. **PURPOSE:** Measure the effect of an GM intervention compared to normal walking on KAM in a randomized sample of mKOA patients. **METHODS:** 7 participants with mKOA completed the intervention (61 ± 13 yrs, 1.7 ± 0.1 m, 80 ± 23 kg). After baseline, participants were randomized into GM or control (CTRL) group. The GM group performed trunk lean (TL) - leaning the trunk over the affected limb. During training, the TL group was provided with real-time haptic feedback. No feedback provided for the CTRL group. 8-week training sessions were performed with KAM measured baseline, week 5 (PT1), 8 (PT2), and 1-week post-training (PT3). During posttests, participants performed 5 unprompted trial, and then were prompted to perform TL gait for 5 more (TL group). Two-sample randomization tests were performed to determine if mean change in PKAM and TL angle from baseline to posttests were significantly different between groups (p<0.05). **RESULTS:** TL angle increased and KAM decreased from baseline to posttest when prompted in the GM group compared to CTRL; however, not all differences reached statistical significance (Table 1). **CONCLUSIONS:** Preliminary data suggests that an 8-week intervention is sufficient for mKOA patients to learn and replicate a modified gait strategy when prompted to reduce KAM. Yet, it appears that there is minimal change in TL angle without prompting, suggesting continued training and/or feedback may be necessary for internalization of the modification.

Table 1. Difference in mean change in KAM and TL from baseline to posttest (GM-CTRL). Positive difference in mean KAM change corresponds to “reduction” in KAM from baseline to posttest (closer to zero). *p<0.05

	PT 1		PT 2		PT 3	
	Un-prompted	Prompted	Un-prompted	Prompted	Un-prompted	Prompted
TL Angle (°)	-1.61	3.10	-1.10	2.98*	-2.70	2.48
PKAM Nm/(kg*m)	0.01	0.06	-0.02	0.03	0.07*	0.11*

2666 Board #127 May 29 9:30 AM - 11:00 AM
Persistent Gait Stability Deficits Associated With History Of Concussion

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 (No relevant relationships reported)

Postural instability during gait is a common symptom following a concussion and is often used as a diagnostic criterion. Specialized equipment has been able to detect impairments in gait patterns and center of pressure (COP) displacement weeks following a concussion. However, difficulty maintaining balance during gait is often not considered when determining whether a concussed individual has made a full recovery unless the impairments are grossly detrimental in nature. **PURPOSE:** To determine if deficits in gait stability seen in concussed individuals persist long after the reception of medical clearance from the initial injury. **METHODS:** Gait parameters were collected using a 20 ft. instrumented pressure-sensitive walkway. Healthy participants reporting a prior history of concussion (n=25) and those reporting no concussion history serving as controls (n=21) were recruited to participate. Individuals with previous history of concussion averaged 7.27 ± 5.73 years since their most recent injury. Participants were instructed to walk in their normal, preferred gait pattern while looking straight ahead. Participants then walked using a tandem gait pattern, walking heel-to-toe in line with each step while looking straight ahead. **RESULTS:** Individuals with prior history of concussion demonstrated significantly greater stride width compared to controls during normal, preferred gait (7.83 cm vs. 10.29 cm, p = 0.09) and tandem gait (0.17 cm vs. 1.63 cm, p = 0.01). Additionally, previously concussed individuals displayed significantly greater single-support COP path length during normal, preferred gait (12.08 cm vs. 12.97 cm, p = 0.06) and significantly greater double-support COP path length during tandem gait (22.71 cm vs. 24.69 cm, p = 0.01). **CONCLUSION:** Individuals that have a sustained one or more concussions demonstrate greater instability in their gait patterns as demonstrated by a wider base of support and greater instability in stance phase during gait years following the initial injury as well as reception of medical clearance. These findings suggest that concussion is associated with long-term impairment in an individual’s ability to maintain postural stability during gait, and that individuals with a prior history of concussion will adopt more conservative gait patterns in order to compensate.

2667 Board #128 May 29 9:30 AM - 11:00 AM
Effect Of Bracing For Scoliosis In Improving Gait Mechanics

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 Reported Relationships: **R.S. Kakar:** Industry contracted research; Aspen Medical.

Patients with scoliosis demonstrate altered gait due to changes in global postural control strategies caused by pain and the spinal deformity. Bracing has been found to reduce pain and increase trunk support in adult degenerative scoliosis (ADS) patients. However, only anecdotal evidence of their efficacy is available in improving gait and posture control mechanics. **PURPOSE:** Investigate the impact of scoliosis bracing on lower extremity kinematics and effectiveness in gait rehabilitation. **METHODS:** 15 patients with ADS (cobb angle >25°; age:73.9±2.9yr; weight:66.6±16.2kg) were recruited using the adult deformity SRS-Schwab system. Oswestry Disability Index (ODI) scores were recorded and patients performed 3m timed up & go, 6 minute walk tests and over-ground 10m walk trials at a self-selected speed at initial evaluation (pre), 45min post fitting (post45) with Peak™ scoliosis brace and after 8 weeks of bracing (post8w). Gait variables were calculated for 5 walking trials and compared between the 3 time points (pre, post45 and post8w) using RM-MANOVA (p< .05). **RESULTS:** Patients walked faster on 3m timed test (pre: 12.5s; post8w: 10.0s) and covered greater distances in the 6 min walk test (p= .01; 61.2m). For kinematic variables, significant differences were observed for swing time of left leg (p =.013; pre:0.40s; post45:0.42s; post8w:0.39s), step length on right (p=.019; pre:0.52m; post45:0.57m; post8w:0.56m), right ankle peak dorsiflexion (p =.049; pre:8.7°; post45:7.9°; post8w:11.7°), both knee peak flexion and extension angles (p <.001- .048), and right hip (p =.002; pre:37.2°; post45:39.2°; post8w:31.6°) and knee ROM (p =.018; pre:29.8° ; post45:31.6°; post8w:37.7°). ODI pain scores (p=.06) showed tendency for statistical significance. **CONCLUSIONS:** Patients with scoliosis demonstrated few immediate and long-term benefits for improving pain and altered gait mechanics. Faster walking speeds, greater walking distances, longer step lengths and greater ROM as observed are indicators of improved gait and dynamic balance. Bracing has immediate effects on improving ambulation and for any neuromuscular adaptation, brace might need to be worn for at least 8 weeks.

2668 Board #129 May 29 9:30 AM - 11:00 AM
The Effect Of Race On Gait Biomechanics In Young Adults: A Pilot Study

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(No relevant relationships reported)

Age, obesity and altered knee biomechanics are known risk factors for developing knee osteoarthritis (OA) in the elderly. Recently racial differences in gait biomechanics have been associated with progression of knee OA in the elderly. It is unknown if these racial differences in gait biomechanics exists in healthy young adults. **Purpose:** The purpose of this study was to determine if there are biomechanical gait differences between young African-American (AA) and Caucasian (C) adults. **Methods:** 20 young adults between the ages 18-30 volunteered for this study. Participants completed a self-report version of the Knee Injury and Osteoarthritis Outcome Score (KOOS). A 10-camera motion capture system and 2 force plates embedded in a walkway were used to collect kinematic and kinetic data while participants completed 5 walking trials at a self-selected pace. 3D knee torques were calculated using inverse dynamic analyses. Gait velocity was collected as participants walked across a 14 foot GaitRite® instrumented carpet at both a self-selected (SS) and fast (F) pace. Outcome variables were internal knee adductor (KAD) and knee abductor (KAB) torque and gait velocity (SS, F). Data analysis was conducted using independent sample (AA vs C) t-test for all outcome measures with the alpha level set at $p < .05$. **RESULTS:** Nine AA (5 females; 4 male) and eleven C (4 females; 7 males) young adults participated in this study. No significant differences were found between the groups for BMI (AA = 28.6 ± 6.6 ; C = 25.5 ± 4.9), age (AA = 25.76 ± 1.5 years; C = 26.1 ± 2.5), or KOOS Global scores (AA = 90.1 ± 15.24 ; C = 94.5 ± 6.2). There were no significant differences found in any of the studied outcome variables.

Outcome Variable	African American	Caucasian
Left KAD (%BW*Ht)	$0.65 \pm .4$	$0.64 \pm .5$
Right KAD (%BW*Ht)	$0.63 \pm .5$	$0.55 \pm .3$
Left KAB (%BW*Ht)	$2.57 \pm .5$	$2.33 \pm .8$
Right KAB (%BW*Ht)	$2.74 \pm .2$	$2.9 \pm .8$
SS gait velocity (m/sec)	$1.20 \pm .07$	$1.28 \pm .07$
F gait velocity (m/sec)	$1.87 \pm .07$	$2.0 \pm .25$

All torques listed are internal torques. **CONCLUSION:** These findings do not support the hypothesis that there are racial differences in gait velocity or knee torques during gait between African American and Caucasian healthy young adults. The generalizability of this study is limited by the small sample size.

2669 Board #130 May 29 9:30 AM - 11:00 AM
The Independent Effects And Interaction Of Gravitational And Inertial Forces On Gait Transition Speed.

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(No relevant relationships reported)

Prior research suggests the relation between gravitational and inertial forces plays an important role in the determination of the preferred transition speed (PTS) for both walk to run transitions (WRT) and run to walk transitions (RWT), and that humans prefer to transition gait when the ratio of inertial force (IF) to gravitational force (GF) (i.e. Froude #) is ~ 0.5 .

Purpose: In this study, we investigated the effect of gravitational and inertial forces on PTS and Froude # for both WRT and RWT. We hypothesized that decreasing gravitational force (-GF) would decrease PTS and increase the Froude # at PTS, but that increases in inertial forces (+IF) or increases in both gravitational force and inertial forces (+GF+IF) would not affect PTS.

Methods: Twelve healthy adults (9 M, 3 F) performed WRT and RWT trials on a motorized treadmill across seven combinations of altered body weight (BW) and body mass (BM). Subjects performed the PTS at 1.0BM/1.0BW, 0.70 and 0.85 BW /1.0 BM (-GF), 1.15 and 1.30 BM / 1.0 BW (+IF), and 1.15 and 1.30 of both BW and BM (+GF+IF). For each condition, we determined PTS (m/s and Froude #) by increasing speed (WRT) or decreasing speed (RWT) 0.09 m/s every 30 seconds through two speeds beyond the PTS.

Results: -GF decreased the PTS of WRT ($p=.02$). At 0.70 BW, the PTS was 93% (1.83 m/s) that of the control (1.97 m/s). Neither +IF ($p=.156$) nor +GF+IF ($p=.149$) affected the PTS of WRT. -GF increased the Froude # at WRT ($p=.01$). At 0.70 BW, PTS Froude # was 120% (Fr=.53) of the control (Fr=.44). +IF also increased the WRT Froude # ($p<.001$). At 1.30 BM, the Froude # was 132% (Fr=.58) of the control. +GF+IF did not affect the Froude # at WRT ($p=.135$). There was no change in PTS

for RWT due to -GF ($p=.263$), +IF ($p=.658$) or +GF+IF ($p=.202$). Yet, -GF increased the Froude # of RWT ($p<.001$). At 0.70 BW, RWT Froude # was 131% (Fr=.55) of the control (Fr=.42). Moreover, +IF increased RWT Froude # ($p<.001$). At 1.30 BM, RWT Froude # was 140% (Fr=.59) of the control. +GF+IF did not affect the Froude # of RWT ($p=.426$).

Conclusion: This study suggests WRT speed and Froude # are influenced by changes in gravitational forces but are unaffected by changes in inertial forces or proportional changes in both gravitational and inertial forces. In contrast, the relation between gravitational and inertial forces did not appear to influence RWT speed but did affect the RWT Froude #.

2670 Board #131 May 29 9:30 AM - 11:00 AM
Restriction In Hip Internal Rotation During Stance Phase In An Early Stage Of Hip Osteoarthritis

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(No relevant relationships reported)

Most studies of gait analysis in hip osteoarthritis (OA) have involved patients with end-stage hip osteoarthritis or after total hip replacement. However, there have been few studies of patients with early stage of hip OA is few investigation. **PURPOSE:** The purpose of this study was to analyse of gait pattern in the hip joint during stance phase, in patients with early stage of hip OA.

METHODS: Data of gait analysis was obtained from medical records of patients. Patients with early stages of hip OA (without acetabular dysplasia [sharp angle 41.9 ± 4.59 deg.], $n=22$, female, age: 55.4 ± 7.962 [44-70] yrs, height: 156.7 ± 5.14 cm, weight: 51.5 ± 6.75 kg [Hip OA]) and patients with traumatic temporomandibular disorder after a road traffic accident without lower extremity and lower back disorder ($n=20$, female, age: 51.9 ± 7.95 [40-66] yrs, height: 160.0 ± 5.86 cm, weight: 54.0 ± 8.76 kg [C]) between 2014 and 2019. Two-way ANOVA was used for statistical analysis between group [Hip OA-C] and within subject [side].

RESULTS: Results (mean \pm SD) of range (degree) of hip extension to flexion during gait cycle were C 48.0 ± 6.63 and Hip OA 45.3 ± 8.29 ($p > .05$). Range of hip adduction of Hip OA was significantly smaller than C ($F = 4.72$, $p < .05$, $ES f = 0.438$). Results of range of hip adduction during early stance phase were C 9.1 ± 3.44 and Hip OA 7.2 ± 2.44 . Range of hip adduction of Hip OA was significantly smaller than C ($F = 4.72$, $p < .05$, $ES f = 0.438$). Results of range of hip internal rotation during early stance phase were small side C 9.7 ± 3.75 , large side C 11.6 ± 3.71 , affected side Hip OA 7.50 ± 3.84 and unaffected side Hip OA 11.2 ± 3.62 . Results of range of hip internal rotation were observed interaction ($F=8.90$, $p<.01$, $ES f=0.472$). Unaffected side Hip OA was significantly smaller than unaffected side ($F = 80.39$, $p<.001$, $ES f = 1.418$) and small side of C ($F = 3.26$, adjusted $p < .15$, $ES f = 0.285$).

CONCLUSIONS: In patients with early stage of hip OA, hip extension during gait wasn't restricted, but hip adduction and hip internal rotation during early stance phase of gait were restricted. This hip joint restriction may be influenced by degeneration of ligamentum teres femoris which carries blood supply of femur head. Rotation restriction during stance phase by weight-bearing in early phase of hip OA occurs before hip joint extension restriction.

2671 Board #132 May 29 9:30 AM - 11:00 AM
Bilateral Imbalance Of Distal Electromyography Is Not Acutely Altered By Exercise Mode In Chronic Stroke

Nicholas J. Siekirk¹, Bradley Kendall², Victoria Pardo³, Qin Lai³, Sujay Galen⁴, Trevor McCready⁵, Samantha Atty⁶, Zachary Atwood³, Jordan Brown¹, Sam Wilson¹, Jessica Mutchler¹, Tamara Hew-Butler, FACSM³. ¹Georgia Southern University, Statesboro, GA. ²Taylor University, Upland, IN. ³Wayne State University, Detroit, MI. ⁴Georgia State University, Atlanta, GA. ⁵Central Michigan University, Mount Pleasant, MI. ⁶University of Southern California, Los Angeles, CA. (Sponsor: Tamara Hew-Butler DPM, PhD, FACSM, FACSM)

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(No relevant relationships reported)

Exercise interventions that approximate the stepping motion are thought to be useful in gait recovery after stroke. However, it remains unknown if hemiparetic asymmetry remains consistent between common exercise modes. **PURPOSE:** Therefore, our primary purpose was to examine contralateral mEMG (i.e., affected leg vs. non-affected leg) of chronic stroke survivors (SC) (10 \pm 5 years post) and age plus sex-matched control (HC) on the NuStep Cross Trainer (NS) and Treadmill (TM).

METHODS: In order to determine self-selected (SS) cadence, each participant performed a 10 minute (min) pretest on the NS and TM at an RPE between 12 and 16. After returning to resting heart rate and blood pressure, participants performed a 5-minute exercise bout on the NS and TM at the SS. The exercise order was randomized. mEMG values were recorded from the rectus femoris (RF), vastus medialis oblique (VMO), semitendinosus (ST), tibialis anterior (TA), medial gastrocnemius (MG) and soleus (SOL) bilaterally. mEMG amplitudes (uV) were converted to a percentage of isometric maximum voluntary contraction (%mVc). Five separate 2 x 2 repeated measures ANOVA were used to examine the effect of limb (i.e., affected vs. non-affected) and exercise mode (i.e., TM vs. NS) on mEMG. Post-hoc data are presented as mean and 95% confidence interval. **Summary of RESULTS:** SC (n = 15) and HC (n = 19) did not differ in age or BMI; $p > .05$. The repeated measures ANOVA found no interaction or main effects for the proximal musculature (i.e., RF, VMO, ST); $p > .05$. However, main effects for limb were detected for the distal musculature (i.e., MG, SOL, and TA); $p < .05$. The non-affected MG produced higher mEMG ($M = 105.08\%mVc$; $CI = 39.52\% - 170.64\%$) than the affected side ($M = 48.92\%mVc$; $CI = 33.58\% - 64.26\%$); $p = .047$. The non-affected SOL produced higher mEMG ($M = 121.65\%mVc$; $CI = 20.68\% - 222.61\%$) than the affected side ($M = 47.96\%mVc$; $CI = 15.49\% - 80.43\%$); $p = .042$. Post-hoc analysis revealed the non-affected TA produced higher mEMG ($M = 33.29\%mVc$; $CI = 21.76\% - 44.81\%$) than the affected side ($M = 18.79\%mVc$; $CI = 14.30\% - 23.29\%$); $p < .001$. **CONCLUSION:** Distal musculature demonstrated higher mEMG in the non-affected limb despite exercise mode. This gives preliminary evidence supporting the use of the NS to elicit mEMG values similar to the TM in the proximal leg musculature.

E-31 Free Communication/Poster - Physical Activity in Older Adults

Friday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

2672 Board #133 May 29 10:30 AM - 12:00 PM Changes In Dual-task Gait Speed Following A 10-week Golf Program In Older Adults

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PURPOSE: To examine the change in dual-tasking ability during gait in response to a golf exercise program in healthy, older adults. **BACKGROUND:** The ability of older adults to perform dual-tasking during gait has been studied as a predictor of fall risk. Therefore, it is important to investigate exercise programs that not only improve fitness and balance in older adults, but also enhance the ability to dual-task. **METHODS:** Fifteen healthy, older adults without previous golf experience were enrolled in a golf program with fitness testing before and after the intervention. One participant had to drop out of the study due to a work-related injury at week 8. Dual-task performance was measured using a fast-gait task while counting backwards by threes on a Protokinetics™ walking mat. Cognitive cost was determined by normalizing the dual-task responses to a seated counting task. Paired t tests were run to determine significance. Results are presented as mean±SD. Cohen's d effect sizes were calculated and reported as small=0.2, medium=0.5, and large=0.8. **RESULTS:** Gait speed during the dual-task was significantly increased following the golf program with a large effect size ($1.75 \pm 0.19m/s$ to $1.91 \pm 0.22m/s$; $p=0.007$; $d=0.85$). This increase in gait speed coincided with increases in both average stride length (2.3%; $p=0.061$; $d=0.55$) and average cadence (5.8%; $p=0.059$; $d=0.55$). Cognitive dual cost did not change between pre and post testing but trended towards improving (40.94%; $p=0.207$; $d=0.35$). **CONCLUSION:** Golf is a unique, multimodal activity that has a beneficial impact on fitness in healthy, older adults. This study demonstrated that a golf program can improve the ability to perform dual tasking. Participants were able to increase their gait speed without compromising the amount of numbers they could recite correctly. The participants trended towards an improved correct response rate following the program as shown by the improvement in cognitive dual cost. Golf should be encouraged as a physical activity program for older adults. Supported by R&A Grant GHA0012017.

2673 Board #134 May 29 10:30 AM - 12:00 PM Feasibility And Adherence Of A Novel Golf Training Intervention For Healthy Older Adults

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Golf is a multimodal physical activity that can potentially be utilized as a health intervention for diverse populations. Golf includes aerobic, power, balance, and cognitive training, yet is overlooked as a therapeutic program due to notions of cost and feasibility. Adherence rate is also a key measure of success in intervention studies. No previous evidence has demonstrated the adherence and feasibility of a golf-based training program in older adults whom did not play golf. **PURPOSE:** This study will report on the adherence and feasibility of a novel 10-week golf training program for healthy older adults. **METHODS:** Fifteen healthy, older adults enrolled and fourteen completed a 10-week golf training program with physical and cognitive testing before and after the program. The golf program consisted of warm up exercises, driving range practice, and golf play twice per week for 90 minutes, under the supervision of a PGA instructor. Functional, fitness, and cognitive measurements were taken in pre- and post-testing. The attendance rate, program-related adverse events, and cost related to the program were collected to determine the adherence and feasibility of the program. **RESULTS:** Participants completed 283/300 (94%) scheduled training sessions. There were no adverse events or drop-outs related to the intervention. Fourteen of fifteen participants completed pre- and post- testing, with one participant leaving the study at week 8 due to a work-related injury. Improvements were found in strength, functional, balance, and cognitive measures. The individual subject investment for the 10-week golf program was \$1,100, which included clubs, hand-cart, range and green fees, lessons, and necessary accessories. The average cost of playing 9 holes on 7 Los Angeles city golf courses is \$8.88 (±2.18) for older adults. There are 29 courses with green fees for 18 holes under \$20 (booked on golfnow.com and open access to public) within a 30-mile radius of downtown Los Angeles. **CONCLUSION:** The nature of golf allows it to be incorporated as a multimodal training intervention that is beneficial for older adults. The cost data demonstrate that golf can be financially feasible for older adults living in the Los Angeles region to participate regularly. Golf should be utilized when designing health and fitness interventions for older adults.

2674 Board #135 May 29 10:30 AM - 12:00 PM Short-term Multicomponent Exercise: Effective For Addressing Major Variables That Influence Fall Risk In Older Adults

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(No relevant relationships reported)

Falls are commonly linked to gait and balance inconsistencies, influenced by a combination of variables including muscle strength and power. For years, short-term higher intensity multi-component dynamic training methods have been used to improve athletic performance in younger populations by significantly affecting variables including muscular strength and force, gait, and balance. Currently, there are a number of fall prevention programs. However, questions specifically surrounding mode and duration of these fall prevention programs still exist. **PURPOSE:** To determine if a short-term, 8-week multi-component dynamic resistance-training program is effective in eliciting positive changes in factors that directly influence fall risk in older adults. **METHODS:** Forty men and women (ages 55-90 yrs.; mean = 69.5) performed 8-weeks of multi-component dynamic training (3x/week; 45-minutes per session) consisting of skill appropriate agility and change of direction training, specific lower body strength exercises, and both stationary and dynamic balance training. Muscle performance was measured pre/post using a 10RM bilateral leg extension and a standardized sit-to-stand test. Repetition-by-repetition force (N) was assessed using a calibrated force plate during the sit-to-stand test. Balance, gait, and speed were measured via standardized balance and walking tests. Changes in lean and fat masses were obtained via dual energy X-ray absorptiometry (DXA). Pre/post mean differences were analyzed using Paired T-tests. **RESULTS:** Training elicited positive outcomes in all muscle performance variables. Sit-to-stand efficiency increased (+53.9%; $p<0.001$) and repetition-by-repetition mean force improved +6.0% ($p<0.05$) during the same test. Significant increases in mean 10RM bilateral leg extension (+8.6kg; +28.0%; $p<0.001$), and positive balance changes were also observed (11.5%; $p<0.01$). Walking time decreased in all participants (-30.1%; $p<0.001$). **CONCLUSION:** Shorter, higher intensity dynamic exercise can be a safe and effective way to improve muscle performance, gait speed, and balance in older adults at risk for falling.

2675 Board #136 May 29 10:30 AM - 12:00 PM

Associations Between Muscular Strength And Digestive System Disorders In Older Adults

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(No relevant relationships reported)

PURPOSE: To examine the associations of handgrip strength (HGS) with prevalence of digestive system disorders (DSD) in older adults.

METHODS: This cross-sectional study included 511 older adults (57% women; mean age 72 years old) who were without heart attack, stroke, or cancer in the past 5 years. HGS was calculated as the sum of the maximal contractions from both hands. Participants were categorized into sex-specific tertiles (thirds) of HGS. DSD cases were identified via self-administered medical history questionnaire. The DSD were further categorized into disorders of the upper tracts (gastroesophageal reflux disease, ulcers), intestines (irritable bowel syndrome, inflammatory bowel disease, diverticulitis), or accessory organs (gallbladder, liver, pancreas). Logistic regression was used to calculate the odds ratios (ORs) and 95% confidence intervals (CI) of DSD among HGS thirds while adjusting for sex, age, smoking, heavy alcohol consumption, diet quality, cardiorespiratory fitness, and body mass index (BMI). **RESULTS:** There were 192 DSD cases. Compared with the lower third of HGS (least strong), the ORs (95% CIs) of having DSD were 0.58 (0.37-0.92) and 0.50 (0.31-0.81) among those in the middle and upper (strongest) thirds, respectively, after adjusting for the possible confounders. Similar trends were observed in the DSD of the upper tracts, intestines, and accessory organs. In a joint analysis of HGS and BMI (another strong risk factor of DSD), participants were dichotomized into weak (lower third) or strong (middle and upper thirds) and normal weight (<25.0 kg/m²), overweight (25.0-29.9 kg/m²), or obese (≥30.0 kg/m²) based on BMI. Compared with the weak-obese group, ORs (95% CIs) were 0.60 (0.28-1.27), 0.27 (0.11-0.65), 0.43 (0.21-0.88), 0.41 (0.20-0.83) and 0.13 (0.06-0.30) for the weak-overweight, weak-normal weight, strong-obese, strong-overweight, and strong-normal, respectively, after adjusting for the possible confounders. **CONCLUSIONS:** HGS was inversely associated with DSD in older adults. In addition, higher HGS appears to attenuate the increased prevalence of DSD in overweight and obese participants. Prospective studies are warranted.

2676 Board #137 May 29 10:30 AM - 12:00 PM

Effects Of Undulating Vs. Linear Periodization On Body Composition In Untrained Older Adults

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(No relevant relationships reported)

The effects of undulating periodization (UP) on body composition and strength during a resistance training (RT) program have been investigated in both sedentary and trained individuals; however, research on the topic is limited in an elderly population. **PURPOSE:** The aim of this study was to evaluate the effect of an UP-RT program on body composition in older adults. **METHODS:** Seventeen ($n=9$, men; $n=8$, women) untrained elderly individuals (64.2±2.0 years, 72.2±10.8 kg; 164.8±7.6 cm; 25.6±2.6 kg·m⁻²) with no previous RT experience were randomly assigned to either a linear training ($n=8$, LT) or UP ($n=9$) program. After 3 weeks of familiarization, all participants performed three weekly RT bouts over an 8-week study period. Body composition was assessed via dual energy X-ray absorptiometry. Statistical comparison (pre-test vs post-test) was performed with the paired t test or Wilcoxon (depending on the normality of the data), and a repeated measures ANOVA was employed to determine interactions (Time=pre-test vs test; Group=LT vs UP and Time x Group). Effect size (ES) was calculated with Hedges g; the normality and homogeneity of the data were checked with the Shapiro-Wilk and Levene tests, respectively. **RESULTS:** The results are reported in the order of LT and UP, respectively. No significant changes were found for the study variables: BM ($\Delta=-0.3\pm 1.0$ kg; $P=0.374$; ES=-0.05 and $\Delta=0.6\pm 1.0$ kg; $P=0.101$; ES=0.06), FM ($\Delta=-0.6\pm 1.3$ kg; $P=0.212$; ES=-0.24 and $\Delta=-0.7\pm 2.3$ kg; $P=0.389$; ES=-0.17) and FFM ($\Delta=0.3\pm 1.8$ kg; $P=0.679$; ES=0.04 and $\Delta=1.3\pm 2.4$ kg; $P=0.145$; ES=0.17). No statistical differences were found between training protocols.

CONCLUSIONS: Although body composition variables did not change significantly over the study period, the slight improvements observed conceivably can contribute to the health of these older adults; this hypothesis is corroborated by parallel studies that

we have carried out in this population. Given previous data showing exercise-induced FFM gains in the elderly, it can be speculated that lack of significant findings may be the result of suboptimal caloric and/or protein consumption.

2677 Board #138 May 29 10:30 AM - 12:00 PM

Associations Of Cardiorespiratory Fitness And Muscular Strength With Cognition In Older Adults

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(No relevant relationships reported)

Purpose: Cardiorespiratory fitness (CRF) has been associated with better cognitive function. However, considerably less is known about relationship between muscular strength (MS), independent of and combined with CRF, on cognitive function in older adults.

Methods: This cross sectional study included 499 older adults (56% women; mean age 72 years old). CRF and MS were assessed with the 400-meter walking test (minutes) and handgrip strength (kg), respectively. Poor cognitive function was defined the slowest 20% of congruent (CRT) and incongruent (IRT) reaction times from the Stroop Color-Word Task. Logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) for CRT and IRT among sex-specific tertiles (thirds) of CRF and MS. Participants were further categorized as Fit (middle/upper CRF) or Unfit (lower CRF) and Strong (middle/upper MS) or Weak (lower MS) for a joint analysis. Covariates included sex, age, body mass index, smoking, heavy alcohol intake, depression, daily steps, diabetes, hypertension, hypercholesterolemia, and CRF or MS in respective analyses.

Results: Compared with the lower third of CRF, the middle and upper thirds had 0.47 (0.26-0.86) and 0.42 (0.21-0.84) reduced odds of poor CRT, respectively, and 0.44 (0.24-0.80) and 0.48 (0.24-0.97) reduced odds of poor IRT, respectively, after adjusting for all covariates including MS. Compared with the lower third of MS, the middle and upper thirds had 0.54 (0.31-0.94) and 0.51 (0.28-0.94) reduced odds of poor CRT, respectively, after adjusting for all covariates including CRF. No associations were found between MS and poor IRT. In a joint analysis, compared with the Weak & Unfit group, the odds of poor CRT were 0.48 (0.23-1.00), 0.37 (0.17-0.79), and 0.25 (0.13-0.49) for the Strong & Unfit, Weak & Fit, and Strong & Fit groups, respectively. Compared with the Weak & Unfit group, the odds of poor IRT were 0.75 (0.37-1.55), 0.31 (0.13-0.71), and 0.39 (0.20-0.75) for the Strong & Unfit, Weak & Fit, and Strong & Fit groups, respectively.

Conclusion: These results indicate that both CRF and MS are independently associated with faster processing speed (i.e., CRTs), but that CRF may be more strongly associated with tasks requiring executive function (i.e., selective attention in the IRTs) than MS.

2678 Board #139 May 29 10:30 AM - 12:00 PM

Applying Decision Tree Technique To Predict Fall Risks Classified By Functional Fitness In Older Adults

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(No relevant relationships reported)

Purpose: To examine an accuracy of the fall risk classification predicted by senior functional fitness tests and health conditions in Korean older adults utilizing a decision tree technique, which is a machine learning algorithm

Methods: A total of 732 older adults (Males 45.9%, age: 73.51±6.20yrs, BMI: 24.07) participated in Korea Survey of National Physical Fitness (KSNPF). All participants performed the senior physical fitness test (SPFT) including body composition (FAT%), 6min walk, hand grip(HG), timed up-and-go (TUG), and chair sit-and-stand. Also, demographic variables (income, employment, etc.) and health markers were measured, which were including blood pressure & waist and hip circumferences as well as physical activity levels and health conditions (disease, medication, and fall experiences). All utilized measures were validated for the Korean elderly in 2014. To determine a classifier of a fall risk and to set cut-off scores of the fall risk classification, a decision tree technique with CHAID algorithm (Kass, 1980) was applied. To examine the accuracy of the fall risk classification predicted by selected variables, 80% of participants were randomly selected to derive the equation for a training group (GR) and the others were assigned for a cross-validation GR (20% for testing). **Results:** Only TUG and HG were significant classifiers with 87.6% of accuracy in the testing GR and 86.6% of precision in the cross-validation GR, respectively. The cut-off score of TUG was 7.13sec. (chi-square=21.22, p<.001), in which 21.1% of participants were classified into the fall risk GR. Within the TUG GR (<7.13sec.), the cut-off score of HG were set as 23.6kg (chi-square=14.87, p<.001), and 52.8% (<23.6kg) was classified into the fall risk GR. **Conclusions:** Among SPFT tests and health related variables, TUG and HG were relatively important to predict the fall risk for the healthy elderly in Korea. Coordination and strength exercise are critical for fall prevention in older adults. *Corresponding author (mylee@kookmin.ac.kr)

2679 Board #140 May 29 10:30 AM - 12:00 PM
Effect Of TaiChi Sward On Function-related Outcomes In Older Adults

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 (No relevant relationships reported)

PURPOSE: The purpose of this present study was to examine the effect of Tai Chi sward (TS) on physical function in Chinese older adults.

METHODS: 160 Chinese older adults were randomly assigned into either an experimental group experiencing four 90-minute TS sessions weekly for seven consecutive weeks or a control group. At baseline and 7 weeks later, all participants were asked to perform physical functional tests for both lower and upper limbs. The test included leg strength, dynamic balance, the Back Scratch Test, One leg Stand Test, the Arm Curl Test, the maximum isometric strength of the hand and forearm muscles, the Spiral Drawing Test, and Moberg Pickup Test.

RESULTS: The finding showed that TS group experienced positive changes on Handgrip Strength Test (17.40 to 22.45), Arm Curl-Up Test (19.25 to 24.28), Back Scratch Test (15.36 to 19.56), Timed Up and Go Test (13.51 to 12.24), and One leg Stand Test (15.65 to 23.37).

CONCLUSIONS: The findings indicated that a short-term and intensive TS training program does not only improve low limb-related physical function such as dynamic balance and leg strength, but also strengthen upper limb-related physical function (e.g., arm and forearm strength, shoulder mobility, fine motor control, handgrip strength, and fine motor function). Health professionals could take into account TS exercise as an alternative method to help maintain or alleviate the inevitable age-related physical function degeneration in healthy older adults.

2680 Board #141 May 29 10:30 AM - 12:00 PM
Comparison Of Handgrip Strength Test Values From International Cohorts Of Normal And Active Older Adults

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The hand-grip strength test (HST) is one of the most utilized tests to measure muscle strength in older adults. It has been used to assess sarcopenia and fragility in older adults' populations. **PURPOSE:** The aim of this study is to compare HST data from active older adults engaged in a physical activity promotion program in Spain with normative values of the general population in the same age ranges in Colombia (Ramírez-Vélez et al., 2019) and South Korea (Yoo et al., 2017). **METHODS:** 1,862 older adults aged ≥ 60 years old who participated in a physical activity promotion program were evaluated with the HST measured with a dynamometer. For the comparison with the other international cohorts [Colombian $N_c=5237$ (≥ 60) and South Korean $N_{sk}=935$ and 147 (≥ 65 and ≥ 80 , respectively)], we divided the study by gender (W = women and M = men) and by age ranges ($\geq 60=1$, $\geq 65=2$ $\geq 80=3$). From our 1,862 sample, we included all of them in 1 (W=1632 and M=230), 1840 in 2 (W=1608, M=232) and 807 in 3 (W=695, M=112). **RESULTS:** Sample (n) and population (N_{sk} and N_c) averages HST values (kg) were obtained in the three age groups (1, 2, and 3). The means were 1 = n (W:20.3; M:34.2) and N (W:16.7; M:26.7); 2 = n (W:19.8; M:33.1) and N (W:20.5; M:33.6); and 3 = n (W:18.9; M:31.1) and N (W:16.7; M:26.9). The Cohen's *d* effect size as the standardized mean difference between n and N using the standard deviation of N due to the large sample size was calculated. The results were as follows: 1 = (W:0.63; M:0.88); 2 = (W:-0.14; M:-0.07); and 3 = (W:0.48; M:0.70). **CONCLUSION:** The comparison shows that our sample data obtained higher values in HST by gender as well as by age, with moderate (0.63) to high (0.88) effect sizes when compared to Colombian data over 60 years old. The comparison with South Korean age groups shows that there are no differences when comparing our sample data with over 65 years data however the effect sizes are moderate when comparing older age groups (≥ 80). These findings suggest that physical activity could be an optimal therapeutic treatment against the muscle lost assessed with the HST even in older adults aged ≥ 80 years old.

2681 Board #142 May 29 10:30 AM - 12:00 PM
Changing Physical Activity In Older Adults With Heart Failure By Increasing Exercise Or Reducing Sitting

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Physical activity (PA) is an essential behavior to manage health of older adults with heart failure, however, most adults with chronic illness do not adhere to structured exercise programs. Promoting the reduction of sedentary behavior may be an alternative strategy to indirectly increase PA in individuals with heart failure.

PURPOSE: To compare two behavior interventions (reducing sitting time [RST] vs. adding structured exercise [EX]) aimed to increase PA in individuals with heart failure.

METHODS: Older adults (N=56, age ≥ 65 years) with heart failure (NYHA class II or III) and at risk for physical disability were randomized to a 3-month behavior intervention. RST: reduce sedentary behavior by replacing sitting time with standing/stepping time whenever possible and interrupting prolonged sitting bouts. EX: gradually increase structured exercise time to 30 minutes per day. Physical function (timed up and go test [TUG]) was assessed at baseline and at 3 months post interventions. Participants wore the activPAL for 7 days at baseline and during the final week of RST and EX to measure PA/sedentary behavior. Time spent sitting, standing and stepping (expressed as mean daily minutes and percent of waking wear time), and daily step counts were quantified using activPAL data. Differences between groups were determined using linear mixed models with repeated measures. Data are presented as mean \pm SD.

RESULTS: At baseline participants spent the majority of waking time sitting (626.4 \pm 112.2 min, 67.3 \pm 10.9%). On average, participants spent 25.8 \pm 9.3% time (237 \pm 84.6 min) standing and very little stepping (63.6 \pm 27.2 min, 7.3 \pm 3%, 2237 \pm 1140 steps). The majority of sitting time was accumulated through prolonged bouts lasting >30 minutes in duration (381 \pm 131.4 min). At 3 months, there was no significant change in time spent sitting (RST: 69.3 \pm 10.5%, EX: 65.7 \pm 8.5%), standing (RST: 23.8 \pm 8.8%, EX: 26.9 \pm 6.3%), or stepping (RST: 6.9 \pm 3.0%, EX: 7.4 \pm 3.5%) in RST and EX. Similarly, TUG was not significantly different at 3 months in either intervention (baseline: 13.2 \pm 2.8, month 3: 13.5 \pm 4.0).

CONCLUSION: Neither RST or EX changed behavior or physical function after 3 months in HF patients. More work is needed to understand the barriers preventing behavior change in participants to improve the adoption of PA interventions in HF patients.

2682 Board #143 May 29 10:30 AM - 12:00 PM
Association Of Muscle Quality And Prevalence Of Diabetes In Older Adults

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PURPOSE: Diabetes is often related to the skeletal muscle; however, studies investigating individual muscle characteristics like strength or mass on diabetes have produced mixed findings. The purpose of this study was to evaluate the association of muscle quality (MQ), a metric that reflects both muscle strength and mass, with diabetes in older adults.

METHODS: This cross-sectional study included 468 older adults aged ≥ 65 years (mean age 72 years; 55% women) enrolled in the Physical Activity and Aging Study (PAAS). Participants were excluded if they had heart attack, stroke, or cancer in the past 5 years. MQ was defined as the ratio of the combined left and right handgrip strength maximums divided by the combined lean mass of the left and right arms (measured by DEXA). Diabetes was defined by self-report, fasting glucose ≥ 126 mg/dl, or taking insulin, or other diabetes medications. Logistic regression was used to calculate the odds ratios (ORs) and 95% confidence intervals (CIs) of diabetes among sex-specific tertiles (thirds) of MQ. Covariates included sex, age, smoking, heavy alcohol consumption, body fat percentage, hypertension, hypercholesterolemia, and physical activity (daily steps).

RESULTS: Forty-five (9.6%) participants had diabetes. Compared to the lower third of MQ, the middle and upper thirds had 0.53 (0.26-1.07) and 0.25 (0.11-0.61) times lower odds of diabetes after adjusting for age and sex (model 1); 0.58 (0.28-1.21) and 0.26 (0.11-0.66) times lower odds of diabetes after adjusting for body fat percentage, smoking, heavy alcohol consumption, and physical activity (model 2); and 0.60 (0.28-1.25) and 0.28 (0.11-0.71) times lower odds of diabetes after adjusting for all confounders including hypertension and hypercholesterolemia (model 3). There was an inverse linear trend between MQ tertiles and diabetes ($p=0.02$).

CONCLUSIONS: Higher MQ was associated with a reduced likelihood of diabetes in older adults. MQ could be an indicator of diabetes, but future prospective studies are needed.

2683 Board #144 May 29 10:30 AM - 12:00 PM
Sedentary Behavior, Physical Activity, and Baroreflex Sensitivity In Middle-aged And Older Adults

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Cardiovascular baroreflex sensitivity (BRS), a risk factor for cardiovascular disease, declines with advancing age. Previous studies reported that the higher amount of moderate- to vigorous-intensity physical activity is associated with the better BRS. However, the associations of BRS with sedentary behavior (SB) and light-intensity physical activity (LPA), which occupies most of the waking time, are not fully understood. **PURPOSE:** The purpose of this study was to examine the associations of BRS with SB and LPA in the middle-aged and older adults. **METHODS:** A total of 162 individuals (64 ± 9 years) participated in this study. Spontaneous BRS was evaluated by transfer function analysis of a 5-minute continuous data (blood pressure and cardiac period) in the supine position. The SB and LPA time were assessed using triaxial accelerometers. The oxygen consumption at ventilation threshold (VO_{2VT}) was measured as the cardiorespiratory fitness parameter. **RESULTS:** A series of multiple linear regression analysis revealed that SB and LPA time were significantly associated with BRS after adjusting for potential covariates such as age, sex, body mass index, heart rate, systolic blood pressure, smoking, menopausal, and medication status ($\beta = -0.205, P = 0.018; \beta = 0.208, P = 0.018$). These associations remained significant after adjusting for the VO_{2VT} ($\beta = -0.189, P = 0.030, \beta = 0.200, P = 0.022$). **CONCLUSIONS:** This cross-sectional study found that the time spent in SB and LPA are independently associated with BRS and suggests that lower SB and higher LPA contribute to maintaining BRS in middle-aged and older adults.

2684 Board #145 May 29 10:30 AM - 12:00 PM
Perceptions Regarding Physical Function Limitations Among Midlife And Older Adults In A Health Ministry Program

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Limitations in physical function lead to decreased quality of life and are predictive of disability, hospitalizations, and mortality. We previously assessed physical function as part of a health-screening program with African American churches in Chicago's West Side. Screenings revealed high rates of functional limitations among midlife and older adults. **PURPOSE:** To inform the development of a church-based intervention that aims to improve physical function. **METHODS:** We conducted 6 focus groups with a total of 40 participants age 40+ from our partner churches and communities who reported difficulty with physical function. Focus groups were audio recorded and transcribed. Qualitative data analysis software was used to analyze the data and generate themes and sub-themes.

RESULTS: Participants (mean age 64.4 ± 11.0 years, range 42-92 years, 88% female) described that physical function limitations negatively impacted their ability to live a full life and play an active role in their family, church, and community. Faith and prayer helped participants cope with limitations and pain. Participants expressed that it is important to keep moving, both from an emotional (not giving up) and physical (moving to prevent more limitations) standpoint. Some participants shared positive experiences making home modifications to adapt to limitations (like installing grab-bars), however, a prevailing opinion was that using mobility aids—especially canes or walkers—leads to further functional decline. An additional emerging theme was the desire to learn how to move better; for example, how to safely navigate stairs or strengthen muscles to facilitate daily activities. Participants expressed frustration that their communities were not conducive to physical activity (particularly in regards to safety and lack of facilities for physical activity), but generally welcomed programs in the church focused on physical function and activity.

CONCLUSIONS: Community-based programs focusing on reducing physical function limitations are needed, and delivering programs through the church is a

potentially acceptable strategy. Along with using physical activity to promote physical function, integrating concepts from physical and occupational therapy could also be beneficial.

2685 Board #146 May 29 10:30 AM - 12:00 PM
Three Months Of Aerobic Exercise Training Improves Vascular Endothelial Function In Overweight/obese Older Adults

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Aging and overweight/obesity (OW/O) are associated with insulin resistance (IR) and impaired vascular endothelial function (VEF), potentially increasing cardiovascular disease (CVD) risk. Aerobic exercise training is an effective intervention to improve IR and VEF. **PURPOSE:** To determine changes in IR and VEF following aerobic exercise training in older OW/O adults. We hypothesized that 3 months of aerobic exercise training would improve IR and VEF, independent of weight loss. **METHODS:** Preliminary data are from 11 (8 women) older OW/O adults participating in a randomized clinical trial: 4 control (CON) (64 ± 8 y; BMI = 32.7 ± 3.3 kg/m², body fat = 41.5 ± 8.0%) and 7 exercisers (EX) (62 ± 4 y; 32.2 ± 5.5 kg/m², 40.2 ± 10.2%). Supervised aerobic exercise training consisted of moderate-intensity (40-60% heart rate reserve) cycling performed 3 d/wk for 3 months. Body mass and composition were measured by bioelectrical impedance analysis following an overnight fast. Brachial artery flow-mediated dilation (FMD), a non-invasive measure of VEF that predicts incident CVD events, was assessed by a trained technician using high-resolution ultrasonography. HOMA-IR was calculated from fasting blood glucose and insulin. **RESULTS:** No between group differences were detected at baseline. Compared to baseline, no changes were found in CON at 3 months (all $P \geq 0.19$). However, percent body fat (40.2 ± 10.2% vs. 38.9 ± 10.4% for baseline vs. 3 months, respectively ($P < 0.05$)) and brachial artery FMD (3.2 ± 3.0% vs. 5.1 ± 2.8% ($P < 0.05$)) improved at 3 months in EX. No other time effects were found in EX. **CONCLUSIONS:** Preliminary data from our ongoing clinical study show that 3 months of moderate-intensity aerobic exercise training improves body composition and VEF in OW/O older adults. Continued recruitment of participants completing a longer exercise training program (i.e., 6 months) will more definitely determine the beneficial impact of aerobic exercise training on VEF and related cardiometabolic risk factors.

2686 Board #147 May 29 10:30 AM - 12:00 PM
IMPROVEMENT THROUGH MOVEMENT: INVESTIGATING FITNESS, FUNCTIONAL CONNECTIVITY, AND COGNITION IN OLDER ADULTS

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As the U.S. population has grown older, it has become increasingly crucial to understand age-related brain alterations in an effort to ameliorate and protect against normal, and especially abnormal, decline. Prior research suggests that physical activity acts on and benefits similar cognitive constructs most commonly affected by cognitive aging. **PURPOSE:** The purpose of this investigation was to advance understanding of functional connectivity as a possible mechanism by which fitness protects and restores brain function. **METHODS:** Data were collected as a part of the "Fit and Active Seniors Trial" between 2015-2018. We evaluated functional brain changes in participants before and after they took part in an exercise intervention. Seventy-seven older adults that had pre- and post-intervention MRI scans, fitness data, and behavioral data were included. All participants (age range: 60 - 80 years, 69% female) were randomized into either an aerobic walking group (n=34) or active control stretching and toning group (n=43) that met three times a week for six months. **RESULTS:** Cardiorespiratory fitness (measured by VO_2 peak) significantly improved within-groups pre/post ($p = .001$), but not between-groups ($p = .374$). Multi-voxel pattern analysis (MVPA) was performed on the resting-state functional MRI scans to detect variability in whole-brain patterns of connectivity. There were no significant between-group differences in functional connectivity at pre-test. However, several significant clusters in the Default Mode Network were identified between-groups at the 6-month post-intervention, including regions of the hippocampus (height threshold $p < 0.001$, cluster threshold $p < 0.05$ corrected for false discovery rate). These MVPA-derived hippocampal voxels were then used for whole-brain seed-to-voxel analysis for post-hoc characterization, and results indicated that increases in between-group functional connectivity were driven by the walking group ($p < 0.01$). **CONCLUSION:**

This research adds to the understanding of the mechanism by which physical activity protects and restores brain function, which ultimately could lead to efforts preventing, minimizing, and improving age-related cognitive decline.

2687 Board #148 May 29 10:30 AM - 12:00 PM

Muscle Capacity, Adiposity And Change In Dynamic Function After Weight Loss In Older Women

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PURPOSE: Improving muscle capacity (strength or power) can improve lower-extremity physical function (LEPF); however, it is unclear how concomitant weight loss impacts this relationship. Exercise training during weight loss may have complicated implications for changes in LEPF due to changes in both muscle capacity and adiposity. This study aimed to determine if adiposity influences the relationship between change in muscle capacity and LEPF in inactive overweight older women following a weight loss and exercise program.

METHODS: Inactive overweight/obese older women ($n = 38$; BMI = 30.0 ± 4.4 kg/m²; 69.3 ± 4.1 y) completed a 6-month weight loss and supervised exercise intervention. Maximal leg strength (STR) was measured via isokinetic dynamometry and leg power (POW) via leg extension power rig. Body composition was assessed via DXA. LEPF was assessed using the 6-minute walk (6MW) and 8-foot Up-and-Go (UPGO), which are both dynamic physical functional tests. **RESULTS:** Body weight ($-9.6 \pm 3.5\%$), fat mass (-6.8 ± 2.4 kg) and leg lean mass (-0.3 ± 0.5 kg) decreased (all $p < 0.01$). Muscle STR (19.7 ± 35.4 N-m) and POW (23.3 ± 39.1 watts) improved (both $p < 0.01$). 6MW (58.9 ± 33.7 m) and UPGO (-0.84 ± 0.74 s) also improved (both $p < 0.01$). Linear regression analysis (unstandardized betas) indicated: a) changes in STR predicted changes in 6MW ($\beta = 0.505$, $R^2 = 0.15$, $p < 0.05$) and changes in UPGO ($\beta = -0.012$, $R^2 = 0.19$, $p < 0.05$); and b) changes in POW predicted changes in 6MW ($\beta = 0.310$, $R^2 = 0.12$, $p < 0.05$) but was not related to changes in UPGO ($R^2 = 0.05$, $p = 0.22$).

There was a strong trend for the addition of change in fat mass to the predictive model to improve the explained variance in LEPF outcomes by 7-10% ($p = 0.053-0.06$).

CONCLUSIONS: Increases in muscle capacity, especially strength, improve dynamic measures of LEPF in response to a weight loss and exercise program in older women, even in the presence of leg lean mass loss. The influence of reductions in fat mass on measures of LEPF appears to be of lesser importance compared to improvements in muscle capacity given the relative amount of variance explained. More research is needed to inform best practice for exercise prescription to enhance LEPF in older adults, especially under weight loss conditions.

2688 Board #149 May 29 10:30 AM - 12:00 PM

Validity Of Combined Heart Rate And Accelerometry To Predict Activity Energy Expenditure In Older Adults

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Purpose The present study compared physical activity related energy expenditure (PAEE) as predicted by group calibrated algorithm combining accelerometry and heart rate.

Methods N=45 older adults with and without cardiac risk performed a protocol consisting of simulated daily living activities (resting period, light, moderate and vigorous physical activity including walking in different speeds and stair climbing) and a cycle ergometer test (25W + 25W every 2 minutes). PAEE was concurrently assessed by indirect calorimetry (IC) and by combined heart rate (HR) plus uniaxial accelerometry (ACC). Raw HR and ACC data were transformed to PAEE using a published branched equation model. Estimated and measured PAEE were compared using Bland-Altman plots.

Summary of results Preliminary results of n=12 healthy older adults without cardiac risk (8 male and 4 female, 71.9 ± 5.2 years) showed lower ACC+HR-estimated PAEE for clustered activities (including cycle ergometer test) and resting period (clustered activities 2.17 ± 1.17 Kcal/min; resting period 0.19 ± 0.17 Kcal/min) than PAEE measured by IC (clustered activities 2.93 ± 1.27 Kcal/min; resting period 0.61 ± 0.40 Kcal/min). The Bland & Altman plots' limits of agreement were between -2.28 and +0.94 kcal/min. Visual inspection showed that the dispersion of the absolute differences between ACC+HR and IC seemed to increase with higher measured values. The correlation between combined ACC+HR-PAEE and IC-PAEE was $r_p = 0.86$.

Conclusion First results indicate that branched equation models based on combined ACC+HR registrations may underestimate PAEE in older people but appear sufficiently valid for the assessment of mean PAEE in groups. If the relatively large limits of agreement were to persist throughout this ongoing study, they would

indicate a limited validity of existing ACC+HR branched equations for the individual assessment of PAEE in older adults. More research is needed to determine whether combined ACC+HR assessments are superior to simple ACC to measure physical activity in older adults.

2689 Board #150 May 29 10:30 AM - 12:00 PM

The Impact Of Sedentary Behavior On Mental Health For Older Adults: A Longitudinal Study Of University Retirees In Beijing China

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PURPOSE: This study was to estimate the impact of physical activity on mental health for older adult from a 5-year follow-up Chinese university retirees study during 2011-2016 in Beijing.

METHODS: We conducted follow-up health surveys on 5503 (2080 males & 3423 females; aged 67.6 ± 8.2 , Height = 162.2 ± 7.5 cm, Weight = 63.3 ± 9.8 kg, BMI = 24.1 ± 43.2) older adults enrolled at Beijing from 2011 to 2016. Sedentary behavior (SB) were measured by the translated "Physical Activity Scale for the Elderly" (PASE) questionnaire (Washburn et al., 1993). Mental health were assessed by self-reported self-rated mental health scores (MHSs) in the participants. The data were analyzed using linear individual fixed-effect regressions.

RESULTS: The average time spent in sedentary behavior for men was 12.9 ± 3.3 hours/day. The mean mental health was 2.4 ± 0.7 scores. SB were negatively associated with mental health for older adults. A one hour increase in SB was associated with a decrease in mental health score by 0.25 (95% [CI] = 0.19, 0.32). A one hour increase in SB was associated with a decrease in mental among females and males by 0.25 (95% [CI] = 0.16, 0.33) and 0.27 (95% [CI] = 0.16, 0.37), respectively.

CONCLUSIONS: SB may decrease mental health among older adults in Chinese follow-up study. Increasing SB in male's older adults tended to decrease their mental health more than females.

2690 Board #151 May 29 10:30 AM - 12:00 PM

Processing Accelerometer Data For Older Adults With COPD

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Sedentary behavior (SB) is often measured with ActiGraph (AG) accelerometers, but the ActivPAL (AP) is the gold standard device. AG processing methods, including cut-points for SB, filters, and non-wear time algorithms, influence sedentary time estimates. The optimal protocol for processing AG sedentary time is not known and may be population specific. **PURPOSE:** To identify which combination of AG SB cut-point, filter, and non-wear algorithm produces sedentary time estimates that have the strongest agreement with AP-measured sedentary time in a sample of 45 older adults with chronic obstructive pulmonary disease (COPD). **METHODS:** Participants wore AG and AP monitors simultaneously for 7 days. AG data was processed using all possible combinations of two SB cut-points (<50 counts per minute [cpm] and <100 cpm), two filters (normal and low frequency extension [LFE]), and non-wear algorithms with three different lengths (60, 90, and 120 minutes) for a total of twelve processing methods. Concordance correlations between AP-measured SB time and each of the twelve AG SB estimates were calculated using the Bland-Altman method. **RESULTS:** Concordance correlation coefficients range from 0.579 to 0.772 (see table). The AG cut-point of <50 cpm and the LFE filter resulted in the highest concordance correlations. Correlations were similar between the three non-wear algorithms lengths. **CONCLUSIONS:** Although the AP is the gold standard for measuring SB, the AG may be an acceptable substitute when optimal processing methods are used. This analysis provides evidence supporting the use of the AG cut-point of <50 cpm for SB and the LFE filter for older adults with COPD. The optimal non-wear algorithm length is less clear.

Processing Method (Filter & Non-Wear Algorithm Length)	Concordance Correlation (SE)	Mean Difference AG-AP(SD)	95% Limits of Agreement
<50 cpm cut-point			
Normal & 60 min.	0.654 (0.031)	40.0 (107.8)	-171.2, 251.2
Normal & 90 min.	0.659 (0.030)	59.3 (102.7)	-142.1, 260.6
Normal & 120 min.	0.666 (0.029)	69.0 (98.5)	-124.1, 262.2
LFE & 60 min.	0.762 (0.024)	18.2 (94.8)	-167.6, 204.0
LFE & 90 min.	0.762 (0.024)	28.0 (94.1)	-156.5, 212.5
LFE & 120 min.	0.772 (0.023)	33.6 (90.5)	-143.8, 211.0
<100 cpm cut-point			
Normal & 60 min.	0.579 (0.033)	69.2 (112.3)	-151.0, 289.3
Normal & 90 min.	0.577 (0.032)	88.4 (106.8)	-120.9, 297.7
Normal & 120 min.	0.581 (0.031)	98.2 (102.3)	-102.4, 298.7
LFE & 60 min.	0.696 (0.027)	55.0 (97.7)	-136.6, 246.6
LFE & 90 min.	0.687 (0.028)	64.8 (96.9)	-125.2, 254.8
LFE & 120 min.	0.692 (0.027)	70.4 (93.0)	-111.9, 252.8

This work was supported by a T32 predoctoral fellowship NIH/NINR NR016914-01, Complexity: Innovations in Promoting Health & Safety and NR016093, Active for Life with COPD.

2691 Board #152 May 29 10:30 AM - 12:00 PM
Sedentary Behavior And Physical Function In Older Adults Following A Randomized Controlled Sedentary Behavior Intervention

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(No relevant relationships reported)

Older adults represent the fastest growing segment of the population, and spend approximately 60-70% of their waking hours engaging in sedentary behaviors, which increases their risk for functional decline and negative health outcomes. Therefore, interventions aimed at breaking up sedentary time by standing up and moving more throughout the day may have important health benefits for older adults, although well-designed randomized controlled trials (RCT) are limited. **PURPOSE:** To examine the effectiveness of a four week sedentary behavior intervention to reduce sedentary time and improve physical function in 56 community dwelling older adults (M age = 74 ± 7). **METHODS:** The intervention consisted of 4 weekly workshop sessions plus a refresher session, and was delivered by community partners from 3 different State Aging Units. A RCT design was implemented assessing sedentary behavior and physical function prior to, immediately following, and at follow-up (8-weeks after intervention). Sedentary time (mins/day) was obtained via accelerometers/inclinometers, and physical function (balance, gait speed, chair stands) was assessed with the Short Physical Performance Battery. Outcomes were analyzed between and within groups using mixed-design repeated measures ANOVAs. **RESULTS:** There were significant ($p < .05$) group x time interactions for sedentary time, balance, gait speed, and chair stands. Analysis of simple effects indicated the intervention group significantly ($p < .05$) reduced their overall sedentary time by a mean of 68 min/day immediately following the intervention compared to a mean increase of 17 min/day in the control group. Also, the intervention group significantly ($p < .05$) improved their physical function following the intervention compared to no significant change in the control group. However, there was a significant ($p < .05$) increase in sedentary time from post-intervention to follow-up for the intervention group, with only a 17 min/day decrease from baseline. **CONCLUSION:** Results indicate that our sedentary behavior intervention reduced sedentary time and improved physical function in older adults, although it appears that additional research is needed in order to ensure this positive behavior change is maintained over time.

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2692 Board #153 May 29 10:30 AM - 12:00 PM
Clinically Meaningful Changes In Mobility After An Exercise Program For Older Adults

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Aging is associated with a progressive decline in muscle strength and mass, eventually leading to reduced functional ability and disability. Regular physical activity can slow this inevitable decline and promote physical wellbeing, improve physical function and reduce risk of chronic diseases in older adults. However, meaningful improvements in physical function for individuals in response to a training stimulus are often missed when only group effects are considered. **PURPOSE:** to examine interindividual variation in changes in functional ability in response to a 10-week exercise intervention designed to improve physical function in older adults. **METHODS:** 97 older adults (age = 72.7 yrs ± 7.9); BMI = 32.3 ± 7.2) completed the 10-week Physical Activity for Seniors for Life (PALS) group exercise and lifestyle behavior change program. 6MW (distance covered in 6 minutes), and UGS (meters/second (m/s) to walk 6 m distance) were measured before and after the exercise program. **RESULTS:** There was a significant ($p < .05$) improvement in 6mw and UGS for the group ($m = 60.2$ meters and 0.1045 m/s respectively). For 6mw, 27% did not improve more than 20 meters (>20 meters is small meaningful change), 23% improved between 20 and 50 meters, and 50% improved more than 50 meters (>50 meters is substantial meaningful change). For UGS 38% showed less than 0.05 m/s improvement (0.05 m/s is small meaningful change), 12% improved between 0.05 and 0.1 m/s, and 47% improved more than 0.1 m/s (0.1 m/s is substantial meaningful change). **CONCLUSIONS:** Consideration of individual variability is important in establishing the clinical meaningfulness of improvements in physical function in response to exercise programs designed for older adults.

2693 Board #154 May 29 10:30 AM - 12:00 PM
Associations Between Sedentary Behavior And The Out-of-pocket Health Care Expense Of Chinese Older Adults

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PURPOSE: To investigate the relationship between sedentary behavior (SB) and medical expenses of older adults in China.

METHODS: We conducted a survey with 4,248 older adults (1776 males & 2472 females, 69.31 ± 7.57 yr., Height = 170 ± 5.9 cm, Weight = 67.7 ± 10.4 kg, BMI = 23.3 ± 3.35) from 47 cities in China between 2013 and 2014. SB were measured by the translated "Physical Activity Scale for the Elderly" questionnaire (Washburn et al., 1993). Healthcare costs were assessed by self-reported out-of-pocket health care expenses across outpatient care, inpatient care, medication, and formal caregiver expenses. The data were analyzed using interval regression.

RESULTS: The average time spent in sedentary behavior for the Chinese older adults men was 12.32 hours/day and the mean yearly medical expenses was 7460.1 \pm 2468.8 RMB. One hour spent on SB was associated with an increase of RMB 255.56 in annual health care expense (95% confidence interval [CI] = RMB 135.25 - 255.56), RMB 86.63 in outpatient care (95% [CI] = RMB 53.45 - 119.82), RMB 32.53 in medication (95% [CI] = RMB 5.72 - 59.33), RMB 164.21 in inpatient care (95% [CI] = RMB 81.84 - 246.57), and RMB 0.48 day in formal caregiver by (95% confidence interval [CI] = 0.28 - 0.68). One hour spent on SB was associated with an increase of out-of-pocket medical expenses by RMB 230.49 (95% [CI] = RMB 72.00 - 388.98) and 319.23 (95% [CI] = RMB 133.41 - 505.05) in annual health care expense, RMB 95.93 (95% [CI] = RMB 51.38 - 139.88) and 86.81 (95% [CI] = RMB 36.66 - 136.97) in outpatient care, RMB 22.57 (95% [CI] = RMB -11.95 - 57.09) and 49.08 (95% [CI] = RMB 6.24 - 91.53) in medication, RMB 190.17 (95% [CI] = RMB 82.18 - 298.17) and 130.48 (95% [CI] = RMB 2.20 - 258.75) in inpatient care, and RMB 0.60 (95% [CI] = 0.28 - 0.92) and 0.49 (95% [CI] = 0.22 - 0.98) day in formal caregiver among females and males, respectively.

CONCLUSIONS: The Chinese older adults who had more SB tended to have higher out-of-pocket medical expenses. Increasing SB in male's older adults tended to increase their out-of-pocket more than females.

2694 Board #155 May 29 10:30 AM - 12:00 PM
Influences Of Baduanjin Exercise On The Blood Lipids And Serum IL-6,apn In The Olders

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PURPOSE: To explore the effects of Baduanjin on the blood lipids and serum IL-6,APN in the olders.

METHODS: The healthy old people without regular exercise behaviour were selected from China Renmin University community, and were divided into the control group (C group, n=9) and the exercise group (E group, n=6) after the physical examination. The subjects took part in the study and gave formal consent. E group carried out Baduanjin for 4 months, while C group kept their routine life especially the daily exercise habits. Body composition and blood were tested at the beginning of the study and four months later, and the blood examination including the blood lipids and serum IL-6,APN.

RESULTS: 1. Body composition Compared with the baseline examination, the lean body mass of 4 months later in E group increased significantly ($P < 0.05$), while the C group showed little difference. E group's body fat percentage and visceral fat mass decreased ($P < 0.01$); and in C group, fat free mass, visceral fat mass hardly changed except the body fat percentage decline ($P < 0.05$). 2. Blood Lipids The baseline total cholesterol (TC) of E group were higher than the C's, and after the 4-month intervention, the E's TC went down (5.13 ± 1.07 vs 4.92 ± 0.74) ($P < 0.05$), but the C's elevated ($P < 0.05$), with the result that E's TC were lower than C's at the 4-month later ($P < 0.01$). Between the two groups, HDL-C and LDL-C also showed great difference, especially E's HDL-C displayed health promotion effects. 3. Serum Factors (1) IL-6 of the both group declined after 4-month duration, with E's $P < 0.01$ and C's $P < 0.05$. (2) Great difference were found between the two groups according to the baseline test of serum APN, but after 4-month E's APN elevated and higher than C's ($P < 0.01$), while the C's went down ($P > 0.05$).

CONCLUSIONS: Regular exercise of Baduanjin could improve the body composition, change the blood lipids. Furthermore, Baduanjin exercise had good effect on the regulation of IL-6,APN, which in turn may alleviate the chronic gradual low inflammation inside the olders. Acknowledgements: This study was supported by Qigong Administration Center of General Administration of Sport of China (No. QG2016028)

2695 Board #156 May 29 10:30 AM - 12:00 PM
Home-based Self-managed Older Adult Exercise Program Improves Physical Activity Status And Sleep Quality

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Aging promotes a decline in overall physical activity (PA) status and is associated with an increase in risk for numerous adverse health conditions, including poor sleep. Poor sleep quality is a commonly reported complaint in older adults that may accelerate many prevalent health conditions and limit daily functional capacity. Habitual PA for older adults has been shown to increase physical fitness with corresponding reductions in adverse health risks, to include sleep quality. However, a barrier for older adult habitual PA are the commonly reported barriers such as time, cost, transportation and poor education on exercise prescription. A possible approach to minimize barriers to habitual PA may be a home-based self-managed exercise program.

PURPOSE: The purpose of this ongoing pilot study is to describe the effects of a home-based self-managed exercise program on physical activity status and sleep quality.

METHODS: 7 older-adults (68±4.7 years) were recruited from area community centers and participate in 6-weeks of the home-based self-managed University of Lynchburg Active Aging Program (ULAAP). Endurance, strength, and balance exercises were prescribed using the National Institute of Aging's Exercise & Physical Activity Guidelines. Sleep parameters were measured with the Pittsburgh Sleep Quality Index (PSQI) and physical activity status was measured with the International Physical Activity Questionnaire (IPAQ).

RESULTS: There was a significant increase in MET-minutes at the end of 6-weeks of PA (pre 2729±2507, post 5626±2850 MET-minutes of light to vigorous exercise; $p = 0.024$). Weekly time spent sitting was reduced (TSit pre 29±12.05, post 18.14±9.8 hours per week, $p = 0.008$). There was a significant increase in sleep quality following 6-weeks of PA (PSQI pre 7.8±3.3, post 4.7±1.6, $p = 0.024$), an increase in total sleep time (TST pre 6.5±0.5, post 7.5±0.5 hours, $p = 0.048$) with no change in sleep efficiency (SE pre 73.9±13%, post 84.7±6.6%, $p = 0.09$).

CONCLUSION: Home-based self-managed older-adult exercise program increased overall physical activity status and reduced sedentary time with improved sleep quality. Our result suggests an older-adult self-managed low-impact multimodal exercise program may positively improve sleep quality.

2696 Board #157 May 29 10:30 AM - 12:00 PM
Does A Recumbent Lateral Stability Trainer Improve Balance Scores Among Older Adults Within 4 Weeks?

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Falls are the leading cause of fatal and non-fatal injuries for older Americans. Modifying exercise programs to address balance and lower body strength would vastly improve stability and functional movement. Past literature has shown balance and strength are important in preventing falls, but few studies have focused on developing strength in a lateral plane compared to an anterior/posterior plane. **PURPOSE:** To determine if a lateral pedal recumbent training device that allows lower limb movement in a horizontal plane can improve balance scores among older adults in 4 weeks. **METHODS:** A two group experimental-control multivariate design was selected for the study. All subjects (n = 56) were between the ages of 59-80 years and without any physical limitations or medical issues. All participants were divided into 2 equal groups, pre-tested and post-tested on a computerized posturography plate (Bertec, Inc. Columbus, OH.) to determine Center of Pressure scores with eyes opened (EOSS), Center of Pressure scores with eyes closed (ECSS), Center of Pressure scores with eyes open perturbed surface (EOPS), and Center of Pressure scores with eyes closed perturbed surface (EPCS). The experimental group used the lateral trainer for 15 minutes, 3 times per week, for 4 consecutive weeks while the control group maintained a sedentary lifestyle. A repeated measures MANOVA was used to determine significance between the two groups within the 4 balance assessments. **RESULTS:** There were no significant main treatment effects for either group ($p = .221$). There were statistically significant differences over time for EOPS ($p = .047$) and EPCS ($p = .047$). Likewise, there were statistically significant differences for each univariate outcome with EOSS ($p = .045$), ECSS ($p = .033$), EOPS ($p = .010$), and EPCS ($p = .026$). Statistical power was achieved ($> .98$) for both univariate and multivariate measures. The multivariate outcome for group x time interaction accounted for 15.2% more variance than time alone (28.1%) for the experimental group alone. **CONCLUSION:** A recumbent lateral stability device can improve balance scores among older adults within 4 weeks of training, 3 x week for 15 minutes.

2697 Board #158 May 29 10:30 AM - 12:00 PM
Comparative Responses To A Social Media Enhanced Physical Activity Program In Older Males And Females

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Most older adults fail to adhere to the multicomponent (aerobic, muscle strengthening, balance training), 2018 Physical Activity (PA) Guidelines. Thus, effective and sustainable multicomponent PA programs that promote adherence in older adults remains a public health priority, especially for females given their higher rates of physical inactivity and risk for physical disability compared to males. **PURPOSE:** To examine if sex/gender influences the effects of a multicomponent 10-week PA intervention grounded in Social Cognitive Theory and augmented with social media (Facebook) on program attendance and engagement, PA behaviors, muscle capacity, and lower extremity physical function (LEPF) in older adults. **METHODS:** Physically inactive older adults (71.3 ± 4.3 yo; n=28, 64% female) completed a 10-week multicomponent PA program that included 1) a twice weekly supervised exercise class (muscle strength and balance training) with PA behavior education, 2) Facebook engagement, and 3) an unsupervised walking prescription. PA behaviors were assessed via accelerometer, questionnaires and pedometer step count logs. Conventional measures of leg strength and power along with a battery of LEPF tests were also employed [6-minute walk (6MW), 8-foot up and go (UPGO), chair stands (CHAIR), and transfer task (TRANSFER)]. A two-way [Gender (G) x Time (T)] ANOVA was utilized to determine significance of change. **RESULTS:** There was a trend for higher class attendance in females compared to males (96.7±3.8% vs. 92.0±6.7%, $p = 0.06$). Females also had a 2.3-fold greater engagement in Facebook compared to males ($p = 0.01$). Males and females improved PA behaviors similarly (T $p < 0.05$; G x T and G $p > 0.05$). Muscle capacity improved similarly (T $p < 0.05$) with males, as expected, having higher leg strength and power (G $p < 0.05$; G x T $p > 0.05$). Regarding LEPF, improvements occurred in 6MW, UPGO and TRANSFER (T $p < 0.05$; G x T $p > 0.05$).

with males also having higher functional capacity, as anticipated, in 6MW, UPGO, and CHAIR (G $p < 0.05$). **CONCLUSION:** A 10-week PA/EX program improves PA behavior, muscle capacity, and LEPP similarly in older males and females. Implementation science research is needed to develop effective and sustainable multicomponent PA programs for older adults which may differ by social factors in older females compared to males.

2698 Board #159 May 29 10:30 AM - 12:00 PM
Estimated Cardiorespiratory Fitness, Comorbidity, And Health-related Quality Of Life In Korean Older Adults With Diabetes

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Purpose: Health-related quality of life (HRQoL) is a multidimensional subcomponent of quality of life that can be affected by health or health-related interventions. This study examined whether or not non-exercise-based estimation of cardiorespiratory fitness (eCRF) mediates the relationship of comorbidity with HRQoL in Korean older adults with diabetes.

Methods: Data from a subgroup ($n=1371$) of Korean older adults with diabetes and age of ≥ 60 years (55% women) who participated in the 2008-2011 Korean National Health and Nutritional Examination Survey were used in this analysis. HRQoL was assessed with the EuroQoL-5 dimensions index and EuroQoL visual analogue scale. Comorbidity was defined as physician-diagnosed chronic conditions. eCRF was assessed with a non-exercise regression equation derived from sex, age, body mass index, and self-reported physical activity. The SPSS macro provided by Preacher and Hayes was used to test whether CRF mediated the relationship between comorbidity and HRQoL at $p=0.05$.

Results: The total effect of the presence of comorbidities on HRQoL was significant (path c: $\beta=-2.670$, 95% CI= $-3.868 \sim -1.472$, $p < 0.001$). The presence of comorbidities was negatively related to eCRF in HRQoL model (path a: $\beta=-0.529$, 95% CI= $-0.652 \sim -0.404$, $p < 0.001$). The effect of eCRF as a mediator on HRQoL was also significant (path b: $\beta=1.434$, 95% CI= $0.928 \sim 1.940$, $p < 0.001$). The mediation analysis using the bootstrapping method (5,000 resamples) showed that eCRF mediated the relationship between the presence of comorbidities and HRQoL in Korean older adults (path ab: $\beta=-0.757$, 95% CI= $-1.104 \sim -0.453$, Sobel test $Z=-2.753$, $p < 0.001$). In addition, a direct effect of the presence of comorbidities on HRQoL was also significant (path c': $\beta=-1.913$, 95% CI= $-3.128 \sim -0.698$, $p < 0.05$).

Conclusions: The current findings suggest that cardiorespiratory fitness (CRF) can contribute to explain the relationship between comorbidity and HRQoL in Korean older adults with diabetes, implying the clinical relevance that promotion of CRF may have an impact beyond physical health in the patients. This study was supported by the National Research Foundation funded by the Korean Government (NRF-2019R111A1A01043771).

2699 Board #160 May 29 10:30 AM - 12:00 PM
Stand Up Now: A Sedentary Behavior Intervention In Older Adults Of Moderate-to-low Physical Function

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BACKGROUND: Sedentary behavior (SB) is associated with impaired physical function, falls, and higher mortality in older adults, which in turn leads to loss of physical independence. **PURPOSE:** The purpose of this feasibility study was to examine the efficacy of a 12-week intervention, Stand Up Now (SUN), to reduce SB and improve physical function and mobility in older adults of moderate-to-low function residing in assisted living facilities. **METHODS:** SUN included two intervention groups: one group focused on reducing total sedentary time (SUNST); one group focused on increasing sit-to-stand (STS) transitions (SUN^{STS}). All participants ($N=71$; $M_{age}=87 \pm 7$ yrs) received weekly health coaching over 12 weeks. SB, physical function, and mobility were measured at baseline, 6, and 12 weeks via the activPALTM, Short Physical Performance Battery (SPPB), and the 8-foot up-and-go (8ft UG), respectively. Linear Mixed Models were used to examine the efficacy of SUN on outcome variables over time. **RESULTS:** Both groups significantly decreased sedentary time (1.3 ± 0.3 hrs, $p < 0.001$) and increased standing time (0.5 ± 0.2 hrs, $p < 0.02$) at 6 weeks that was maintained at 12 weeks, compared to their baseline. SUN^{STS} significantly increased STS transitions at 6 weeks (5.4 ± 4.1 , $p < 0.001$) while SUNST had no changes (0.5 ± 3.1 , $p > 0.9$). No changes were noted in stepping time (0.04 ± 0.08 hrs, $p < 0.15$) or steps (261 ± 234 , $p < 0.14$) per day in either group. Both groups improved physical function from baseline to 6 weeks (1.5 ± 0.4 points, $p < 0.001$) that was maintained at 12 weeks. No significant changes were seen in mobility for either group

(0.5 ± 1.5 sec, $p > 0.05$). **CONCLUSIONS:** SUN demonstrates the efficacy to improve SB and physical function and may be a promising strategy to maintain function for activities of daily living to prevent loss of independence in older adults.

2700 Board #161 May 29 10:30 AM - 12:00 PM
Association Between Air Pollution And Daytime Sleep Duration: A Follow-up Study Of Chinese Older Adults In Beijing

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PURPOSE: This study was to estimate the association between air pollution and daytime sleep duration for older adults from the 5-year follow-up Chinese older adult surveys during 2011-2016 in Beijing, China.

METHODS: We conducted follow-up health surveys on 5503 (2080 males & 3423 females; Age 67.6 ± 8.2 yr., Height = 162.2 ± 7.5 cm, Weight = 63.3 ± 9.8 kg, BMI = 24.1 ± 4.3 in 2011) older adults enrolled at Beijing from 2011 to 2016, once per year. Sleep duration was measured using the Pittsburgh Sleep Quality Index (PSQI), which has been validated in China to measure sleep duration. Corresponding levels of average hourly PM2.5 ($\mu\text{g}/\text{m}^3$) on the survey days were gathered from data provided by the mission China air quality monitoring program run by the US Department of State in Beijing. The data were analyzed using the linear individual fixed-effect regressions.

RESULTS: The average time spent in daytime sleep for older adults was 0.6 ± 0.5 hours/day. The mean PM2.5 was 123.9 ± 52.5 ($\mu\text{g}/\text{m}^3$). Daytime sleep was positively associated with air pollution for older adults. Overall, an one standard deviation (SD) increase in air pollution concentration in PM2.5 ($56.6 \mu\text{g}/\text{m}^3$) was associated with an increase in daytime sleep hours by 1.49 (95% confidence interval [CI] = 1.17, 1.81), with the corresponding increases in females and males were 0.91 (95% [CI] = 0.33, 1.49) and 1.82 (95% [CI] = 1.34, 2.30) hours, respectively.

CONCLUSIONS: Increased air pollution seems led more daytime sleep among older Chinese adults and the impact on males was more significant than females.

2701 Board #162 May 29 10:30 AM - 12:00 PM
Concurrent Training Reduces Depressive Symptoms In Mexican Female Older Adults

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Nearly 35% of Mexican older adults (OA) are diagnosed with mild depression. Exercise has shown positive effects on reducing depression symptoms in OA. The correlation between physical function, body composition and mild depression risk in healthy OA has been neglected in Mexico. **PURPOSE:** To determine the effect of a concurrent-training exercise program (CTEP) on mild depression in Mexican female OA. A secondary aim was to determine the correlation between physical function, body composition and depressive symptoms in OA following a CTEP. **METHODS:** Twenty-one females (age = 64.0 ± 5.38 yr., weight = 72.0 ± 12.6 kg, BMI = 29.0 ± 4.7 kg/m²) participated in the study. Before (Pre) and after (Post) the CTEP, participants were measured on depression by the *Hamilton Depression Rating Scale* (HAM-D), body fat, muscle mass [MM], physical function by the *Senior Fitness Test*, and aerobic capacity by the 6-min walking test (6MWT). The CTEP consisted in two days of aerobic exercise and one day of resistance training performed for 50-min at moderate intensity (12 to 14 on Borg's RPE scale) for 12-weeks. Paired t-tests were computed to compare pre- to post-CTEP effects, and Spearman correlations studied the association between body composition, physical function and depression scores using the GraphPad PRISM 5.0 software. **RESULTS:** The CTEP reduced HAM-D scores (Pre = 15.7 ± 4.5 vs. Post = 10.3 ± 5.3 pts., $p = 0.0001$), improved upper-body strength (Pre = 15.1 ± 2.6 vs. Post = 18.9 ± 3.0 reps, $p = 0.0001$), lower-body strength (Pre = 12.0 ± 2.4 vs. Post = 14.5 ± 2.9 reps, $p = 0.0001$), agility (Pre = 6.5 ± 0.9 vs. Post = 6.0 ± 0.9 s, $p = 0.0001$), and MM (Pre = 21.8 ± 2.9 vs. Post = 22.26 ± 3.1 kg, $p = 0.002$). No significant changes were found in aerobic capacity (Pre = 587.9 ± 164.4 vs. Post = 619.6 ± 144.9 m, $p = 0.06$) and body fat (Pre = 31.0 ± 8.8 vs. Post = $30.8 \pm 9.1\%$, $p > 0.05$). The HAM-D scores were inversely correlated with upper-body strength ($r = -0.53$, $p = 0.002$) and lower-body strength ($r = -0.64$, $p = 0.002$), and directly correlated to agility ($r = 0.50$, $p = 0.0004$). **CONCLUSIONS:** A CTEP reduced depressive symptoms in Mexican female OA in

spite of lack of changes in body composition. The increased physical function relates to a reduction in depressive symptoms; thus, highlighting the importance of improving functionality in OA.

2702 Board #163 May 29 10:30 AM - 12:00 PM
Associations Of Physical Activity And Sedentary Behavior With The Onset Of Long-term Care Need In Community-dwelling Independent Japanese Older Adults: The Tsuru Study

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(No relevant relationships reported)

Limited data are available for the examination of the associations of physical activity (PA) and sedentary behavior (SB) with the onset of long-term care need (OLCN) in older adults. **PURPOSE:** The purpose of this study is to investigate the independent and joint associations of moderate PA (MPA) and SB on the OLCN among Japanese elderly in the local municipality. **METHODS:** A cohort of 3937 Japanese elderly men [median (IQR) age 74 (65–99) years] and 2048 women [median (IQR) age 74 (65–99) years] without certification of long-term care need have reported on PA and SB in 2016. The participants were divided into three categories (0 min/week: MPA-none, 1–299 min/week; MPA-M₁, ≥ 300 min/week; MPA-M₂) based on MPA and two groups based on median (200min/week) of SB (SB-M₁, SB-M₂). The OLCN was defined as the time of the certification of long-term care need by the Certification Committee of Needed Long-Term Care in the municipality. The information of the OLCN during follow-up from 2016 to 2018 was obtained from the person in charge of Tsuru city. Hazard ratios (HR) and 95% confidence intervals (95% CI) for the OLCN were obtained using proportional hazard models while adjusting for sex, age, educational level, marital status, activities of daily living, and history of current illness. **RESULTS:** During the 2-year follow-up period, 517 participants obtained certification of needed long-term care. With the independent effects of MPA and SB, using the MPA-none as reference, HRs and 95% CIs for MPA-M₁ and MPA-M₂ were 0.67 (0.51–0.86) and 0.48 (0.35–0.66), respectively (P for trend < 0.001) and using lower SB (SB-M₁) as reference, HR and 95% CI for higher SB (SB-M₂) was 0.74 (0.58–0.94). With the joint effects of MPA and SB, using MPA-none & SB-M₁ as reference, HRs and 95% CIs for MPA-none & SB-M₂, MPA-M₁ & SB-M₁, MPA-M₁ & SB-M₂, MPA-M₂ & SB-M₁, and MPA-M₂ & SB-M₂ were 0.62 (0.44–0.87), 0.58 (0.42–0.82), 0.50 (0.34–0.74), 0.39 (0.26–0.60), and 0.39 (0.25–0.62), respectively. **CONCLUSIONS:** These results suggest that MPA and SB might be independent factors for the onset of long-term care need and that these factors might have a strong joint effect on the onset.

2703 Board #164 May 29 10:30 AM - 12:00 PM
Effect Of 16-weeks Of Strength Training On Functionality And Body Composition Of Older Adults.

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The effect of different types of contractions (eccentric/concentric) has gained attention in the last years, where it was suggested that eccentric training would promote better results regarding the muscle mass development, affecting the functionality of older adults. **PURPOSE:** Analyze the effect of 16-weeks of eccentric and concentric training on functionality and body composition of older adults. **METHODS:** Sixteen-weeks of strength training with an emphasis on concentric/eccentric contractions were applied in 35 older adults, which were randomized into three groups: Eccentric Training N=12 (ET); Concentric Training N=12 (CT) and Control Group = 11 (CG). Functionality was analyzed through the timed up and go test (TUG), 30-second chair test, and handgrip strength. Body composition was accessed through the amount of lean body mass (LBM) and body fat (%BF), analyzed with a Bioelectrical Impedance Analysis (BIA). Muscle thickness of biceps brachialis (BTH)

and femoris rectus (FRTH) were accessed with an ultrasound (Eco III CHSON). All the analyses were made at the beginning of the intervention and after 16-weeks of the training protocol.

RESULTS: TUG was significantly lower in ET and CT compared to CG after 16 weeks of strength training (13.6 ± 0.7 to 17.02 ± 0.7 and 13.8 ± 0.6 to 17.02 ± 0.7 with p=0.001) without significant difference between intervention groups. The 30-second chair test was significantly higher in ET and CT compared to CG (11.9 ± 0.73 to 6.1 ± 0.71 with p= 0.001 and 10.9 ± 0.64 to 6.1 ± 0.71 with p=0.01 respectively). Hand Grip was statistically better in ET and CT compared to CG (21.5 ± 0.50 to 17.2 ± 0.5 with p= 0.001 and 21.4 ± 0.46 to 17.2 ± 0.5 with p=0.002). The %BF reductions were 6% higher in ET compared to CT and 19% higher compared to CG. BTH was significantly higher in ET compared to CG (0.46 ± 0.143 cm to 0.08 ± 0.137 with p=0.001) without differences between ET and CT. FRTH was significantly higher at the end of 16 weeks in ET and CT compared to the pre-test (2.40 ± 0.2 to 2.67 ± 0.19 cm with p=0.001 and 2.35 ± 0.193 to 2.61 ± 0.1 cm with p=0.05), with the control group presenting a significant decrease (2.58 ± 0.19 cm to 2.36 ± 0.18 cm with p=0.001) **CONCLUSIONS:** Both ET and CT promote improvements in the functionality and the body composition of older adults; however, no statistical change was observed between ET/CT groups.

2704 Board #165 May 29 10:30 AM - 12:00 PM
A Moderate-length Exercise Training Intervention Reduces Serum Protein Status In Older Adults

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Chronic exercise programs improve cardiometabolic status, lipid profile and glycemic control in older adults. These interventions usually last between 15 to 24 weeks with a frequency of three to four times per week, jeopardizing the older adult continuous interest in the program and eventually its adherence. **PURPOSE:** To determine the effect of a moderate-length exercise program on metabolic and protein status older adults. **METHODS:** Thirty-five volunteers (age= 62.6±7.3 yr., BMI= 28.3±3.9 kg/m², Body fat = 39.8±7.1%) completed the exercise program. Measures of body composition (body fat, BMI, muscle mass [MM] and muscle index [M_{index}]), serum total proteins (TP), albumin (ALB), glucose (GLU), triglycerides (TG), total cholesterol (TC), 6-min walking test (6MWT), and estimated VO_{2max} were recorded before and after completion of the program. Each training session was performed for 50-min at moderate intensity (12 to 14 on Borg's RPE scale), with three-days of aerobic exercise and two-days of resistance training, accumulating five sessions per week for 12 weeks. Paired Student's t-tests with Cohen's d effect sizes were computed on JASP v0.9.2 software. **RESULTS:** No significant changes were observed on BMI (Pre= 28.3 ± 3.9 vs. Post= 28.6 ± 4.2 kg/m², p= 0.067, d= -0.35), body fat (Pre= 39.8 ± 7.1 vs. Post= 40.1 ± 7.4%, p= 0.63, d= -0.09), MM (Pre= 22.7 ± 4.1 vs. Post= 22.8 ± 4.1 kg, p= 0.15, d= -0.27), M_{index} (Pre= 9.1 ± 0.9 vs. Post= 8.0 ± 3.1 kg/m², p= 0.059, d= 0.34), TC (Pre= 183.2 ± 68.9 vs. Post= 175.8 ± 115 mg/dL, p= 0.70, d= 0.06), 6MWT distance (Pre= 480.7 ± 105.7 vs. Post= 461.8 ± 123.6 m, p= 0.9, d= 0.02) and VO_{2max} (Pre= 29.4 ± 6.9 vs Post= 28 ± 7.1 mL·kg⁻¹·min⁻¹, p= 0.46, d= 0.13). Significant reductions were found on GLU (Pre= 98.0 ± 54.4 vs. Post= 77.5 ± 45.3, p= 0.011, d= 0.45), TG (Pre= 122.2 ± 82.0 vs. Post= 99.5 ± 66.5 mg/dL, p= 0.05, d= 0.34), TP (Pre= 6.5 ± 2.6 vs. Post= 4.3 ± 1.5 mg/dL, p= 0.0001, d= 0.90), and ALB (Pre= 3.7 ± 1 vs. Post= 2.9 ± 0.9 mg/dL, p= 0.0001, d= 0.80). **CONCLUSION:** A moderate-length 12-week exercise program improved GLU and TG levels in older adults. The lowered TP and ALB with a concomitant trend of the M_{index} reduction suggest a metabolic overreaching tending to undernutrition after the program.

2705 Board #166 May 29 10:30 AM - 12:00 PM
Physical Activity Intervention Access Effects Physical Function And Physical Activity Outcomes In Older African Americans

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Older African Americans (AA) have the highest rates of disability of any racial/ethnic group and <25% meet recommended PA levels. Overcoming barriers to PA adoption and maintenance continues to be a major challenge without clear consistent solutions. Self-regulation strategies have shown promise in PA behavior change interventions. **Purpose:** To examine the effect of location of a PA intervention on physical function, PA and self-regulation in older AAs using a pre-post study design. **Methods:** Sedentary older AA participants (n=40) participated in an evidence-based behavioral intervention

aimed to improve physical function outcomes (usual gait speed, UGS; 6-minute walk, 6MW; timed up and go, TUG), self-regulation and long-term maintenance of PA (CHAMPS questionnaire). The PA intervention was held in government subsidized housing complexes where participants lived, (PA-Apt, n=22 participants) or in convenient neighborhood facilities (PA-NF, n=18 participants). The intervention, based on self-regulation principles, includes a 10-week moderate intensity strength, flexibility and aerobic group exercise class 60 minutes/3 times/week plus a 6-month maintenance period with bi-weekly coaching telephone calls. Measures were assessed at baseline, after the 10-week group exercise class, and following a 6-month maintenance period. Participants included 6 males and 34 females, aged 59-85 years (M=67.9, sd=6.40) with mean BMI 34.23 (sd=9.19, range 14.99-57.47). 47.5% were morbidly obese. **Results:** Significant improvements ($p<.01$) in TUG, UGS, 6MW, moderate intensity and total PA and self-regulation were found immediately following the 10-week group class and were maintained for 6 months ($p<.01$) in the PA-Apt group. Significant improvements ($p<.05$) in TUG and 6MW were found immediately following the 10-week group class and were maintained for 6 months ($p<.01$) while moderate intensity and total PA and self-regulation were significant after the 10-wk intervention but were not maintained after 6 months in the PA-NF groups. No significant difference was found for UGS. **Conclusions:** Providing PA interventions in facilities where older AAs live may be more effective in improving and maintaining PA than in convenient community settings near where participants live.

2706 Board #167 May 29 10:30 AM - 12:00 PM
Physical Activity Format Does Not Influence Daily Energy Expenditure Or Sleep Quality In Older Adults.
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PURPOSE: Regular physical activity is known to prevent chronic diseases, improve cognitive function, increase self-efficacy, decrease mortality, and reduce risk of falls in older adults. Sleep quality, quantity, and waking behaviors have been associated with increased quality of life, improved health, and increased overall energy expenditure. Sixty percent of older adults report not participating in regular physical activity or exercise, yet those who are active utilize different programming options (structured and unstructured) to achieve this behavior. We assessed how different activity options impact sleep behaviors, step counts, and perceived quality of life in the older adult population.

METHODS: Forty-five older adult volunteers were divided into one of four groups based on their current structure of physical activity participation (Supervised Exercise (SE), Independent Exercise (IE), Active Lifestyle (AL), or Control (C)). Subject group selection was the result of answering "Do you exercise?" If answered "Yes", then asked "Is it instructed (SE) or independent (IE)?" If answered "No", then asked "Do you lead an active lifestyle (AL) or not (C)?" Nine men and 36 women participated, with the following representation per group - SE: 73.9±6.6yrs (n=13), IE: 76.5±6.1yrs (n=13), AL: 79.9±9.6yrs (n=10), C: 69.8±5.8yrs (n=9). Energy expenditure and sleep quality were measured through a wrist worn Fitbit Charge HR for seven days. Perceived health status and sleep quality were assessed with the SF-36 & PSQI, respectively.

RESULTS: Groups were not different by height, or weight ($p>0.05$), but SE and C were found to be younger ($p=0.02$) than the IE and AL groups. No differences were observed between groups for energy expenditure, sleep quality, or sleep efficiency ($p>0.05$). The AL group noted lower pain ($p=0.002$) and physical functioning ($p=0.01$) compared to the remaining groups. Trends toward statistical significance between groups were observed with perceived health perception ($p=0.07$) and steps ($p=0.07$). **CONCLUSIONS:** The current study suggests that energy expenditure and sleep quality are not related to structure of physical activity programming with older adults.

2707 Board #168 May 29 10:30 AM - 12:00 PM
Epidemiological Differences In Young, Middle-aged, And Older Golfers' Injuries
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Golf is a popular sport worldwide, yet injuries sustained during golf rarely receive the same recognition as sports perceived as violent or strenuous. However, golf injuries have been shown to occur with a high incidence. **PURPOSE:** To examine the differences in young, middle-aged, and older golfers' injury profiles, as well as determining factors associated with injury risk. **METHODS:** Amateur golfers aged 18 years and older who played golf on a regular basis completed a questionnaire documenting their previous 12-month injury status and associated golfing demographics. **RESULTS:** This study consisted of 1170 golfers (young: 127 females, 110 young males; middle-aged: 450 females, 165 males; older: 227 females, 91 males), with median handicaps of young, middle-aged, and older females (12, 16,

17), and males (15, 12, 13) respectively. Younger golfers sustained significantly more injuries than middle-aged and older golfers (females 45.7%, 32.7%, and 27.3%; males 45.5%, 44.5%, and 35.2%, respectively). Odds ratio (OR) analysis showed that older golfers were less likely to report sustaining an injury than younger (OR: 0.813, $p=0.008$) and middle-aged golfers (OR: 0.745, $p=0.029$). Of the 423 injuries (36.5%), 72.8% impacted the golfers' performance or participation. Overall, the lower back was the most frequently injured region (27.6%), with strains the most frequent type of injury (49.5%), but differences in injury profiles were evident between groups. Older golfers sustained significantly more knee, groin, and hip injuries, whereas younger golfers sustained significantly more wrist, foot, and ankle injuries (all $p\leq 0.01$). Other than age, hours of play / week, hours of practice / week, and total golf participation hours / week were all significant, independent predictors of injury. The Hosmer and Lemeshow test indicated an acceptable goodness of fit of the model ($p=0.878$). **CONCLUSIONS:** Injuries occur to golfers of all ages and have a significant impact upon golfers' lives. Before suggesting that golfers limit their golf participation, other injury prevention avenues must be investigated to ensure that participation in physical activity is not viewed as harmful. Further, prevention strategies need to be investigated in relation to specific characteristics of golfers to attempt to reduce injury risk.

2708 Board #169 May 29 10:30 AM - 12:00 PM
Comparison Of Omentin-1 And Insulin Resistance Markers In Different Physical Activity Levels Older Adults
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PURPOSE: Omentin-1 is a good adipokine produced by omental adipose tissue and plays a pivotal role in regulating the insulin resistance. The aim of this study was to compare serum omentin-1 concentration together with insulin resistance markers in active-obese, inactive-obese, normal-weight Chinese older adults.

METHODS: 128 older adults (men: n=32, women: n=96) were recruited to participate in this study. Subjects were divided into the following three groups. 1) active-obese (n=49, age=63±6years; BMI=25.9±2.3kg/m²); 2) inactive-obese (n=48, age=66±6years; BMI=26.5±2.4kg/m²); 3) normal-weight (n=31, age =64 ±5years; BMI=21.1±1.5kg/m²). ActiGraph GT3X-BT triaxial accelerometers were used to measure the levels of physical activity. We define it as active subjects based on average number of minutes spent on the moderate-to-vigorous physical activity (180min/week). Venous blood samples were collected to measure omentin-1, insulin and glucose levels. The homeostasis model assessment of the insulin resistance (HOMA-IR) was calculated as the following formula: fasting glucose (mmol/L) × fasting insulin (mU/L)/22.5.

RESULTS: The results showed that omentin-1 concentration was significantly lower in obese than normal-weight group (17.1±12.4 vs. 24.2±13.4ng/ml, $p<0.01$). Meanwhile, Glucose, insulin and HOMA-IR was significantly higher in obese than in normal-weight group (5.3±1.2 vs. 4.8±0.4mmol/L, 7.9±3.8 vs. 4.7±1.9μU/mL, 1.94±1.18 vs. 1.00±0.39, both $p<0.05$). However, there was no significant difference between serum omentin-1 levels and glucose in active-obese and inactive-obese groups (both $p>0.05$). Insulin and HOMA-IR in active-obese were significantly lower than inactive-obese group (7.2±3.1 vs. 8.8±4.3μU/mL, 1.68±0.90 vs. 2.22±1.41, both $p<0.05$).

CONCLUSIONS: Our results suggested that physical activity can improve the negative effects of obesity on insulin resistance markers, but did not affect the concentration of omentin-1 significantly of obese older adults.

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2709 Board #170 May 29 10:30 AM - 12:00 PM
Investigation Of The Relationship Between Physical Activity, Inflammatory Proteins And Adiponectin In Older Adults
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INTRODUCTION: Chronic low-grade inflammation (CLGI) is a hallmark of aging and significantly contributes to the development and progression of numerous chronic diseases including cardiovascular disease (CVD) and diabetes. CLGI is frequently defined as elevated serum levels of inflammatory proteins including C-reactive protein (CRP) and interleukin-6 (IL-6). Physical activity has been reported to have anti-inflammatory effects. **PURPOSE:** To explore the relationships among habitual physical activity, inflammation, and cardiometabolic risk factors in older adults. **METHODS:** In 82 subjects (23 male / 59 female) body composition was determined

(bioelectrical impedance) and physical activity was measured objectively (7-day accelerometry) as well as subjectively (Community Health Activities Model for Seniors (CHAMPS)). Enzyme-Linked Immunosorbent Assays (ELISA) were used for the quantitative measurement of IL-6, CRP, and anti-inflammatory, adipose tissue derived hormone, adiponectin. Blood lipids were also measured utilizing a point-of-care analyzer. Partial correlations (controlling for age and sex) were used to analyze associations. **Summary of RESULTS:** Mean values included: age (68.5 ± 6.3 yr); body fat percentage (31±11%); accelerometry (cts/min: 114.1±56.5, sedentary-to-moderate ratio: 12.8±6.1); CHAMPS (2,328±1658 kcal/wk); CRP (1.5±1.6 mg/dL); IL-6 (4.2±1.0 ng/mL); adiponectin (11.2±6.0 µg/mL); LDL (114±28 mg/dL); and HDL (62±17 mg/dL). CRP was significantly ($p < 0.05$) correlated with body fat percentage ($r = 0.54$), HDL/LDL ($r = 0.42$), IL-6 ($r = 0.37$), and adiponectin ($r = -0.25$). IL-6 was significantly correlated with body fat percentage ($r = 0.24$), activity counts/min ($r = -0.27$), and LDL/HDL (0.29). Adiponectin was significantly correlated with body fat percentage ($r = -0.35$), CHAMPS ($r = 0.28$), and HDL ($r = 0.51$). **CONCLUSION:** The average CRP value for this population of older adults is indicative of moderate risk for the development of CVD. The correlations reported here are supportive of previous research suggesting that body composition and physical activity level are important determinants of inflammatory profile and disease risk. This project was funded by an NIH grant 1R15AG055923-01

2710 Board #171 May 29 10:30 AM - 12:00 PM
Effect Of Exercise On Cardiovascular Risk Factors In Older African American Couples: A Pilot Study

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 (No relevant relationships reported)

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Background: African Americans (AAs) have higher rates of obesity and several cardiovascular disease (CVD) risk factors compared to other races/ethnicities in the U.S. Romantic partners can positively influence health habits, yet their influence on exercise effects is understudied. This study examines the effects of resistance training (RT) and walking on CVD risk factors in older AA couples. **Methods:** Seven (body mass index 31.2±4.3 kg/m²; 6022±1532 average steps/day) AA romantic couples (n=14; 7 females, 7 males; 63.5±8 y) were recruited for a 12-week supervised RT (two days/week) plus unsupervised walking intervention (≥30 minutes, three times/week). Couples were randomized to exercise together (ET) or individually (I). Waist and hip circumferences, body composition via iDXA, and resting blood pressure were assessed. Venous blood was assessed for glucose, hemoglobin A1c (HbA1c), insulin, total cholesterol (TC), high-density lipoprotein cholesterol, triglycerides, C-reactive protein, and fibrinogen. Tests were performed pre- and post-intervention. Repeated measures ANOVA was used to analyze dependent variables. Post hoc paired-samples T-tests were used to determine significant findings. Significance was accepted at $p \leq 0.05$. **Results:** A significant group x time interaction was found for TC with a significant decrease in I (180.8±34.5 to 162.2±28.9), but no other variables. There were significant mean time effects for waist circumference (ET: 97.8±8.4 to 96.2±8.4 cm; I: 97.3±9.2 to 95.7±9.5 cm), body fat (ET: 37.8±6.6 to 37.5±7.1%; I: 38.0±9.4 to 37.0±9.9%), gynoid fat (ET: 39.2±7.8 to 38.9±8.2%; I: 38.5±9.2 to 37.5±9.7%), fat mass (ET: 36.3±5.6 to 35.6±8.1 kg; I: 33.7±9.8 to 32.9±10.4 kg), and HbA1c (ET: 5.8±0.5 to 5.7±0.4; I: 5.9±0.6 to 5.6±0.4%). **Conclusion:** Twelve weeks of RT plus walking may significantly improve several CVD risk factors in older AA couples. The current study is ongoing and will continue to examine the intervention's effects in a larger sample.

2711 Board #172 May 29 10:30 AM - 12:00 PM
Muscle Quality Predicts Improvements In Transfer Task Performance After Weight Loss In Older Women

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Purpose: The contributions of weight loss and exercise to improvements in physical function in older adults remains debated and of high public health importance. Physical function tasks vary, but an inability to complete those most simple in life can be highly distressful for older individuals. The Transfer Task (TT), simple to administer, assesses an individual's ability to stand up from the floor, but whether weight or fat loss (i.e., the load to be moved) or improved muscle quality (i.e., ability to move the load) is more important to successfully complete this task is unclear. This study aimed to examine the relative contributions of changes in muscle capacity and body composition to improvements in Transfer Task performance following a weight loss and exercise program in inactive obese older women.

Methods: Inactive older women (n = 34; BMI = 30.0 ± 4.5 kg/m²; 69.4 ± 4.4 y) completed a 6-month weight loss and supervised exercise intervention. Maximal leg strength (STR) was measured via isokinetic dynamometry and leg power (POW) via leg extension power rig. Fat mass and mineral free lean mass (Leg-MFLM) were assessed via DXA. Muscle quality (MQ) was calculated as a ratio between maximal STR and POW and Leg-MFLM (MQ-STR; MQ-POW). The Transfer Task (TT) required sitting down on the floor and returning to a standing position as quickly as possible.

Results: Body weight (-9.6 ± 3.5%), fat mass (-6.8 ± 2.4 kg), and Leg-MFLM (-0.3 ± 0.5 kg) decreased (all $p < 0.01$). MQ-STR and MQ-POW improved (8.2 and 10.1%, respectively, both $p < 0.001$). TT time improved (-39.0 ± 19.8%, $p < 0.01$). Stepwise linear regression indicated that changes in MQ-POW predicted improvement in TT [unstandardized $\beta = -0.50$, $R^2 = 0.18$, $p = 0.017$]; MQ-STR was excluded from the model. A second stepwise model determined that neither change in weight ($\beta = 0.24$, $p = 0.15$) nor fat mass ($\beta = 0.21$, $p = 0.21$) influenced the predictive relationship between changes in MQ-POW and TT.

Conclusion: Changes in muscle quality based on power independently predicts improvements in transfer task performance. Thus, the ability to move the load appears to be more important than the load to be moved regarding the ability to sit on the floor and return to standing after a weight loss and exercise program for older women.

2712 Board #173 May 29 10:30 AM - 12:00 PM
Are Lower-leg And High Muscle Resistance Training Equally Effective To Adl-related Functional Fitness For Community-dwelling Elderly Females?

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PURPOSE: The purpose was to compare the magnitude of lower-leg training program and high muscle training program to ADL-related functional fitness changes for community-dwelling elderly Japanese women.

METHODS: After giving written informed consent, the subjects, unable to stand on one leg for more than 25 seconds with their eyes open, were divided into a lower-leg training group (LLG; 10 females, 72.9±4.2 yrs, BMI 22.1±1.8) and a high muscle training group (TMG; 10 females, 70.6±2.5 yrs, BMI 22.1±1.2). The program was 60min. two times per week for 16 weeks. Each training program consisted of three parts. At first, participants learned about management skills for their physical stiffness. Secondly, they learned each resistance program. LLG participated in the program using unstable disk and elastic band. TMG learned program was to strengthen their thigh muscles with elastic band. Finally, both groups learned a three-minute arm and leg combined exercise program with music. Participants were asked to follow their learned management skill program and resistance program every day and check it on the card. ADL-related functional fitness (sitting & standing time, zig-zag walking time, self-care working time), dynamic balance ability which measured by one-leg standing time with their eyes open and knee extension strength was evaluated. Each measurement items were assessed before and after the intervention period. Student's t-test and two-way repeated measures ANOVA were used to test the effectiveness.

RESULTS: The class participation rates were 82± 4% and 81± 8% and home participation rates were 76± 10% and 72± 15% respectively. ADL-related functional fitness of TMG improved significantly compared to LLG; Sitting & standing time (TMG: 18.6±7.4 to 13.4±6.1 sec., LLG: 16.3±7.4 to 13.8± 5.7sec., $F=18.00$, $P=0.033$), self-care working time (TMG: 16.3±5.3 to 11.3±3.2sec., LLG: 16.1±3.2 to 14.9±4.3sec., $F=17.00$, $P=0.026$), zig-zag walking time (TMG: 15.6±7.2 to 14.2±5.5sec., LLG: 14.2±3.2 to 12.6±3.0sec., $F=0.043$, $P=0.838$). Knee extension strength improved significantly in TMG ($P=0.029$). One-leg standing time with their eyes open improved in LLG ($P=0.038$)

CONCLUSIONS: High-muscle training was found more effective to improve ADL-related functional fitness than lower-leg muscles for community-dwelling females.

2713 Board #174 May 29 10:30 AM - 12:00 PM
Effects Of Mechanical Stress-free Walking Workshop In The Elderly

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PURPOSE: Ensuring walking is important for health maintenance. However, elderly people, particularly, with advanced articular cartilage degeneration need to deal with mechanical stress applied to their body. In this study we examined the effects of mechanical stress-free walking (MSFW), which was devised to reduce the stress to human body, based on previous our studies. **METHODS:** In the first examination, we introduced the MSFW to two different groups: 1) health exercise/fitness instructors (n=110, mean age=54.1±11.6 years) and 2) the elderly, 65 years and older (n=47, mean age=76.1±6.05 years). The 30-minutes workshop for the MSFW were given to the both groups. The MSFW includes 4 walking tips: 1) walking with the upper body upright, 2) catching the ground softly, 3) taking the width of the left and right feet, and 4) not twisting the knee joints. We compared the length of strides and mechanical stress assessed by 3-D acceleration Safety Walk Navi (Descente Ltd, Tokyo, Japan) before and after intervention in both groups. In the second examination, the same workshop was given to different elderly group (n=17, mean age=75.1±4.86years) for 4 weeks. And we compared the data before and after the 4-weeks intervention. **RESULTS:** In the first examination, the health exercise/fitness instructors reduced the length of strides and the mechanical stress of walking (i.e., forward, upward, downward and lateral accelerations) after receiving the 30-minutes MSFW workshop. However, elderly participants did not reduce the mechanical stress, particularly, downward acceleration (mean: 1.67±0.17 G). In the second examination, elderly group received the 4-weeks MSFW workshop. At the end of the workshop, the length of strides and all the measured accelerations were significantly reduced in the elderly participants (height ratio of stride: from 0.46±0.04 to 0.44±0.04**, forward acceleration: from 0.84±0.36 G to 0.66±0.16 G**, upward acceleration: from 0.56±0.16 G to 0.48±0.13 G**, downward acceleration: from 1.79±0.14 G to 1.74±0.13 G*, and lateral acceleration: from 1.04±0.30 G to 0.80±0.21 G**. (** P<0.01 *P<0.05) **CONCLUSIONS:** The MSFW workshop designed to reduce mechanical stress on a body while walking, was effective in any age groups. Even elderly people can learn and achieve MSFW.

2714 Board #175 May 29 10:30 AM - 12:00 PM
Association Between Lower Extremity Muscular Strength And Functional Performance In Community-Dwelling Elderly

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The combination of aging with reduced muscle mass and muscle strength results in a higher risk of falls, hospitalizations, dependence, poorer quality of life, and all-cause mortality. Our hypothesis, in the present study, is that the elderly who present higher values in gait speed, as well as lower values in the Time Up and Go test, will have higher values of lower limb muscle strength. **PURPOSE:** To correlate functional capacity of walking and time up and go tests with the maximal isometric lower limb strength test in community-dwelling elderly. **METHODS:** Thirty-two elderly (2 men; age: 72 ± 9.2 yrs; body mass: 66 ± 10.6 kg; height: 152.27 ± 7.79 cm) who attended the *Centro de Convivência do Idoso* located in Paranoá, Brasília, DF participated. The tests were performed in an integrated and dynamic circuit format, where each station had a single evaluator. The maximal isometric muscle strength of lower limbs used the *mid tight pull* position where a traction dynamometer (*E-lastic*) was fixed to the ground by a metal chain and at its other end a hand strap. The elderly were instructed to perform their maximal concentric movement strength with semi-flexed knees and extended arms for 3-5 seconds with verbal encouragement. The muscle strength was measured in kilograms (kg). In the *Walking Test* (TC), the elderly should walk through the distance of 10m as fast as possible. Gait speed (m/s) was calculated. In the *Time Up and Go* (TUG) test, the elderly should get up from a chair without the aid of their arms and walk at a comfortable pace at a distance of three meters, get around an obstacle, return and sit again while time to end the task was measured. A Pearson

correlation coefficient was determined between the maximum isometric strength test and the walking and time up and go tests. The statistical package adopted was SPSS (IBM, version 23). **RESULTS:** The findings revealed a significant and moderate correlation for gait speed and lower limb muscle strength ($r = 0.391$; $p = 0.033$) as well as the functional test and lower limb muscle strength level ($r = -0.376$; $p = 0.041$). **CONCLUSION:** Elderly who had higher lower limb strength values obtained the shortest times in the time up and go test and the highest gait speed in the walking test.

2715 Board #176 May 29 10:30 AM - 12:00 PM
Effects Of Undulating Vs. Linear Resistance Training On Strength And Physical Fitness In Elderly Population

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Resistance training (RT) programs employing an undulating periodization (UP) model have consistently shown to enhance muscle strength and physical performance in both trained and sedentary subjects; however, the effects on an older population are less studied. **PURPOSE:** This research aimed to compare the effects of UP vs. linear training (LT) on strength levels and functional capacity in elderly adults. **METHODS:** Eighteen (n=10, men; n=8, women) untrained elderly individuals (64±2.1years, height=165.12±7.7cm, body mass=72.5±11.4kg) with no previous RT experience were randomly assigned to either a linear training (n=9, LT) or UP (n=9) program. Assessments: Chair stand test (CST), chair sit and reach (CSR), arm curl test (ACM), the 6-min walk test (6MWT), back scratch test right (BST-R), 1RM rowing machine (RM), 1RM vertical bench press (VBP), 1RM leg extension (LEx), 1RM unilateral leg press (ULP) and 1RM squat based on mean velocity concentric. **RESULTS:** According to the analysis ($\Delta = \pm SD$; P ; ES to LT and UP, respectively), there were significant changes in CST (3.8±3.1reps; 0.01; 1.67 and 3±1reps; <0.05; 2.58), ACM (5.1±3.6reps; 0.012; 1.41 and 3.6±0.9reps; <0.05; 2.19), 6MWT (250±92.6m; <0.05; 3.76 and 155.6±52.7m; 0.006; 3.02), BST-R (-2.9±0.8cm; <0.05; -0.45 and -1.2±1.1cm; 0.01; -0.18), BST-L (-3.1±1.4cm; <0.05; -0.78 and -1.3±1.3cm; 0.016; -0.18), 8UG (-1.0±0.0s; 0.005; -1.12 and -0.1±0.9s; 0.705; -0.17); RM (25.6±6.8kg; <0.05; 1.76 and 17.8±7.9kg; <0.05; 1.51), VBP (24.6±17.4kg; 0.011; 1.55 and 23.9±6kg; <0.05; 2.09); LEx (30±9.7kg; <0.05; 1.71 and 14.4±6.3kg; <0.05; 0.76), ULP (45.6±25.1kg; 0.001; 1.38 and 36.7±27.8kg; 0.007; 2.1) and squat (17.2±9.4kg; 0.001; 0.82 and 10.3±3.2kg; <0.05; 0.54). No changes were found in CSR in any group (-3.1±7.2; 0.498; -0.68 and 0.4±2; 0.525; 0.09). There were differences in 6MWT by *Group* and by *Time x Group* ($P=0.013$ and 0.019), in ACM by *Group* ($P=0.020$) and BST-R, BST-L, 8UG y ULE ($P=0.003$, 0.015 , 0.016 , y 0.002). **CONCLUSIONS:** A supervised RT program using either linear or undulating periodized design has positive effects on indicators of functional autonomy and physical fitness in older adults, highlighting that the LT protocol generated the largest in changes.

Keywords: Power muscle, aging, muscle training

2716 Board #177 May 29 10:30 AM - 12:00 PM
Physical Fitness Changes In Pre frail Elderly Adults After 4-years'S Participation Of Community-based Health-care Classes

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 (No relevant relationships reported)

PURPOSE: There are few long-term follow-up reports on health status or physical fitness changes in frail elderly adults who are participating in community-based health-care classes. This study aimed to examine physical fitness changes between community-dwelling elderly adults with or without prefrailty after participating in preventive health-care classes for 4 years. **METHODS:** We defined "prefrailty" as grip strength <30 kg for men and <20 kg for women. Subjects were divided into two groups based on grip strength (with or without prefrailty) before the preventive health care classes started. We examined the physical fitness changes (i.e. grip strength and 10-m walking speed) in these two groups. **RESULTS:** Twenty-two men and 43 women participated in the classes for 4 years (2011 to 2015), including 3 men and 6 women with prefrailty. At baseline, grip strength

showed statistically significant differences between groups with or without prefrailty in both men (with: 23.2±3.2 kg, without: 37.3±5.6 kg) and women (with: 13.7±1.2 kg, without: 23.7±3.5 kg). Also, walking speed showed statistically significant difference between groups in both males (with: 1.65±0.22 m/sec, without: 2.06±0.51 m/sec), and females (with: 1.49±0.28 m/sec, without: 1.83±0.25 m/sec). After 4 years, an analysis of covariance using age as a co-variable showed that the changes of grip strength were significantly different between two groups ($p < 0.05$), but the walking speeds were not significantly different between two groups. Changes in walking speed were increased in both groups with or without prefrailty (with: +0.10±0.17 m/s, without: +0.04±0.08 m/s). There were no gender differences in changes of grip strength and walking speed. **CONCLUSIONS:** This is the first demonstration that the long-term participation in preventative health-care classes effectively increased walking speed in elderly adults with and without prefrailty.

2717 Board #178 May 29 10:30 AM - 12:00 PM
**Effects Of A Non-linear Resistance Training Program
 On Biochemical And Physiological Health Parameters
 In Elderly**

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Resistance training (RT) has been shown to have positive effects on older adults' health by increasing muscle mass and improving metabolic profile. Nonetheless, the potential benefits of a non-linear RT program on biochemical and physiological health parameters in older individuals are less known. **PURPOSE:** This study assessed the effects of an undulating-periodized (UP) RT program on glucose, cholesterol (total, HDL-c and LDL) and triacylglycerol (TG) concentrations in blood, and arterial blood pressure (BP). **METHODS:** Seventeen ($n=9$ men; $n=8$ women) untrained elderly individuals (64.2±2.0 years, 72.2±10.8 kg; 164.8±7.6 cm; 25.6±2.6 kg·m⁻²) with no previous RT experience were randomly assigned to either a linear training ($n=8$, LT) or UP-RT ($n=9$) program. After 3 weeks of familiarization, all participants performed three RT weekly bouts for 8 weeks. Blood samples were collected pre- and post-study after a 12-hour overnight fast, and biochemical analyses were carried out. Systolic and diastolic BP were measured using a digital sphygmomanometer. Statistical comparison was performed with the paired t test or Wilcoxon, and a repeated measures ANOVA was employed to determine interactions ($Time=pre-test$ vs $test$; $Group=LT$ vs UP and $Time \times Group$). Effect size (ES) was calculated with Hedges g . **RESULTS:** Statistical analysis ($\Delta=X \pm SD$; P ; ES) showed differences on basal glycemia for LT (-11.1±8.1 mg·dL⁻¹; 0.006; -1.61) and UP (-5.7±4.2 mg·dL⁻¹; 0.004; -0.65). There were changes in LDL (LT=-15.1±9.5 mg·dL⁻¹; -1.18; 0.003, UP=-9.4±4.4 mg·dL⁻¹; -0.33; <0.0002), total cholesterol (LT=-21.1±14.6 mg·dL⁻¹; -1.19; 0.005, UP=-10.2±6.2 mg·dL⁻¹; -0.28; 0.001) and TG (LT=-18.3±16.0 mg·dL⁻¹; -0.56; 0.014, UP=-6.7±3.9 mg·dL⁻¹; -0.24; 0.001) in both groups, but HDL-c remained statistically unchanged (LT=-2.6±6.3 mg·dL⁻¹; -0.38; 0.277, UP=3.0±6.8 mg·dL⁻¹; 0.27±0.223). There were no changes on either SBP or DBP in LT (-3.4±8.5 mmHg; -0.25; 0.289, and -3.2±5.7 mmHg; -0.48; 0.079, respectively) but there were in UP (-4.5±4.4 mmHg; -0.56; 0.015, and -4.0±4.3 mmHg; -0.83; 0.023, respectively). No significant between-group differences were found for any variable. **CONCLUSIONS:** A supervised RT program with either linear or UP provides improvements in cardiometabolic markers in older adults and, therefore, health enhancement.

2718 Board #179 May 29 10:30 AM - 12:00 PM
**Concurrent Exercise Improves Blood Pressure, Body
 Composition, Lipids And Fitness Components In
 Elderly Women**

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Aging is associated with progressive decline of cardiovascular and muscular health, which affects overall fitness and body composition. It is crucial to prevent or attenuate the negative effects of aging on cardiovascular and muscular health by implementing effective lifestyle interventions, such as exercise training. Several longitudinal studies lasting <16 weeks have shown that aerobic, resistance, and concurrent training (CT),

improve blood pressure (BP), muscle strength and body fat percentage (BF%) in elderly cohorts. However, studies evaluating these adaptations following extensive training periods (≥ 1 year) are currently lacking. **PURPOSE:** The purpose of this study was to evaluate BP, BF%, blood lipids, walking capacity and muscular strength values in elderly women following 1 year of habitual CT. **METHODS:** 101 elderly women [age (77 ± 6 years) and body mass index (24.1 ± 3.8 kg/m²)] were randomized to either CT ($n=57$) or non-exercising control group ($n=44$) for 1 year. Participants in the CT group trained 3/week. CT consisted of moderate aerobic exercise that progressed in duration from 25 to 45 min as well as resistance exercise, which entailed 9 exercises for the major muscle groups using 8-12 repetitions. Brachial BP, BF%, blood lipids, 2-minute walking distance (2MWD) and quadriceps strength were evaluated following 1 year of their assigned intervention. **RESULTS:** Systolic BP (~10 mmHg), BF% (~6%), low-density lipoprotein cholesterol (~15) were significantly ($P < 0.05$) decreased, while 2MWD (~19 meters) and quadriceps strength (~4 Kg) were significantly ($P < 0.05$) increased in the CT group when compared to control. **CONCLUSIONS:** Elderly women in CT group had improved BP, BF%, low-density lipoprotein cholesterol, muscle strength and walking capacity when compared to control counterparts. Habitual CT may protect against the development of hypertension, hypercholesterolemia, obesity and muscle weakness in elderly women.

2719 Board #180 May 29 10:30 AM - 12:00 PM
**Exercise Interventions, Physical Function And Mobility
 After Hip Fracture: A Meta-Analysis**

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(No relevant relationships reported)

PURPOSE: To conduct a meta-analysis of current evidence regarding the effects of exercise interventions on physical function and mobility in individuals after hip fracture. **METHODS:** This meta-analysis was conducted following the PRISMA guidelines. An electronic search using a number of keywords ("hip fracture" or "trochanteric fracture" or "femoral neck fracture" and "exercise" or "physical activity" or "locomotion" or "movement" and "human" and "randomized controlled trial") in six databases (Pubmed, Embase, Cochrane Library, Web of Science, Clinical and PsycINFO) was performed from their inception to September 2019. Inclusion/exclusion criteria limited articles to randomized controlled trials investigating the effects of exercise interventions on physical function and mobility after hip fracture, compared to non-exercise controls. Standardized mean differences, relative effect sizes (ES; Hedges's) and heterogeneity statistics (I^2) were calculated using a random-effects model. **RESULTS:** Among 2028 citations retrieved, 15 citations (15 studies) met the inclusion criteria, and all were conducted in older adults ($n=1196$, age=80.04±7.72 yrs). The interventions included aerobic exercise only ($n=1$), resistance exercise only ($n=3$), functional exercise only ($n=1$), and various combinations of aerobic, resistance, functional and/or balance exercise ($n=10$). The pooled Hedges's SMD for overall physical function was 0.46 (95% CI=0.27 to 0.65, $p=0.000$, $I^2=58.9\%$) in favor of exercise interventions. Exercise interventions also had a significant effect on mobility (ES=0.22, 95% CI=0.08 to 0.36, $P=0.0\%$). The mean ESs on balance (ES=0.50, 95% CI=0.31 to 0.69, $I^2=11.1\%$), muscle strength (ES=0.30, 95% CI=0.14 to 0.47, $I^2=0.0\%$), activities of daily living (ES=0.20, 95% CI=0.04 to 0.35, $I^2=0.0\%$), and self-efficacy (ES=0.39, 95% CI=0.19 to 0.60, $I^2=0.0\%$) were also significant. There was no publication bias on Egger's test ($p=0.302$). **CONCLUSION:** Our findings suggest that exercise interventions can improve physical function and mobility in older adults after hip fracture. As exercise is a promising rehabilitation for this special population, future research is needed to establish best practices.

E-32 Free Communication/Poster - Athlete NutritionFriday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall**2720 Board #181 May 29 9:30 AM - 11:00 AM
Screening Nutritional Understanding And Behavior Of Brazilian Elite Athletes**Silvana Vertematti¹, Jean Michel R S Leite², Flavia Meyer³, Marília Santos Andrade¹. ¹Universidade Federal de São Paulo, São Paulo, Brazil. ²Universidade de São Paulo, São Paulo, Brazil. ³Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil.

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Nutritional misinformation may hinder healthy attitudes and impair athlete's performance. **PURPOSE:** To compare the frequency of right understanding and behaviour on nutritional related issues among male and female elite Brazilian athletes. **METHODS:** A total of 128 athletes, age 24.4±4.5 yrs, (61 males) who competed various modalities at international competitions participated in the study. The frequency of right answers (based on scientific literature) and the odds ratios for the association with sex were calculated. **RESULTS:** The table shows the frequency of right answers by sex.

Questions	Female (%)	Male (%)	OR
Understanding questions			
Is it important to eat more calories on more intensive training days?	56.7	65.5	0.68
Is it important to adjust the calories intake on rest days?	77.6	75.4	1.13
Do proper dietary recommendations benefit the athlete?	53.7	45.9	1.36
Is it important to eat fruits and vegetables as a source of vitamins and minerals?	7.4	14.7	0.46
Are dairy products sources of calcium and vitamin D?	74.6	80.3	0.72
Is water sufficient to replace all that is lost in sweat?	8.9	3.2	2.90
Is it important to eat in the first 45-60 minutes after training?	32.8*	8.1	5.47
Behaviour Questions			
I increase carbohydrate consumption before competitions	30.3	41.6	0.60
I try to consume a lot of protein regardless of origin	48.4	49.1	0.97
I have protein supplements prescriptions by qualified professionals.	59.7	70	0.63
I Take sports drink	70.1	77	0.70

*p<0,05 (female% >male%), OD = odds ratios

The only significant sex difference was the higher misunderstanding of males regarding the attitude towards the importance of eating after training. Depending on the questions, there was a large range in the % of adequate answers. **CONCLUSION:** A screening questionnaire, as used in the present study, may therefore guide to identify some specific aspects that deserve more focus in an educational intervention.

**2721 Board #182 May 29 9:30 AM - 11:00 AM
Validity And Reproducibility Of A Food Frequency Questionnaire To Assess Dietary Intake In Athletes**Kathryn L. Beck¹, Dayna Stockley¹, Cathryn A. Conlon¹, Pamela R. von Hurst¹, Rozanne Kruger¹, Helen T. O'Connor². ¹Massey University, Auckland, New Zealand. ²The University of Sydney, Sydney, Australia.

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Optimal nutrition is essential for athletes to maximise performance. Food frequency questionnaires (FFQs) are commonly used to assess habitual dietary intake as they are inexpensive, quick and easy to administer.

PURPOSE: To determine the relative validity and reproducibility of an athlete-specific FFQ for assessing food group intake in high performing athletes.

METHODS: Athletes (n=66), 16-35 years, from several sports competing at regional level or above completed a 129-item FFQ at baseline (FFQ1) and four weeks later (FFQ2) to assess reproducibility. An estimated 4DFR was completed between these assessments to determine FFQ1 validity. Agreement between methods was assessed using Wilcoxon signed rank tests, Spearman correlation coefficients, cross-classification and the weighted kappa statistic.

RESULTS: The FFQ overestimated intake for 17 of 28 food groups compared with the 4DFR (p<0.05). Correlations ranged from 0.11 (processed meats) to 0.78 (tea, coffee & hot chocolate), with a mean of 0.41. Correct classification of food groups into the same tertile ranged from 35.4% (starchy vegetables) to 55.5% (fats & oils). Misclassification into the opposite tertile ranged from 4.6% (legumes) to 15.4% (starchy vegetables; sauces & condiments). The weighted kappa demonstrated fair to moderate (k =0.21-0.60) agreement for most food groups. FFQ1 intake was significantly higher than from FFQ2 for 13 food groups (p<0.05). Reproducibility correlations ranged from 0.49 (potato chips; fats & oils) to 1.00 (tea, coffee & hot chocolate), with a mean of 0.65. Using tertiles, most (20 of 23 assessed) food groups had >50% of participants correctly classified and <10% grossly misclassified, and demonstrated moderate to good agreement (k=0.61-0.8).

CONCLUSIONS: The FFQ showed reasonable relative validity and good reproducibility for assessing food group intake in high performance athletes in New Zealand. The FFQ could be used in future research to assess athletes' food group intake.

**2722 Board #183 May 29 9:30 AM - 11:00 AM
Macronutrient Intake And Blood Markers Concentrations In Mexican University Athletes.**

Alma Melissa Rodriguez-Arellano, Sayra Nataly Muñoz-Rodríguez, Sergio Alejandro Copado-Aguila, Marisol Villegas-Balcazar, Alejandro Gaytan-Gonzalez, Juan Ricardo Lopez-Taylor. Universidad de Guadalajara, Guadalajara, Mexico.

(No relevant relationships reported)

PURPOSE: To analyze the association between the concentration of different blood markers and macronutrient intake by sex in university athletes.

METHODS: 242 (139 males, 103 females) athletes of different sports were evaluated on their food habits. We administered 24-hour dietary recalls of a training day by standardized staff. Then, we estimated the absolute (g/day) and relative (g/kg/day) macronutrient intake. Also, we obtained uric acid, urea, creatinine, cholesterol, triacylglycerides, glucose, hemoglobin, and hematocrit concentrations from blood analysis. We only analyzed the data of subjects who had their blood samples and dietary recall within a period of no more than 30 days apart. The analysis was divided by sex.

RESULTS: Subjects' age, body weight, and height were: 21.4 ±3.0 and 20.7 ±2.0 years, 73.6 ±14.1 and 61.7 ±11.6 kg; and 175.8 ±6.8 and 163.6 ±6.9 cm, for men and women respectively. For males, there were significant associations between relative (beta [95% CI], -0.328 [-0.037 to -0.619]; p = 0.027) and absolute (-0.005 [-0.001 to -0.009]; p = 0.027) protein intake and uric acid concentrations; similarly, absolute protein intake was significantly associated with lower creatinine concentrations (-0.014 [-0.001 to -0.027]; p = 0.031). For females, there was a significant association between relative carbohydrate intake and blood glucose (1.912 [0.259 to 3.566]; p = 0.024). No other significant association was found.

CONCLUSIONS: In this study, protein intake was associated with lower blood creatinine and uric acid concentrations in males, and carbohydrate intake with higher blood glucose concentrations in females.

**2723 Board #184 May 29 9:30 AM - 11:00 AM
Food Provision For Athletes At The Olympic Games: Current Challenges And Future Directions**

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(No relevant relationships reported)

Providing appropriate food for athletes at the Olympic Games is a significant undertaking for organizing committees and caterers, particularly with increasing demands by teams for individualized dietary requirements, and consideration of global issues such as sustainability. Despite evidence that teams want a culturally appropriate performance-based menu, there is significant variation in the delivery of food at each event. **PURPOSE:** The aim of this study was to explore the perceptions of key stakeholders on issues with appropriate food delivery at major competitions, and understand the barriers to an integrated approach to nutrition servicing.

METHODS: Using an exploratory case study design, 12 stakeholders (event organizers, catering management, service staff, senior chefs, food safety auditor, and dietitians) with previous experience in catering at major competitions were interviewed

using a semi-structured question format. Interviews were audio-recorded, transcribed and thematically analyzed, then mapped to the foodservice system framework using a logic model as per case study reporting.

RESULTS: There were 7 major themes that emerged from the data. 1) consumers expectations of food provision are increasing; 2) the menu needs improvement in design and delivery but is limited by the catering system; 3) early planning and integration of the nutrition service in the food program is important; 4) previous experience and training of staff minimizes challenges; 5) there is greater demand to cater for food allergens and intolerances, which increases the risk to stakeholders; 6) food provision is segregated between the village and venues, which impacts the efficiency of the system; and, 7) better technology for labeling and communication of the menu is essential. Barriers were reported as organizing committees' viewpoints, limited budget for catering, local food environment, poor understanding of nutrition expertise, and segregation of food delivery. Mapping using a systems approach demonstrated that change is needed to the food vision and catering tender, due to the disconnect between high level policy and operation.

CONCLUSIONS: Development of a framework for provision of nutritionally adequate, culturally suitable and safe food will ensure consistency for future competition events.

2724 Board #185 May 29 9:30 AM - 11:00 AM

Association Between Carbohydrate Intake And The Dental Caries Presence In University Athletes

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(No relevant relationships reported)

PURPOSE: To analyze the association between carbohydrate intake and consumption of sugar group servings with the presence of dental caries in college athletes.

METHODS: 159 (90 men, 69 women) college athletes from different sports were evaluated. 24-hour dietary recalls were administered to estimate the carbohydrate intake and the number of sugar servings consumed. In the same period, a dental evaluation was performed to determine oral health and possible dental injuries (specifically dental caries). Logistic regression analysis was performed to analyze the association between carbohydrate intake (g/day, g/kg/d, or categories as ≤3 g/kg/day, 3.1 to 5 g/kg/day, and > 5.0 g/kg/day), sugar group servings (sugar, honey, jam, jelly, sweet beverages) and the presence of dental caries.

RESULTS: 22 athletes (13.8%) presented dental caries. Carbohydrate intake was not significantly associated with dental caries when expressed in g/d (OR [95% CI], 1.00 [0.996 - 1.003]; p = 0.801), nor g/kg/d (0.992 [0.799 - 1.232]; p=0.943). The amount of sugar servings consumed was neither significantly associated with caries (1.010 [0.940 - 1.084]; p=0.793). In the analysis by carbohydrate categories (≤3 g/kg/day reference group) consuming 3.1 to 5 g/kg/day (0.779 [0.191 - 3.180]; p=0.728), neither >5.0 g/kg/day (1.3030 [0.487-3.484], p=0.598) were significantly associated with the presence of dental caries. Even after adjusting the model, there were no significant associations with carbohydrate and sugar servings with dental caries (Table 1).

CONCLUSIONS: Carbohydrate intake (expressed as g/d, g/kg/d, and categories) nor the number of sugar servings consumed were associated by themselves with the presence of dental caries. Further research is needed to elucidate if other non-dietary variables might modulate the association of carbohydrate intake and the presence of dental caries.

Table 1. Adjusted model analysis between carbohydrate intake and dental caries (n=159)

Model	Variables	OR	95% CI	p-value
1	Sugar servings	1.022	0.937 to 1.115	0.620
	CHO (g/d)	0.999	0.995 to 1.115	0.633
2	Sugar servings	1.014	0.935 to 1.100	0.736
	CHO (g/kg/d)	0.973	0.760 to 1.246	0.827
3	Sugar servings	1.012	0.937 to 1.093	0.760
	CHO (3.1 to 5 g/kg/d)	1.639	0.419 to 6.416	0.478
	CHO (>5 g/kg/d)	1.200	0.274 to 5.266	0.809

Adjusted model 3: ≤3 g/kg/day reference group.
CHO: Carbohydrates.

2725 Board #186 May 29 9:30 AM - 11:00 AM

Assessment Of Pre-season Body Composition, Meal Patterns, Food Choices And Preferences In NCAA Division 1 College Athletes

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(No relevant relationships reported)

The transition from high-school to college is typically associated with substantial changes in body composition, eating patterns, and food choices. **PURPOSE:** To assess pre-season body composition, eating patterns, food choices and preferences in Division I NCAA college athletes. **METHODS:** 118 incoming first-year athletes (males: n=69, BMI 25.5±5.5 kg/m2; females: n=49, BMI 22.3±2.7 kg/m2) from basketball, football, soccer, lacrosse, cross-country and tennis teams were recruited. Meal Patterns (MPQ), Food Preferences (FPQ) and Food Choices (FCQ) Questionnaires were used to assess eating patterns, factors that influence food choices and preferences. Body composition was assessed using dual energy x-ray absorptiometry (DXA) for lean body mass (LBM), fat mass (FM) and body fat % (BF%). A two-way ANOVA was used for analysis with significance accepted at p<0.05. **RESULTS:** Evening (86.2%) and lunch (66.1%) meals were the most frequently consumed meals followed by breakfast (52.5%) and evening snacks (21.2%). Nocturnal eating (eating during the night after having been to sleep) was the least common form of eating (31.4%). There was no significant difference observed in FPQ and FCQ between genders (p>0.05). However, a significant difference was observed in the importance of food for weight control (p=0.02), preference for vegetables (p=0.03) and starches (p=0.02) among sports. In addition, significant body composition differences were observed between males and females (FM: 13.4±10.9 kg and 17.0±7.3 kg, LBM: 67.5±9.0 kg and 44.8±5.3 kg, BF%: 14.8±8.4% and 26.7±7.3 %, p<0.001, respectively) and among sports (p<0.001). **CONCLUSIONS:** Certain eating patterns, such as skipping breakfast or lunch meals, may be detrimental to the maintenance of appropriate body composition in their sport. In addition, athletes in the endurance sports had higher preference for starches and based their food choices on the need to control weight.

2726 Board #187 May 29 9:30 AM - 11:00 AM

A Novel Tool For Understanding Factors That Can Influence The Food Choices Of High-performance Athletes.

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(No relevant relationships reported)

There are many facets that can influence the foods athletes choose and thus impact on achieving optimal nutrition, hydration, body composition goals and gut comfort. Despite this there are a limited number of studies exploring these determinants in athletes and no validated tool for understanding athlete food choices. **PURPOSE:** This research aimed to develop and validate an Athlete Food Choice Questionnaire (AFCQ) to determine the key factors influencing food choice in an international cohort of athletes. **METHODS:** A preliminary questionnaire containing 84 items on a 5-point frequency scale was developed and used to collect the first sample from athletes at the 2017 Universiade, Taiwan. Principal Component Analysis (PCA) was conducted on this sample to identify key factors and develop the AFCQ. A second sample was collected using the AFCQ at the 2018 Commonwealth Games, Australia. The second sample was analysed via Confirmatory Factor Analysis (CFA) to validate the factorial structure. Descriptive analysis of the combined samples was used to examine the AFCQ sensitivity in detecting differences in factor ratings between athlete cohorts. **RESULTS:** Sample one (n=156) contained athletes from 31 countries and 17 sports. The PCA extracted 36 questionnaire items organised into nine factors explaining 68.0% of variation. Sample two (n=232) contained athletes from 45 countries and 20 sports. The final model confirmed the nine constructs from the PCA, these were: 'nutritional attributes of the food', 'emotional influences', 'food and health awareness', 'influence of others', 'usual eating practices', 'weight control', 'food values and beliefs', 'sensory appeal' and 'performance'. The CFA resulted in a good model fit ($\chi^2=685.2$, $df=428$, $\chi^2/df=1.60$, $p < 0.01$) with the removal of four items, reducing the number of items to three per factor. The AFCQ was successful in distinguishing differences between factor ratings across demographic characteristics including gender, athlete caliber and sporting type. **CONCLUSION:** Simple enough to be utilised with athletes from a diverse range of sports, this new tool will enable researchers and sports dietitians to better tailor nutrition education and dietary interventions to suit the individual or team.

2727 Board #188 May 29 9:30 AM - 11:00 AM

Omega-3 Index Associated With Dietary Intake In NCAA Division 1 Collegiate Women Soccer Athletes

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Docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) omega-3 fatty acids are essential nutrients in supporting overall health. Omega-3 Index, a percentage of total fatty acids, is the sum of erythrocyte membrane DHA and EPA. This description of erythrocyte DHA+EPA is a standard measure of nutrient status. Previous research in NCAA Division 1 American football athletes (n=404) report mean Omega-3 Index was $4.4\% \pm 0.8\%$ suggesting an omega-3 deficient status. Dietary habits can influence omega-3 status. Food frequency questionnaires (FFQ) are often utilized to represent DHA and EPA intake habits from reported dietary recalls. Recently, in pregnant women, an abbreviated 7-question FFQ assessing DHA and EPA intake was correlated with Omega-3 Index. However, its potential utility in female athletes has not been explored. Also, Omega-3 Index is unknown in women collegiate athletes. **PURPOSE:** To measure Omega-3 Index and assess dietary DHA and EPA intake using an abbreviated 7-question FFQ on a NCAA Division 1 collegiate women's soccer team as well as investigate the association between respective measures. **METHODS:** 24 women soccer athletes, pre-season, completed abbreviated FFQ and provided Omega-3 Index blood collection sample. One drop of whole blood from a finger stick was collected by research group and analyzed by OmegaQuant Analytics, LLC (Sioux Falls, SD). Means and standard deviations were computed. Pearson correlations between Omega-3 Index and FFQ were determined. **RESULTS:** The mean Omega-3 index among all athletes was $4.3\% \pm 0.6\%$. Mean FFQ DHA and EPA intake was $84\text{mg/d} \pm 61\text{mg}$ and $49\text{mg/d} \pm 37\text{mg}$ respectively. The abbreviated FFQ was moderately correlated with Omega-3 Index ($r=0.487$, $p=0.016$). **CONCLUSIONS:** Division 1 women soccer athletes' Omega-3 Index are like previously reported American football athletes indicating a possible deficiency. Also, the abbreviated FFQ was correlated to Omega-3 Index suggesting it to be a possible predictor of omega-3 nutrient status in an athlete population. Lastly, these reported Omega-3 Index and FFQ findings in women soccer athletes suggest inadequate dietary intake of DHA and EPA to support overall health.

2728 Board #189 May 29 9:30 AM - 11:00 AM

NUTRITION KNOWLEDGE AND SELF-REPORTED CONFIDENCE IN THAT KNOWLEDGE AMONG DIVISION II ATHLETES

Brian P. Reagan, Christa Parkes, Riggs Klika, FACSM, Nathan Eckert. *University of Indianapolis, Indianapolis, IN.* (Sponsor: Dr. Riggs Klika, FACSM)
(No relevant relationships reported)

NUTRITION KNOWLEDGE AND SELF-REPORTED CONFIDENCE IN THAT KNOWLEDGE AMONG DIVISION II ATHLETES.

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Limited nutrition knowledge (NK) with high confidence is frequently reported among athletes. Overconfidence in false information increases poor nutrition behaviors and sharing of inaccurate nutrition information. **PURPOSE:** We hypothesized that NCAA Division II (DII) athletes will present limited NK (below 80% criterion) while reporting high confidence levels in four categories: (1) carbohydrates (CHO), (2) fats, (3) protein (PRO) and (4) weight management (WM). **METHODS:** All subjects signed informed consent and completed a modified Macronutrient and Energy Metabolism Survey (MEMS) via Qualtrics in a designated computer lab. Participants (N = 168) reported their confidence level based on their survey answers (39 total questions) using a Likert scale (1- 4): (1) not at all sure, (2) not sure, (3) somewhat sure, (4) very sure. Descriptive statistics were calculated with Spearman rank correlation coefficients between variables (e.g. correct vs. incorrect per category). **RESULTS:** Student athletes (n = 88 males, n = 80 females) completed the MEMS survey (return rate = 36%). Athletes lacked NK: mean score of 17/39 (43.5%) correct. The mean correct scores were 42% for fats, 41% for CHO, 41% for PRO, and 51% for WM. Also, a trend in overconfidence existed; for example individuals with incorrect responses for CHO, 65% felt at least (3) somewhat sure. Secondary analysis included a Spearman's rho correlation that resulted in a significant ($p = 0.05$) but weak negative correlation between response "correctness" and confidence level within each category: Fats ($r_s[1680] = -0.06$), CHO ($r_s[1680] = -0.2$), PRO ($r_s[1680] = -0.14$), and WM ($r_s[1512] = -0.23$). **CONCLUSION:** The results suggest that DII athletes lack NK and have relatively high confidence in misinformation. This study identifies an opportunity for intervention using Registered Dietitians to educate athletes about nutritional basics and raise awareness of respective misinformation.

2729 Board #190 May 29 9:30 AM - 11:00 AM

Dietary Intake Patterns And Risk Of Energy Deficiency In Ncaa Endurance Athletes

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PURPOSE: This study assessed dietary intake patterns among elite collegiate runners administered through a one-on-one counseling session with the team sports dietitian. **METHODS:** During the Fall sports seasons of 2015 to 2018, endurance runners from two NCAA Division I Cross-Country teams were asked to participate in a prospective study that focused on optimizing the health of the athletes. A 15 to 30-minute nutritional assessment involving the team sports dietitian was conducted. Runners in the current sample were non-injured. In the one-on-one nutrition counseling session, a standardized assessment evaluated the runner's dietary intake patterns and nutritional risks. Data was analyzed using chi-square and independent-samples t-tests. **RESULTS:** Final analyses yielded data from 158 male and female runners (47.1% male; 52.9% female), averaging 66.2 ± 2.1 (males) and 49.0 ± 9.4 (females) miles per week. A total of 23.4% of runners reported not eating for >4 hours on 4 or more days of the week, while 92.4% reported eating within 30 minutes upon completing exercise. Average meals/day and snacks/day among the sample were 2.9 ± 0.50 and 2.6 ± 1.1 , respectively. Females, compared to males, were more likely to report eating <3 meals per day (23.2% of females vs. 2.7% of males, $X^2 = 13.8$, $p < 0.001$), following a vegetarian or vegan diet (6.3% of females vs. 0% of males, $X^2 = 4.7$, $p = 0.03$), avoiding a food component or food group (31.6% of females vs. 11.0% of males, $X^2 = 9.6$, $p = 0.002$); Based on the one-on-one meeting/nutrition assessment, the sports RD noted higher proportion of female runners with an energy deficiency risk. (48.1% of female vs. 19.7% of males, $X^2 = 12.1$, $p < 0.001$). **CONCLUSIONS:** Most elite endurance runners reported eating a post-workout snack, which may aid in recovery efforts. As more females reported eating <3 meals per day it is recommended that females avoid skipping meals to reduce risk of energy deficiency and subsequent potential consequences to health and performance.

2730 Board #191 May 29 9:30 AM - 11:00 AM

Validation Of A Sports Nutrition Knowledge Questionnaire For Athletes In The United Kingdom And Ireland

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PURPOSE: This study aimed to establish validity of an Australian/New Zealand developed sports nutrition knowledge questionnaire, Platform to Evaluate Athlete Knowledge in Sports-Nutrition Questionnaire (PEAKS-NQ) for use in United Kingdom and Irish (UK-I) athletes. **METHODS:** To confirm content validity, a convenience sample (n=16) of sports nutritionists (SN) from elite, UK-I sports institutes provided feedback on the PEAKS-NQ via a modified Delphi method. After minor changes, the UK-I version of the PEAKS-NQ (section A: demographics; sections B-F knowledge domains; max score 113 points) was administered via weblink to a convenience sample of UK-I SN recruited from the British Dietetic Association Senior Exercise and Nutrition Register, and elite athletes (EA) training at elite sports institutes in the UK-I. SN scores were the benchmark informing instrument construct validity. Cronbach's alpha (good ≥ 0.7) established internal consistency. Independent t-tests or non-parametric tests were conducted as appropriate. Results are reported as mean \pm SD, proportions and effect size (ES). **RESULTS:** SN achieved greater overall (SN (n=23): $92.3 \pm 9.3\%$ vs EA (n=154): $71.4 \pm 10.0\%$; ES: 2.1; $p < 0.0005$) and individual section scores ($p < 0.0005$) except section B ($p = 0.072$). Sub-section scores were as follows; Section B-Food groups (SN: $95.7 \pm 5.6\%$, EA: $91.5 \pm 7.8\%$), Section C-Nutrients (SN: $92.5 \pm 4.1\%$, EA: $76.3 \pm 9.5\%$), Section D-Applied Sports Nutrition (SN: $88.5 \pm 8.9\%$, EA: $56.7 \pm 14.5\%$), Section E-Competition Nutrition (SN: $88.6 \pm 5\%$, EA: $62.3 \pm 15.8\%$), Section F-Supplements and Sports Nutrition Concerns (SN: $92.3 \pm 9.3\%$, EA: $73.5 \pm 20.5\%$). Largest knowledge

differences between SN and EA were in section D. Sex, education level and sport type (endurance, high intensity/intermittent) did not independently influence EA total score. Instrument overall Cronbach's alpha (0.82) was good.

CONCLUSIONS: This study confirms content and construct validity of the PEAKS-NQ for assessing sports nutrition knowledge in UK-I athletes.

2731 Board #192 May 29 9:30 AM - 11:00 AM
Development And Validation Of An Electronic Sports Nutrition Knowledge Questionnaire For Athletes
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PURPOSE: Reliable assessment of sports nutrition knowledge (SNK) would help inform athlete nutrition education to address knowledge gaps. Electronic assessment is an accessible option able to provide immediate feedback. The aim of the study was to validate an electronic SNK assessment tool - Platform to Evaluate Athlete Knowledge of Sports Nutrition Questionnaire (PEAKS-NQ).

METHODS: PEAKS-NQ was informed by focus groups with sports nutritionists (n=16) from elite sports institutes in Australia and New Zealand (NZ) with content validity established via a modified Delphi Process. The PEAKS-NQ captured demographics (Section A) and assessed SNK across 5 domains (Sections B-F; max score 113 points). PEAKS-NQ was deployed to 92 developmental (junior) athletes (DA) in NZ, with a subset (n=50) invited to complete a re-test to evaluate reliability. To establish construct validity via the known groups method, 255 accredited sports dietitians (ASD) were invited to complete PEAKS-NQ. Score differences between DA and ASD were analysed using independent t or non-parametric tests. Reliability and internal consistency were evaluated using Sign Tests and Cronbach's α (good = ≥ 0.8) respectively. Results are reported as mean \pm SD.

RESULTS: DA (n=88) were 17.6 \pm 1.4y, 61.4% female, and mostly in high school (94.3%). ASD (n=45) were 37.8 \pm 7.6y, 82.2% female, with >5 years of dietetic experience (59.1%). ASD scored higher in all sections and overall (91.5 \pm 3.4%) compared to DA (67.1 \pm 10.5%) (p<0.001). Both DA and ASD scored best on Section B - Food groups (87.1 \pm 8.5 v 98.5 \pm 3.5%, p<0.001) and lowest on Section D - Applied Sports Nutrition (51.1 \pm 13.8 v 86.7 \pm 10.0%, p<0.001). In DA, there were no section or overall differences between re-tests (n=18; p=0.14). Overall Cronbach's α was good (0.86). Overall median completion time was 24 minutes.

CONCLUSIONS: PEAKS-NQ is a valid and reliable instrument for assessing SNK in athletes. A final stage of testing with more athletes will assist in establishing score ranges and factors influencing SNK.

2732 Board #193 May 29 9:30 AM - 11:00 AM
Plasma Nutritional Markers From Brazilian Olympic Athletes
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Plasma Nutritional Markers from Brazilian Olympic Athletes
 Nutritional approach of athletes are still challenging in spite of progress on training issues. Training log and metabolic demands require specific strategies involving dietary pattern and supplementation, looking at clinical and injury issues. Nutrition biochemistry markers may guide specific approaches for optimizing health and enhance performance.

Purpose: The present study analyzed nutritional plasma biomarkers of Brazilian Olympic athletes at the moment they were called prior to the Olympic Summer Games - London 2012 and Rio 2016 (Judo, Boxing, Rowing, Canoeing, Synchronized Swimmers - 9 were medalists).

Methods: Fasting blood samples were taken from 69 athletes (21 males and 48 females; 23 \pm 7 years). The plasma was analyzed for Glucose (Glu), Insulin (Ins), Triglycerides (TG), Cholesterol (CT), HDL-c, LDL-c, Albumin (Alb), Osmolality (Osm) and Calcium (Ca). Whole blood was assayed for Haemoglobin (Hb) and used for Mean Corpuscular Volume (MCV) calculation. Values were expressed as Mean \pm standard deviation.

Results: Mean values were 67 \pm 9mg.dL⁻¹ (Glu - normal range: 70-100mg.dL⁻¹), 7.6 \pm 2.1mIU.L⁻¹ (Ins - 2-25mIU.L⁻¹), 84.7 \pm 17mg.dL⁻¹ (TG - <150mg.dL⁻¹); 173 \pm 13 mg.dL⁻¹ (CT - normal range: <200mg.dL⁻¹), 61 \pm 7 mg.dL⁻¹ (HDL-c - normal >40mg.dL⁻¹), and 94 \pm 2mg.dL⁻¹ (LDL-c - normal <130mg.dL⁻¹), Hb 14.4 \pm 3g.dL⁻¹ (normal range:

11.5-17.5g.dL⁻¹), MCV 87 \pm 6 fl (80-96fl); Alb 4.8 \pm 1.1g.dL⁻¹ (normal range: 3.5-5.5g.dL⁻¹) and Ca 9.8 \pm 2mg.dL⁻¹ (normal range: 8.5-10.2mg.dL⁻¹). Osmolality mean value was 293 \pm 52mmol.kg⁻¹ (normal range: 275-295mmol.kg⁻¹).

Conclusion: Besides all but glucose are within normal values, the haematological levels might be considered as target for some micronutrients supplementation. Similarly the found Osm would signal for additional hydration requirements. Nutritional requirements are specific due metabolic demand according to training log. Matching dietary pattern and supplementation aspects is challenging and should consider clinical as well as performance issues.

2733 Board #194 May 29 9:30 AM - 11:00 AM
Abstract Withdrawn

2734 Board #195 May 29 9:30 AM - 11:00 AM
Association Of Adequate Carbohydrate And Protein Intake And Maximal Dynamic Strength In University Athletes

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 (No relevant relationships reported)

PURPOSE: To analyze the association between adequate carbohydrate and protein intake with the maximal dynamic strength in bench press and deadlift in university athletes.

METHODS: 30 male college (soccer and fast-soccer) athletes were evaluated. A 24-h dietary recall was administered to determine the macronutrient intake. Carbohydrate (CHO) and protein (PRO) intake were calculated and adjusted for body mass (g/kg/day). Consumption was classified as "adequate" if the athlete consumed the minimum amounts recommended for each macronutrient: 5 g/kg/day of CHO, 1.2 g/kg/day of PRO. Bench press and deadlift one repetition (1RM) tests were performed to determine the maximal dynamic strength. 1RM was adjusted for body mass (kg lifted/kg body mass). The association between macronutrient intake and 1RM was tested with linear regression. A sub-analysis was performed with the subject's categorization according to their CHO and PRO adequacy.

RESULTS: Neither g/d nor g/kg/d of CHO nor PRO were significantly associated with 1RM bench press nor deadlift. When participants were selected for their CHO (n=18) and PRO (n=29) adequacy there were no significant associations between CHO with 1RM of bench press (p = 0.763) and deadlift (p = 0.397). PRO showed the same pattern with no significant associations with bench press (p = 0.595) and deadlift (p = 0.912).

CONCLUSIONS: No association was observed between the adequate carbohydrate and protein intake with the 1RM of bench press and deadlift in university soccer players.

	Bench press		Deadlift	
	b (95% CI)	p-value	b (95% CI)	p-value
Protein (g/kg/d)	0.075 (-3.874 to 5.652)	0.704	0.023 (-7.154 to 8.036)	0.906
Protein (g/d)	0.145 (-0.430 to 0.920)	0.461	0.130 (-0.750 to 0.147)	0.511
Carbohydrate (g/kg/d)	0.176 (-1.438 to 3.731)	0.370	0.101 (-3.084 to 5.147)	0.611
Carbohydrate (g/d)	0.255 (-0.110 to 0.540)	0.191	0.233 (-0.220 to 0.086)	0.234

2735 Board #196 May 29 9:30 AM - 11:00 AM
Iron Status And Perceived Fatigue And Recovery Across A Cross-country Season In Collegiate Runners
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Iron depletion, with or without anemia, is of concern to endurance athletes given increased iron loss risk factors such as sweating, foot strike hemolysis, menstrual blood loss, and gastrointestinal bleeding. However, little is known regarding the impact of training volume on iron status, fatigue, and recovery in endurance athletes.
PURPOSE: To observe iron status and its subsequent effects on aerobic capacity and perceived fatigue and recovery in distance runners over a cross-country season.

METHODS: Male (n=10, age 19±1 yr, height 179±4 cm, weight 67±7 kg) and female (n=4, age 20±1.5 yr, height 164±6 cm, weight 57±3 kg) division II collegiate cross-country runners completed a complete blood count, ferritin level, maximal oxygen uptake test (VO_{2max}), and a three-day food record pre-season (August 2019) and post-season (November 2019). Survey data regarding average weekly mileage, fatigue (visual analog scale, 0-100 mm), and recovery (scale from 0, very poorly recovered - 10, very well recovered) were taken at baseline then monthly for a total of four assessments. **RESULTS:** Pre-season hemoglobin concentrations were 15.6±0.8 g/dl (males), 13.7±0.3 g/dl (females), and ferritin levels were 67.4±25.7 ng/ml (males), 56.8±44.4 ng/ml (females). Pre-season VO_{2max} was 64.1±2.4 ml·kg⁻¹·min⁻¹ for males and 52.6±2.9 ml·kg⁻¹·min⁻¹ for females. Weekly mileage remained similar across pre-season (51±17 mi), month 1 (56±7 mi), and month 2 (53±7 mi). Perceived fatigue increased significantly from pre-season (26±9 mm) to month one (59±15 mm) ($p < 0.001$), then decreased at month two (50±22 mm, $p = 0.23$). Perception of recovery decreased significantly from pre-season (7±1) to month one (5±2) ($p < 0.05$), then increased at month two (6±2, $p = 0.45$). Post-season iron status and VO_{2max} data will be evaluated following season completion. **CONCLUSIONS:** Relationships between iron status, VO_{2max} , and perceived fatigue and recovery will be assessed following completion of the competitive season.

2736 Board #197 May 29 9:30 AM - 11:00 AM
Analysis Of Dietary Influence On Crossover Point In Combat Athletes And Runners

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Crossover point describes the moment during exercise that an athlete transitions from fat to carbohydrate for energy. There is limited research on sport specific differences, especially in Combat Athletes. Additionally, there is a need to understand the influence of diet on crossover point in an effort to optimize performance. **PURPOSE:** To evaluate if differences in crossover point exist between two sport types during a submaximal exercise test, and if an acute dietary intervention, 30 minutes before exercise, can influence crossover point. **METHODS:** Five male athletes (29.8 ± 6.3 years of age, 82.5 ± 8.9 kilograms, 174.7 ± 7.6 centimeters) were measured for respiratory exchange ratio during a submaximal exercise treadmill test under a fasted (FAST) condition, a fat-fed condition (FAT), and a carbohydrate-fed condition (CHO). Descriptive statistics determined average time, heart rate and percentage of maximal oxygen consumption (VO_{2max}). We used a Mann Whitney U test to denote differences between Combat Athletes and Runners, and Friedman's test to denote differences across dietary conditions. **RESULTS:** Combat Athletes (n=3) and Runners (n=2) achieved crossover at 12:20 ± 02:55 minutes (min) and 23:30 min ± 00:42 seconds (sec), respectively, with no significant differences between sport types ($p > 0.05$). All athletes achieved crossover at 16:48 ± 6:28 min, 59.5 ± 27.6% VO_{2max} at a heart rate of 124±19.5 beats per minute (bpm) during FAST. Under FAT, all athletes achieved crossover at 15:36 ± 5:53 min, 54.2 ± 17.7% VO_{2max} , and 122 ± 16 bpm. Under CHO, all athletes achieved crossover at 8:12 ± 02:27 min, 37.2 ± 13.5% VO_{2max} , and 95.6 ± 7.1 bpm. We found significant differences in time to crossover across dietary conditions ($p = 0.022$). **CONCLUSIONS:** Although we did not find differences in crossover points between sports, we did find differences among dietary conditions. It appears that CHO may dictate an earlier use of carbohydrate, while FAT did not increase reliance on fat. Future studies should seek to replicate our findings with a larger sample of athletes with parametric analyses to elucidate mechanisms of acute feeding on crossover differences across sport type. This study was not funded

2737 Board #198 May 29 9:30 AM - 11:00 AM
Exercise And Diet On Muscle Strength And Body Composition In College Freshmen Composition In College Freshmen

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Freshman often experience body changes upon entering college, but how do different exercise habits and diet patterns influence their physical outcomes? **PURPOSE:** To examine the differences in basic body characteristics and fitness levels based on exercise habits and diet pattern in college freshmen. **Methods:** The sample consisted of 103 college freshmen who completed measurements of body weight (BW), height, percent body fat (%BF), and physical fitness components including muscular strength (hand grip), flexibility, agility, and endurance. Exercise habits and diet patterns were surveyed. Total calorie consumption as well as carbohydrate, fat, and protein intakes were evaluated based on three-day dietary recall logs using computer software (Diet

Power, Inc., Danbury, CT). Participants were divided into exercise (EX; n=60) and no exercise (NE; n=43) groups based on current involvement of regular exercise. They were also categorized into eating less than two meals (LM; n=58) or three meals or more per day (TM; n=45). Descriptive results are expressed as means and standard deviation. Independent t-tests were used to compare group differences (EX vs. NE, LM vs. TM) on all variables. **Results:** Of the 103 participants, 27.4% were male and 72.6% were female. The participants in EX group (56.6%) had significantly higher muscular strength (29.17 ± 9.14 vs. 24.87 ± 6.14 (kg), $p = .007$) and lower %BF (31.59 ± 11.13 vs. 36.71 ± 10.34, $p = .017$) than participants in NE group. Interestingly, there was no significant difference in body weight between the two exercise groups. Participants in TM group (42.9%) had significantly higher muscular strength (30.51 ± 9.33 vs. 27.27 ± 7.07 (kg), $p < 0.05$) and height (1.66 ± 0.093 vs. 1.62 ± 0.079 (m), $p < 0.05$) than participants in LM group (57.1%). Participants in TM also had significantly higher total calorie consumption (4,005 ± 1,647.48 vs. 3,462 ± 1,091 (Kcal), $p < 0.05$), protein (703.56 ± 272.26 vs. 597.18 ± 261.75 (Kcal), $p < 0.05$), and fat intakes (1,579 ± 772.46 vs. 1,345 ± 496.02 (Kcal), $p < 0.05$) compared to the values in NM but not carbohydrate intake. **Conclusion:** This study shows that engaging in regular exercise is related to greater muscular strength and lower percent body fat, while consuming three meals per day is related to greater muscular strength and higher calorie intake in college freshmen.

2738 Board #199 May 29 9:30 AM - 11:00 AM
Examination Of Nutritional Intake Among University Marching Band Artists

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 (No relevant relationships reported)

Marching band (MB) artists (musicians and auxiliaries) have similar energy needs to those of athletes, based on the physical demands of performances. However, MB artists may lack knowledge of the recommendations for nutritional intake for active individuals. **Purpose:** To examine energy intake and Macronutrient (protein [PRO], carbohydrate [CHO], fats) intake compared to the nutritional recommendations in MB artists. **Methods:** We utilized data from a larger cross-sectional study. MB artists (n=37, Males: n=12, age: 19.8±1.4 years, height: 177.1±7.8 cm, weight: 74.6±23.8 kg; Females: n=25, age: 20.0±1.1 years, weight: 68.4±16.4 kg; height: 163.3±4.6 cm; from an NCAA Division I institution completed a survey (eg, basic demographics, band background, etc.) and were measured for height, weight, body composition, and resting metabolic rate (RMR). They participated in marching rehearsals for minimally 1.5 hours per day and completed a 7-day online dietary log to measure energy intake (EI). Basic descriptive statistics examined the proportion of participants who met nutritional recommendations. Independent samples t-test were used to compare between genders. Chi square were used to determine intake compared to recommendations. **Results:** MB artists demonstrated RMR and EI for males and females respectively; (2090.2±676.6 kcal, 1580.8±374.0 kcal) and (1531.0±460.7 kcal, 1258.0± 226.1 kcal). Significant differences were found when comparing gender and consumption of all macronutrients with Males consuming greater amounts than females; PRO: (94.7±39.1 g vs 60.3±23.2 g, $p = 0.002$), CHO: (249.7±80.4 g vs 193.7±73.1 g, $p = 0.042$), and fats: (80.9±32.3 g vs 57.7±16.4 g, $p = 0.006$). No significant differences were found between gender and nutritional recommendations for PROs, CHOs, and fats. However, 64.9% (n=24) and 94.6% (n=35) reported under consuming PROs and CHOs, while 43.2% (n=16) overconsumed fats. **Conclusion:** Overall, MB artist may be at risk for inadequate nutritional intake. With the physical demands associated with MB, it is recommended that MB artist be viewed as athletes. Therefore, healthcare professionals, such as athletic trainers, should provide resources and education on energy needs, proper fueling and adequate amounts of macronutrient intake.

2739 Board #200 May 29 9:30 AM - 11:00 AM
Dietary Restrictions To Mitigate Gastrointestinal Symptoms In Runners

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Endurance runners frequently experience exercise-induced gastrointestinal symptoms, which can negatively impact their performance. As such, food choices pre-exercise have a significant impact on the gut's tolerance to running, yet little guidance is available. **PURPOSE:** Assess pre-race dietary intakes of runners to determine which foods and beverages are consumed and avoided and determine the most common gastrointestinal symptoms in runners who participate in races. **METHODS:** A questionnaire designed to assess dietary restrictions pre-race and gastrointestinal symptoms experienced during racing was administered to 388 runners (n=44% male). Fisher's exact tests determined differences in gender, age, performance level,

and distance with follow-up multivariable logistic regression modeling. **RESULTS:** Runners regularly avoided meat (32%), milk products (31%), seafood (28%), poultry (24%), and high-fiber foods (23%). Caffeinated beverages were commonly avoided in events 10 km or less ($p < .001$); whereas, in females, increased running distance was a predictor of avoiding high fiber foods ($OR = 6.7$; 95% $CI = 1.6-28.5$). Rates of food avoidance were elevated in younger and more competitive runners. Common gastrointestinal symptoms included stomach (42%), intestinal (23%), side ache/stitch (22%), urge to defecate (22%), and bloating (20%). The prevalence of gastrointestinal symptoms was higher in younger athletes, especially females, which may explain their propensity to avoid foods. Lower recreational athletes were the least likely to report gastrointestinal symptoms. Diarrhea increased with running distance. **CONCLUSIONS:** Identification of voluntary food restrictions in the pre-running meal highlights trends, which can be explored to develop dietary recommendations. Supported by the Mount Royal University Innovation Grant.

2740 Board #201 May 29 9:30 AM - 11:00 AM
The Influence Of Macronutrient Intake And Body Composition On Biomarkers In Female Ballet Dancers

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Low body fat percentage (%BF) and caloric intake may be associated with hormonal disruptions and adverse health effects in athletes. **PURPOSE:** The purpose of this study was to assess relationships between body composition (BC), dietary intake, and hormonal disruptions in female ballet dancers with self-reported oligomenorrhea. **METHODS:** Female ballet dancers ($N=7$; $M_{age} = 15.8 \pm 1.4$ y; $M_{BMI} = 18.8 \pm 1.5$ kg/m²) underwent BC testing to determine %BF and fat-free mass (FFM). Blood was drawn and analyzed for lipids (total cholesterol [TC], LDL, HDL, triglycerides [TG]), thyroid markers (thyroid-stimulating hormone [TSH], T₃, T₄), and adipokines (leptin [LEP], adiponectin [APN]). Five-day diet logs were recorded to determine energy (kcal) and macronutrient (CHO, PRO, fat) intake relative to body mass (kg). Pearson product correlations (r) were used to determine relationships between BC, biomarkers, and diet. Significance was set at $P < 0.05$. **RESULTS:** While BC did not significantly correlate with lipid markers, FFM correlated with T₃ ($r = -0.85$; $P < 0.05$), and the relationship with APN trended towards significance ($r = 0.93$; $P = 0.07$). Kcal/kg was positively correlated with TC ($r = 0.82$), and CHO/kg positively correlated with TG ($r = 0.91$) ($P < 0.05$). Correlations between CHO/kg and both LEP ($r = 0.83$) and APN ($r = -0.93$) approached significance ($P < 0.10$), while PRO/kg negatively correlated with TSH ($r = -0.91$; $P < 0.01$). Fat/kg correlated positively with TC ($r = 0.76$; $P < 0.05$), and correlations with LDL ($r = 0.59$) and T₄ ($r = -0.67$) approached significance ($P < 0.10$). **CONCLUSION:** Energy and macronutrient intake, rather than BC measures, appear to have greater associations to blood lipid levels, indicating dietary intake may play a larger role in augmenting lipid status and metabolism in this population. Additionally, increased PRO intake may play a unique role in overall metabolic status, suggested by the negative correlations with TSH. However, more research is needed to determine the influences of both energy intake and BC on menstrual status in this population. These findings warrant future investigations into dietary interventions designed to improve overall metabolism and health in ballerinas. Funding provided by Quest Diagnostics.

2741 Board #202 May 29 9:30 AM - 11:00 AM
Food Accessibility And Eating Patterns In Elite Collegiate Endurance Runners

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PURPOSE: This study aimed to evaluate factors relating to food accessibility and eating patterns among elite collegiate endurance runners. **METHODS:** From Fall 2015-2018, runners from two NCAA Division I Cross-Country teams were invited to participate in a study designed to optimize the health of endurance runners. All runners were non-injured and training regularly. The runners met with a team sports dietitian for a 15 to 30-minute counseling appointment. In these sessions, the dietitians conducted a standardized assessment to evaluate any outcomes relating to food

accessibility and eating patterns among collegiate endurance runners. **RESULTS:** The sample size involved 158 NCAA Division I collegiate athletes (47.1% male; 52.9% female). Runners reported training an average mileage of 66.2 ± 2.1 (males) and 49.0 ± 9.4 (females) miles per week. A total of 120 (79.5%) runners reported living in the dorms; 34.2% ($n=54$) reported no access to a kitchen; 3.8% ($n=6$) reported no access to a microwave or refrigerator; 2.5% ($n=4$) reported no access to a kitchen, microwave, or refrigerator. A higher proportion of runners without access to a kitchen reported eating < 3 meals per day (22.2% vs. 9.6% , $X^2 = 4.7$, $p = 0.03$). Runners living in the dorms ($n=120$) vs. those not living in the dorms ($n=31$) reported eating fewer meals per day, 2.9 ± 0.5 vs. 3.1 ± 0.5 , $p = 0.04$ and fewer snacks per day, 2.5 ± 1.1 vs. 2.9 ± 0.9 , $p = 0.05$. **CONCLUSIONS:** Collegiate runners living in the dorms and those without access to a kitchen reported consuming fewer meals and/or snacks per day. This may increase their risk of energy and nutrient deficits.

2742 Board #203 May 29 9:30 AM - 11:00 AM
ASSOCIATION BETWEEN DIET, PERFORMANCE, AND HORMONAL CHANGES IN DIVISION I MALE SOCCER PLAYERS

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PURPOSE: The condensed preseason and match fixture in collegiate soccer impacts hormonal status, though the role of diet on this response is less studied. The purpose of this study was to assess athlete adherence to diet logs and determine relationships between diet and hormonal changes in collegiate soccer players. **METHODS:** Male collegiate soccer players ($N=22$) participated in preseason testing to assess body composition (%BF, FFM) and VO₂max. Energy expenditure (EEE) was measured during all on-field activities via heart rate monitoring. Blood draws were conducted during preseason and 45 d later for analysis of leptin (LEP), thyroid hormones (TSH, T₃, T₄), free cortisol (CORT), free testosterone (TEST), and IGF-1. Two 3-day diet logs were completed 21 d apart. Pearson product correlations and hierarchical regression were used to assess relationships between performance, diet, and biomarkers at $\alpha = 0.05$. **RESULTS:** Four (18.2%) participants completed all six days of diet logs. As such, individuals who completed ≥ 3 d were included in dietary analyses ($n=9$). %BF negatively correlated with Δ TSH ($r = -0.47$, $P = 0.04$). Protein intake correlated positively with FFM ($r = 0.75$, $P = 0.02$) and negatively with Δ LEP ($r = -0.74$, $P = 0.02$) and Δ TSH ($r = -0.74$). Moderate correlations were seen between Δ LEP and Δ IGF-1 ($r = 0.41$, $P = 0.04$) and Δ CORT and Δ TEST ($r = 0.41$, $P = 0.03$). When controlling for EEE, protein intake accounted for variance in Δ LEP ($R^2 = 0.51$; $P = 0.04$) and Δ TSH ($R^2 = 0.60$; $P = 0.02$), and FFM accounted for variance in TSH ($R^2 = 0.20$; $P = 0.06$). No relationships were found with VO₂max, T₃, T₄, and other measures. **CONCLUSIONS:** These findings show the limited utility of implementing diet logs in this population. The correlations between different hormones show the inherent associations between metabolic status, stress, and anabolism. Overall, the roles of body composition and protein intake on LEP and TSH, hormones associated with energy availability, suggests that protein may be a unique and understated factor in this equation. Funding provided by Quest Diagnostics

2743 Board #204 May 29 9:30 AM - 11:00 AM
An Investigation Of Dietary Patterns And Macronutrient Intakes Among Resistance-trained Men

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PURPOSE: This study aimed to assess the adequacy of dietary patterns and macronutrient intakes in support of the adaptations to resistance training within a weekly microcycle of resistance-trained (RT) men using traditional dietary assessment methods. **METHODS:** Thirty-seven RT men (age (y) Mdn (IQR) 24.9 (20.7-29.7), body mass (kg) M (SD) 81.3 (11.8)) were recruited to participate in this study. Dietary data were collected by self-reported 7-day weighed intake record and analysed on both a daily and per eating occasion (EO) basis using nutrition software. Adequacy was assessed against recommendations for this population (ACSM, 2016; IOC, 2018). Data are reported as M (SD), Mdn (25-75 percentile) and p -value (p). **RESULTS:** Average daily energy intake for training day (TD) and rest day (RD) was 36 (7) and 34 (8) kcal·kg⁻¹·d⁻¹, respectively. Daily protein (PRO) intake (g·kg⁻¹·d⁻¹) was significantly greater than recommended minimum (1.6 g·kg⁻¹·d⁻¹) on TD (2.1 (0.5), $p < .001$) but was not different on RD (1.8 (0.6), $p = .050$). Carbohydrate (CHO) intake

(g·kg⁻¹·d⁻¹) was significantly lower than 5 g·kg⁻¹·d⁻¹ on both TD (3.6 (1.1), *p* < .001), and RD (3.3 (1.0), *p* < .001). Daily frequency of EO was significantly higher than the recommended 3-4 EO (*p* < .001) for TD (4 (3-6)) and RD (5 (4-5)). When analysed per EO (g·kg⁻¹·EO⁻¹), average PRO intake was significantly greater per main meal (MM) on TD (0.5 (0.4-0.7), *p* < .001) and RD (0.5 (0.4-0.6), *p* < .001), but not significantly different per snack (SN) (0.2 (0.1-0.3)) for TD (*p* = .126) and RD (*p* = .185) vs recommended 0.25 g·kg⁻¹·EO⁻¹. CHO intake (g·kg⁻¹·EO⁻¹) per MM was 0.9 (0.7 - 1.1) for TD and 1.0 (0.7-1.1) for RD. CHO (g·kg⁻¹·EO⁻¹) consumed per SN was 0.2 (0.1 - 0.3) for both TD and RD. Daily number of MM was 3 (3, 3) for TD and RD, and of SN were 3 (2-4) for TD, (1-3) for RD.

CONCLUSION: RT men met dietary recommendations to optimise adaptation to resistance training. However, the traditional dietary assessment methods do not address the importance of quantity, quality (source), timing, distribution and frequency of nutrients relative to a specific training session, termed peri-training nutrition (PTN), to optimise training adaptation. Future work must work towards analysis methods in support of periodised, personalised nutrition, relative to a specific training stimulus. FHI Grant TC20130001.

2744 Board #205 May 29 9:30 AM - 11:00 AM
Nutritional Food Containing Inulin And Lactulose Reduces Bone Resorption Marker In Japanese Female Athletes

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Non-digestible oligosaccharides (NDOs) such as inulin and lactulose are regarded as the most beneficial prebiotics for improving bone health owing to their balancing effect on the gut microbiota. As many Japanese female athletes have issues related to bone health, a better understanding of the bioactivity of NDOs is vital.

PURPOSE: To determine the effect of nutritional food containing inulin and lactulose on bone turnover markers in Japanese female athletes.

METHODS: A total of 29 Japanese female athletes (age, 22 ± 1 years) were included. Participants took their regular meals with one pack of nutritional food per day, for 12 weeks. One pack of nutritional food provided 100 kcal of energy, 2.5 g of inulin, 1.0 g of lactulose, 100 mg of calcium, and 0.5 µg of vitamin D. Nutritional and exercise status were assessed at baseline, mid-intervention period, and 12 weeks later. Nutritional status was investigated using weighed food records, while exercise status was measured by using an accelerometer. Fecal samples were collected at baseline, 1, 2, 3, 4, 8, and 12 weeks for gut microbiota analysis. TRACP-5b, a bone resorption marker, and bone-specific alkaline phosphatase (BAP), a bone formation marker, were assessed at baseline, 4, 8, and 12 weeks. Body composition and bone status were measured using dual energy X-ray absorptiometry (DXA) at baseline and 12 weeks later.

RESULTS: The body composition, nutritional status, and exercise status of the participants did not change significantly during the intervention period. The occupation ratios of *Bifidobacterium* spp. increased at 3, 4 and 12 weeks (18.0 ± 8.3%, 17.6 ± 8.5% and 17.1 ± 7.6%, respectively) compared to that at the baseline (11.7 ± 7.3%) (*p* = 0.019, *p* = 0.035, and *p* = 0.073, respectively). Serum TRACP-5b was significantly decreased at 12 weeks (363 ± 112 mU/dL) compared to that at the baseline (430 ± 154 mU/dL) (*p* = 0.018).

CONCLUSIONS: These results suggest that intake of nutritional food containing inulin and lactulose over 12 weeks could help to reduce bone resorption marker in Japanese female athletes.

2745 Board #206 May 29 9:30 AM - 11:00 AM
Implications Of Protein Consumption On Quadriceps' Muscle Fiber Atrophy After Anterior Cruciate Ligament Tear

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 (No relevant relationships reported)

There are well documented deficits in muscle mass and strength following anterior cruciate ligament (ACL) injury and reconstruction. Many factors influence recovery and progression of these deficits after ACL reconstruction such as pre-operative strength, rehabilitation quality and psychological factors. Overall energy and protein requirements increase after injury; however, little is known about the impact of nutrition following ACL injury. As protein is critical for repairing damaged tissues and promoting muscle anabolism, optimizing intake could help minimize loss of mass and strength following a sports injury. **PURPOSE:** To examine the role of pre-operative nutrition following an ACL injury and its potential relationship to quadriceps' muscle fiber atrophy. **METHODS:** 7 subjects with an ACL tear in the past 8 weeks (4M, 23.86 ± 5.79 y, BMI 24.24 ± 3.29) completed self-reported food records (6.6 ± 5.1 days pre surgery) over 3 non-consecutive days, including 1 weekend day. Subjects were given

written and verbal directions on how to log food in the *MyNetDiary* app. Nutrient reports were then extracted from food records using The Food Processor ® version 11.6.522 (ESHA Research, Salem, Oregon). Daily protein intake (g/kg of BW) was averaged across all 3 days. Biopsies were taken from injured and uninjured vastus lateralis (22.9 ± 10.7 days post-injury) to determine mean fiber cross-sectional area (CSA) between the injured and un-injured limb for each subject. Data are compared with a paired t-test or Pearson Correlation. **RESULTS:** Uninjured limb mean CSA was 4483 ± 380 µm²; injured limb mean CSA was 3816 ± 671 µm². The difference in CSA between limbs was significant (15% ± 16%, *p* = 0.03). Mean protein consumed among subjects 0.86 ± 0.23 g/kg per day, above the Recommended Dietary Allowance (RDA; 0.8 g/kg). There was a positive, non-significant correlation between atrophy and mean daily protein consumption per kg body weight (*p* = 0.23). **CONCLUSIONS:** These results serve as preliminary evidence to support the consumption of protein at the RDA may be insufficient given the substantial degree of muscle fiber atrophy occurring following an ACL tear. There is a need to optimize nutritional support during rehabilitation and our data suggest that protein consumption may be a therapeutic target to improve rehabilitation outcomes.

2746 Board #207 May 29 9:30 AM - 11:00 AM
A Comparison Of Body Image Perception And Weight Management In Latino And White Adolescent Soccer Players

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Weight-related behaviors and perception during adolescence can influence life-long weight management habits. Among the general population, difference in behaviors and beliefs have been observed by race/ethnicity and sex, but research is limited in athletes. **PURPOSE:** Determine if weight-related behaviors and perceptions differ by sex, race/ethnicity, and socioeconomic status (SES) in adolescent soccer players. **METHODS:** Adolescent soccer players (n=493, 56% Female, 45% Latino) completed a health history survey that included questions related to weight-related behaviors and perception. Body Mass Index (BMI, kg/m²) was determined from measured height and weight. **RESULTS:** Self-reported behaviors (trying to gain/lose weight or not change weight) differed by sex and by race/ethnicity (*p* < 0.05). Males were 10.2 times more likely to desire weight gain than females. Latinos were more likely to desire to lose weight vs. Whites. Weight-status perception varied by sex (*p* = 0.03); more males self-reporting being "underweight" than other categories. No race/ethnicity differences were observed (*p* > 0.05). Weight loss strategies differed by race/ethnicity (*p* < 0.0001) with Latinos reporting using exercise and drinking more water for weight loss. Adolescents desiring weight loss (38.7%) were 2.4 times more likely to skip breakfast or lunch. **CONCLUSIONS:** Future research should focus on understanding factors related to race/ethnicity and sex that influence weight-related attitudes/behaviors.

2747 Board #208 May 29 9:30 AM - 11:00 AM
Effects Of 8-Weeks Of Blueback-fish Consumption On Gut Microbiota In Elite Japanese Nordic Combined Athletes

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PURPOSE: It is important for athletes in winter sports to maintain good conditions for performance during overseas expedition. Recently, differences in gut microbiota among athletes have been reported related to inflammation and performance. Omega-3 polyunsaturated fatty acid (PUFA) potential action in restoring eubiosis in gut microbiota (Costantini et al. 2017). On the other hands, n-3 PUFA deficiency induces a state of gut dysbiosis through alteration of gut microbiota composition (Robertson et al. 2017). However, in the athletes, the chronic effect of n-3 PUFA (blueback-fish)-riched foods intake on the gut microbiota is remains unclear. The present study investigated whether 8-weeks dietary n-3 PUFA enhances gut microbiota in athletes. **METHODS:** Six male (27 ± 6 yrs) elite Japanese Nordic combined athletes consumed processed foods containing blue-backed fish [800 mg eicosapentaenoic acid (EPA), 1300 mg docosahexaenoic acid/time] 4-5 times a week and continued for 8-weeks. Before and after the intervention, blood variables and gut microbiota, dietary surveys were evaluated. The gut microbiota was measured by Illumina sequencing of the bacterial 16S rRNA gene.

RESULTS: As a result of the dietary survey, there was no significant change in the energy intake and the intake of fish before and after the intervention except food of intervention. Resting concentrations of serum EPA (49 ± 18µg/mL vs. 108 ± 38 µg/

mL, $p = 0.01$) and EPA/AA ratio (0.26 ± 0.1 vs. 0.68 ± 0.3 , $p = 0.01$) were significantly elevated in after intervention. In gut microbiota, in after intervention decreased the indicator related to obesity and inflammation *Firmicutes/Bacteroidetes* ratio and significantly increased proportion of *Bifidobacteria* which lipopolysaccharide-suppressing bacteria ($2.4 \pm 2.1\%$ vs. $6.7 \pm 5.4\%$, $p = 0.046$).

CONCLUSIONS: A 8-weeks consumption of processed foods containing blueback-fish increased blood n-3 PUFA concentration and the presence of health-related taxa in gut microbiota. It may be possible the positive impact on gut microbiota in Japanese Nordic combined athletes.

2748 Board #209 May 29 9:30 AM - 11:00 AM
Effect Of The Menstrual Cycle And Regular Workout On Oxidative Stress In Collegiate Female Students
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 (No relevant relationships reported)

Physical exercise is well known to impose oxidative stress due to the generation of reactive oxygen species. Additionally, in eumenorrhic women, oxidative stress may also be affected because the secretion of female hormones, which have antioxidant effects, varies during the menstrual cycle. The collegiate female athletes might have different oxidative stress at rest than normal women, due to both the increase in reactive oxygen species from daily training and changes in female hormones during the menstrual cycle. **PURPOSE:** To examine the influence of the menstrual cycle on oxidative stress levels at rest in collegiate female athletes and sedentary students. **METHODS:** Blood sample were taken from eleven female athletes and nine sedentary female students at four points during the menstrual cycle: menstrual phase (day 2.9 ± 0.9), follicular phase (day 9.0 ± 1.1), early luteal phase (day 15.9 ± 1.0) and late luteal phase (day 22.6 ± 0.9). Female athletes had done at least five three-hour regular workouts per week for over three years. All participants have a regular menstrual cycle and have never taken oral contraceptives. We measured plasma reactive oxygen metabolites (Reactive Oxygen Metabolites-derived compounds: d-ROMs) and antioxidant capacity (Biological Antioxidant Potential: BAP). **RESULTS:** The d-ROMs was significantly lower in the female athletes than the sedentary students (female athletes: 262.1 ± 27.8 U.CARR vs. sedentary students: 276.3 ± 36.4 U.CARR, $p < 0.05$). The d-ROMs slightly increased at the menstrual phase in sedentary students but it was not significantly altered by the menstrual cycle. The BAP was similar in both groups (female athletes: 2111.8 ± 132.6 $\mu\text{mol/L}$ vs. sedentary students: 2151.6 ± 212.6 $\mu\text{mol/L}$, NS) and unaffected by the menstrual cycle. **CONCLUSION:** Resting oxidative stress was lower in female athletes who regularly workout than in sedentary students, and it was not affected by the menstrual cycle. Interestingly, there was no difference in antioxidant capacity between them. These findings indicate that regular workout reduce the oxidative stress levels at rest in collegiate female athletes. However, the regular menstrual cycle had no effect on oxidative stress levels at rest in both athletic and sedentary female collegiate students.

2749 Board #210 May 29 9:30 AM - 11:00 AM
Abstract Withdrawn

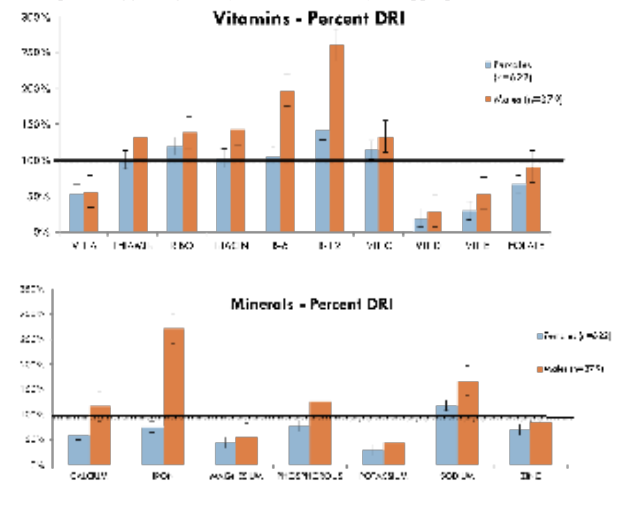
2750 Board #211 May 29 9:30 AM - 11:00 AM
Clinically-diagnosed Vitamin And Mineral Deficiencies And Disorders In The United States Military
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No previous study has used medical records to assess the incidence of vitamin and mineral deficiencies in any civilian or military population. **Purpose:** This investigation examined incidence rates, temporal trends, and demographic factors associated with vitamin and mineral deficiencies/disorders in the entire United States military population from 1997 to 2015 (mean N = 1,382,266/year). **Methods:** A retrospective cohort design was employed. The Defense Medical Epidemiological Database and specific International Classification of Diseases, Ninth Revision, codes were used to determine incidence rates for clinically-diagnosed vitamin and mineral deficiencies/disorders. Associations with demographic factors were examined. Cases were selected only if the deficiency/disorder was the primary diagnosis. **Results:** The highest rates of vitamin and mineral deficiencies/disorders were for iron (104.3 cases/100,000 person-years [p-y]), vitamin D (53.7 cases/100,000 p-y), iodine (36.2 cases/100,000 p-y), other B-complex vitamins (20.2 cases/100,000 p-y), vitamin B₁₂ anemia (7.6 cases/100,000 p-y), deficiencies of "other vitamins" (5.9 cases/100,000 p-y), and vitamin A (2.5 cases/100,000 p-y). Thiamin, riboflavin, niacin, pyridoxine, folate, vitamin C, and vitamin K deficiencies and hypervitaminoses A and D had <1 case/100,000 p-y. Incidence rates for vitamin D, other B-complex deficiency,

"other vitamin" deficiency, thiamin deficiency, iron, and iodine increased over time (1997-2015), while vitamin A and C deficiencies decreased. Women had higher incidence rates for all examined deficiencies/disorders except niacin and vitamin C, especially for iron which was 12-fold higher. Incidence rates rose with age in 10 of 18 deficiency/disorder categories and blacks had higher incidence rates in 13 of 18 deficiency/disorder categories. **Conclusions:** Clinically-diagnosed vitamin and mineral deficiencies/disorders in the military population were low, but higher in women and minorities. As for most illnesses, the diagnosed incidence of such disorders may be an underestimate of the actual incidence. These findings can be used to guide clinical decision making with regard to testing for nutritional deficiencies and delivering public health information to at risk military and civilian populations.

2751 Board #212 May 29 9:30 AM - 11:00 AM
Vitamin And Mineral Intake Relative To The DRIs In Young Adults
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 (No relevant relationships reported)

Food choices by college-age students are influenced by budgetary constraints, convenience, and irregular eating patterns which together may negatively affect micronutrient intake. NHANES groups adults from age 19-60 which may misrepresent the subset of young adults. **PURPOSE:** To evaluate the eating pattern of young adults in relation to micronutrient intake and the DRI. **METHODS:** Three-day nutrient intake reports were collected from male (n=379) and female (n=627) students, ages 18-21, enrolled in an introductory nutrition course, and entered into nutrition assessment software. Micronutrients reported included: vitamins A, thiamin, riboflavin, niacin, B6, B12, C, D, E, & folate, and Ca, Fe, Mg, P, K, Na & Zn. **RESULTS:** Both males and females met or exceeded DRI for thiamin, riboflavin, niacin, B6, B12, C, but were $\leq 50\%$ of DRI for A, D, & E. Only Na intake exceeded DRI in females while intake of Ca, Fe, P, & Na exceeded DRI in males with iron intake being the largest male-female difference. **CONCLUSION:** Micronutrient intakes in this population confirm the self-reported food choices: low milk/dairy consumption and high consumption of meat products. Sodium and phosphorus intake was suggestive of high consumption of processed foods and soft drinks. Vitamin C intake is consistent with high consumption of citrus fruit and fruit smoothies. However, the consumption of fresh vegetables was lacking. Daily caloric intake was adequate for this population (males 9200 KJ; females 6700 KJ). While multivitamin use was not documented, nutrient intake based on food consumption was inadequate, suggesting a daily multivitamin may be appropriate.



E-33 Free Communication/Poster - Nutritional Ergogenic Aids

Friday, May 29, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

2752 Board #213 May 29 9:30 AM - 11:00 AM Effect Of Creatine Supplementation On Muscle Oxygen Saturation

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 (No relevant relationships reported)

Data have indicated that creatine supplementation can result in an increase in lower leg anterior compartment pressure at rest and post exercise. Although the increased pressures seen during these studies were not pathological, this and additional factors associated with creatine supplementation could possibly influence skeletal muscle oxygen concentration (SmO₂) during exercise and recovery. **PURPOSE:** To determine the effects of acute creatine monohydrate supplementation on SmO₂ during treadmill exercise. **METHODS:** 21 male, physically active participants were randomized in a double-blind fashion to placebo (PL) (n=10, 23±2 yrs.) or creatine (CM) (n=11, 21±2 yrs.) groups. Subjects received 0.3 g/kg/day creatine monohydrate or placebo in gelatin capsules for 7 days. The subjects performed submaximal exercise tests (10 minute treadmill activity at 3.7 mph and 9% incline) at baseline and on day 7 of the study. During exercise SmO₂ and lower leg pain (LP) were monitored utilizing near infrared spectroscopy and an analog visual scale, respectively. The % change in SmO₂ was defined as: ((Baseline SmO₂ - peak exercise SmO₂)/baseline SmO₂)*100. Pre- and post-exercise lower leg pain thresholds (PTH) were determined using a digital force gage. **RESULTS:** There was a significant group effect (P<0.03) but no significant effect of supplementation (P>0.05) on the % change in SmO₂ during the exercise tests (CM: pre 66.49 ± 30.54; post 59.61 ± 23.87 vs. PL: pre 39.87 ± 16.72; post 38.51 ± 26.95 % change SmO₂; M ± SD). No significant effects of supplementation were seen between the groups for PTH (P>0.05) or peak LP during exercise (P>0.05). **CONCLUSIONS:** Using a randomly controlled, double-blind trial with validated measurements of SmO₂, acute creatine supplementation does not appear to impact skeletal muscle oxygen saturation during exercise in young, otherwise healthy males.

2753 Board #214 May 29 9:30 AM - 11:00 AM Omega-3 Fatty Acid Supplementation With Resistance Exercise Improves Muscular Strength And Inflammation In Older Adults

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 (No relevant relationships reported)

Fish oil (FO) enriched with omega-3 polyunsaturated fatty acids has attracted great attention for their health-enhancing benefits; however, synergistic effects of FO supplementation combined with resistance training (RT) in muscular strength, inflammation, and antioxidant capacity in older adults are not well established. **PURPOSE:** To investigate the effects of 12-wk FO consumption with programmed RT on muscular strength and inflammatory and antioxidant biomarkers in older adults. **METHODS:** Twenty healthy older adults (62 - 77 years) were randomly assigned to the resistance training (RT; n=10) or RT combined with FO group (RTFO; n=10). The RTFO group consumed fish oil supplements enriched with n-3 polyunsaturated fatty acids [3 capsules per day - 2100 mg of eicosapentaenoic acid (EPA) and 720 mg of docosahexaenoic acid (DHA)] and performed progressive RT including lat pull-down, seated row, biceps curl, leg press, and calf raise (2 sets of 10 repetitions; 2x/week for 12 weeks). One repetition maximum (1RM) for muscular strength assessment and blood C-reactive protein (CRP) and catalase (CAT) were evaluated for inflammation and antioxidant capacity pre- and post-intervention. Data were analyzed using 2 × 2 (group × time) repeated-measures ANOVA. **RESULTS:** Muscle strength in all five muscle groups substantially increased in both groups with a greater extent in RTFO; lat pull-down (+12 vs. +21%), seated row (+25 vs. +46%), biceps curl (+26 vs. +36%), leg press (+24 vs. +55%), and calf raise (+32 vs. +45%) (p < 0.05). There was a significant decrease in CRP in RTFO (-6% p < 0.05), while no detectable change was observed in RT. There was no significant change in CAT for both groups (p > 0.05). **CONCLUSION:** Twelve-weeks of FO supplementation appears to enhance the benefits from programmed RT in muscular strength, while improving systemic inflammation in healthy older adults. Supported by New Mexico State University.

2754 Board #215 May 29 9:30 AM - 11:00 AM Effects Of Ammonium Salt Inhalation On Reaction Time And Resistance To Fatigue In Male Athletes

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 (No relevant relationships reported)

Strong scents stimulate the central nervous system, potentially increasing reaction time. Ammonium salt inhalants have no known physiological effect, but there is evidence of positive psychological effects on performance. Many athletes believe ammonium salt inhalants provide an edge or a feeling of "wakefulness". **PURPOSE:** To analyze the effect of ammonium salt inhalants on reaction time, power, and resistance to fatigue in male collegiate athletes. **METHODS:** Ten male athletes (21 + 0.82 yrs, 178.33 + 6.97 cm, 85.12 + 15.57 kg) were familiarized with the testing procedures during session one. Two randomized treatment sessions (ammonium salt inhalants or control) were performed 48 hr apart. In session two, subjects inhaled one treatment before each of three trials of reaction time test and vertical jump (VJ). After running to fatigue on the Anaerobic Treadmill Test (ATT) subjects inhaled the substance, then resumed the test to exhaustion. In session three, the same procedures were followed with the opposite inhalant. **RESULTS:** Reaction time after inhaling ammonium salt (0.645 + 0.060 s) was not significantly different from reaction time after inhaling the control treatment (0.646 + 0.098 s; t(9) = 0.032; p = 0.975). VJ after inhaling ammonium salt (54.51 + 5.00 cm) was not significantly different after inhaling the control treatment (55.93 + 6.58 cm; t(9) = 1.038; p = 0.326). ATT run time increased after fatigue when inhaling ammonium salt (12.873 + 4.60 s), but not significantly compared to inhaling the control treatment (11.30 + 4.55s; t(9) = 1.29; p = 0.227). **CONCLUSION:** Ammonium salt inhalants did not significantly improve reaction time, VJ, or ATT run time after fatigue in male collegiate athletes. Ammonium salts may have greater efficacy for anaerobic exercise performance compared to power performance.

2755 Board #216 May 29 9:30 AM - 11:00 AM Abstract Withdrawn**2756 Board #217 May 29 9:30 AM - 11:00 AM 30 Days Of Montmorency Tart Cherry Supplementation Has No Effect On Inflammation, Sleep, Or Body Composition In Healthy Adult.**

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 (No relevant relationships reported)

INTRO: Tart cherries possess antioxidant, anti-inflammatory and analgesic properties that may reduce inflammation and improve sleep. Additionally, animal models suggest tart cherry supplementation can reduce weight, however human data is lacking. Furthermore, processing may affect the properties of tart cherries and therefore reduce their health benefits.

PURPOSE: To investigate the effect of different tart cherry supplements on markers of inflammation, body mass, and sleep time and quality over the course of 30 days in healthy individuals.

METHODS: 58 participants (age: 28 ± 10 y, Height: 169.76 ± 8.55 cm, body mass: 72.2 ± 12.9 kg) were separated into four groups: group 1 (Montmorency tart cherry juice), group 2 (Montmorency tart cherry capsule), group 3 (juice placebo) and group 4 (capsule placebo), and asked to consume their supplement for 30 continuous days. Participants in groups 1 & 3 drank two 8 oz. bottles per day. Groups 2 & 4 consumed two capsules with breakfast. Participants completed four trials: baseline, day 7, day 14 and day 30. During each trial participants provided a blood sample (assessed for inflammatory markers), and had their body mass and body composition assessed via bioelectrical impedance. Participants tracked their sleep daily via an online survey that asked about length of sleep (hours) and subjective rating of sleep quality (100 mm VAS). Linear mixed models were used to examine changes in inflammatory markers, body mass and body fat between groups. Additionally, a random coefficient model was used to assess the change in total sleep, and sleep quality across time (i.e. 30 days), between group.

RESULTS: There was a significant increase in erythrocyte sedimentation rate (f = 14.7, p < 0.001) between baseline and day 7 (p < 0.001; 95% CI = 3.16 - 6.96), day 14 (p < 0.001; 95% CI = 3.14 - 5.94), and day 30 (p < 0.001; 95% CI = 3.21 - 6.57). There was no significant difference in body fat, or body mass (p ≥ 0.08). There was a significant positive association between sleep quality and time (f = 5.47, p = 0.02). On average, sleep quality increased by 0.38 mm every day. There was no association for total sleep time (p ≥ 0.15).

CONCLUSION: These data suggest tart cherry supplements do not significantly reduce inflammation or improve sleep time, body fat or body mass. However, subject sleep quality improved over 30 days.

2757 Board #218 May 29 9:30 AM - 11:00 AM
Effectiveness Of Two Different Forms Of Marine Oil On Muscle Soreness Following Eccentric Exercise

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 (No relevant relationships reported)

PURPOSE: We have previously shown¹ that four weeks of supplementation with PCSO-524®, a marine lipid fraction of the New Zealand green-lipped mussel (*Perna canaliculus*), rich in omega-3 fatty acids, attenuates muscle damage and delayed onset muscle soreness (DOMS) following eccentric exercise in untrained men. The present study sought to determine if a blend of 75% PCSO-524® and 25% krill oil (ESPO-572®) will be 'at least as good' as PCSO-524® in attenuating DOMS and functional indices of muscle damage during recovery from muscle damaging exercise in untrained men. **METHODS:** This study was conducted as a randomized, parallel group, double-blind non-inferiority trial. Fifty-one untrained men were randomly assigned to consume 600 mg·d⁻¹ (4 capsules) of either PCSO-524® (n=24) or ESPO-572® (n=27) for 26 d prior to muscle damaging exercise (downhill running), and continued for 72 h following exercise. DOMS, pressure pain threshold (PPT), limb swelling, knee extensor range of motion (ROM), and isometric torque (MVC), were assessed at baseline following supplementation before eccentric exercise, and at 24, 28 and 72 h post-eccentric exercise. For data analysis purposes we included placebo group (olive oil) (n=16) data generated from our previously published work¹ that followed an identical study design. **RESULTS:** ESPO-572® is 'at least as good' as PCSO-524®, but both blends were significantly better (p<0.05) than placebo, in reducing DOMS at 24, 48, 72 h following muscle damaging exercise. At 24 and 48 h following the eccentric exercise bout ESPO-572® significantly increased (p<0.05) ROM compared to PCSO-524®. Compared to placebo, ESPO-572® significantly improved (p<0.05) ROM at 24, 48 and 72 h, while PCSO-524® significantly increased (p<0.05) ROM at 48 and 72 h during recovery. There were no significant differences (p<0.05) between ESPO-572® and PCSO-524® for PPT, limb swelling and MVC during recovery from muscle damaging exercise. **CONCLUSION:** These data suggest that ESPO-572® may represent a useful therapeutic agent for attenuating muscle soreness following eccentric-type exercise in untrained men. ¹Mickleborough et al. *Journal of the International Society of Sports Nutrition* (2015) 12:10. Supported by a grant from Pharnalink International Ltd, Hong Kong.

2758 Board #219 May 29 9:30 AM - 11:00 AM
Antioxidant Capacity Of Mango Peel Extract (Mangifera Indica) On Oxidative Stress Induced By Strenuous Exercise

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Strenuous exercise (SE) is a trigger for oxidative stress (OxS) associated with severe tissue damage, fatigue and the development of chronic degenerative diseases. **PURPOSE:** To evaluate the antioxidant capacity (AOxC) of mango peel extract (MPE) on OxS associated with SE in rats. **METHODS:** An animal bioassay, approved by bioethics committee, which consisted in an acute SE session performed, or not, after a sub-chronic (1 month) supplementation was executed. The treatments applied were: A) Standard diet (CTRL); B) Standard diet + gallic acid (GA); C) Standard diet + MPE (SMPE). The plasma OxS markers were quantified by Malondialdehyde (MDA) and protein carbonyls (PC). Creatine kinase (CK) and transaminases (ALT & AST) were evaluated as tissue damage markers. Finally, the plasma AOxC was evaluated by ferric reducing antioxidant power (FRAP) assay. **RESULTS:** The bioassay results are depicted in **Table 1**. The SE raised PC but no MDA plasma concentrations, on all treatments, also increase CK and AST. Otherwise as response to SE, FRAP activity on plasma was boosted on GA and SMPE. Preliminary phytochemical analysis on MPE presented a total phenolic compound content of 77±3 mg Gallic Acid Eq·g⁻¹ dry weight and 11±0 mg Catechin Eq·g⁻¹ dry weight of total flavonoids. **CONCLUSION:** The MPE has a high concentration of phenolic compounds and its administration improves the plasma AOxC, but it was not able to inhibit the effects of tissue damage or OxS associated with SE. Also, there was found that MPE has a prooxidative effect by altering the levels of protein oxidation after SE.

Table 1. Antioxidant capacity after the bioassay.

Marker	No exercise group			Strenuous exercise group		
	CTRL	GA	SMPE	CTRL	GA	SMPE
MDA	2.5±1 ^a	2.4±1 ^a	2.5±1 ^a	2.6±1 ^a	2.3±1 ^a	2.0±1 ^a
PC	31±13 ^a	23±9 ^a	17±7 ^a	221±61 ^b	239±56 ^b	353±71 ^c
CK	860±243 ^a	1146±207 ^a	1241±490 ^a	2459±1580 ^b	2399±645 ^b	2631±452 ^b
ALT	52±4 ^a	51±14 ^a	48±13 ^a	57±9 ^a	63±13 ^a	53±19 ^a
AST	72±10 ^a	78±16 ^a	75±16 ^a	100±33 ^{ab}	93±20 ^{ab}	113±38 ^b
FRAP	0.32±0 ^a	0.29±0 ^a	0.30±0 ^a	0.37±0 ^{ab}	0.39±0 ^b	0.47±0 ^b

Mean±SD. MDA: Malondialdehyde, μM MDA·mL⁻¹; PC: Protein carbonyls, nM·mL⁻¹; CK: Creatine kinase, U·L⁻¹; AST: Aspartate aminotransferase, U·L⁻¹; ALT: Alanine aminotransferase, U·L⁻¹; FRAP: Ferric reducing antioxidant power, μM Fe²⁺ Eq. Different letter means statistical difference between treatments (p<0.05).

2759 Board #220 May 29 9:30 AM - 11:00 AM
D-ribose Supplementation On Delayed Onset Muscle Soreness After Plyometric Exercise In College Students: A Randomized Controlled Trial.

Junqiang Qiu¹, Wei Cao¹, Tianwei Cai¹, Longyan Yi¹, Dan Benardot, FACSM², Menghui Zou¹. ¹Beijing Sport University, Beijing, China. ²Emory University, Atlanta, GA.
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 (No relevant relationships reported)

PURPOSE: This study was aimed to investigate the effect of D-ribose supplementation on delayed onset muscle soreness (DOMS) induced by plyometric exercise. **METHODS:** 21 male untrained college students (age 21±2 yr, weight 75.5±11.2 kg) performed a lower-limb plyometric exercise protocol (7 sets of 20 frog jumps with 90s-rest between each sets) to induce DOMS. Muscle soreness were measured with Visual Analogue Scale before and 24, 48 hours after exercise. Subjects were then randomly divided into the D-ribose group (RIB, n=11) and the placebo group (PLA, n=10) according to BMI and muscle soreness. After a 14-day washout period, both groups performed the same plyometric exercise protocol. The RIB ingested 200ml solution containing 15g D-ribose 1 hour before and 1, 12, 24, and 36 hours after exercise, while the PLA ingested 200 ml calorically equivalent solution containing Sorbitol and β-cyclodextrin. Muscle soreness were collected and isokinetic muscle strength tests were performed and venous blood was collected before and 24, 48 hours after exercise. **RESULTS:** In RIB, muscle soreness at 24h and 48h after the second exercise session were lower than those after the first exercise session (Fig 1). In the second exercise session, muscle soreness and some blood indicators including CK, LDH, MB and MDA in RIB were lower than those in PLA at 24h after exercise (MDH, p<.05; CK, LDH, MB, p<.01). At 48h after exercise, LDH (176.19±65.12 vs. 304.76±45.51 U/L) and MDA(3.76±1.18 vs. 6.89±1.42 U/m) in RIB were still significantly lower than that in PLA (p<.01). There was no difference in results of isokinetic muscle strength and some oxidative stress indicators including superoxide dismutase and total antioxidant capacity between the two groups 24h and 48h after exercise. **CONCLUSIONS:** D-ribose supplementation reduces muscle soreness and makes recovery of muscle damage and inhibit the formation of lipid peroxides after plyometric exercise.

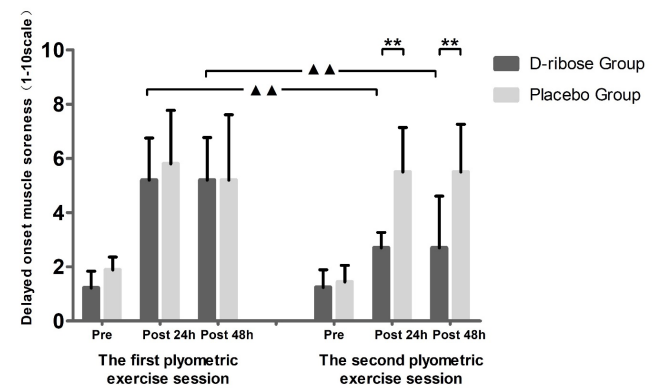


Figure 1. Muscle soreness in different groups

2760 Board #221 May 29 9:30 AM - 11:00 AM
Effects Of Alpha-gpc And Huperzine-a On Memory And Power Output Post Exhaustion

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 (No relevant relationships reported)

Introduction: The use of multi-ingredient pre-workout supplements has been steadily on the rise in the fitness industries. Companies make claims about improvements in performance both physically and cognitively for users but seldom provide research to back up the claims made about the ingredients or dosages. **Purpose:** To examine the effects of Huperzine-A and Alpha-GPC on short term memory and anaerobic power output, post exhaustion compared to caffeine and placebo in healthy college age students. **Methods:** The study was conducted as a double blind, placebo controlled, randomized design on 62 healthy adults (N=62 height 68.4 ± 3.5 in., weight 78.5 ± 15.1 kg.). The wash out period was a minimum of 48 hours after completion of the familiarization. Subjects reported to the exercise physiology lab thirty minutes before testing began and consumed either a caffeine, Alpha-GPC and Hup-A, or placebo solution. After the thirty-minute digestion period subjects performed one computer-based short-term memory test, and a thirty-second Wingate anaerobic power test. Subjects then performed an exhaustion protocol before repeating the memory and power test. Once all testing was completed subjects returned between 2 and 14 days after the last test and repeat the protocol. A power analysis was run using G* Power software 3.1.9.2 based from Zeigenfuss et al., (2008). The percent change between pre and post was compared across visits using ANOVA with repeated measures. Significance was found with an Alpha level $P \leq 0.05$ with Tukey Post Hoc analysis will be used to determine pairwise comparisons. All stats were run on IBM SPSS 23. **Results:** The ANOVA with repeated measures and Tukey Post Hoc analysis found there was no significant difference in performance pre to post, between groups, or factoring the percent change pre to post. **Conclusion:** This result suggests there is no physical or mental benefit acutely dosing 600 mg. of Alpha-GPC and 200 mcg. of Huperzine-A in healthy recreationally active adults. This was the first study to look at the two in combination so, the finding is neither supported nor opposed to the current body of research. The finding does oppose the logic some supplement companies have been using to justify their sales tactics. Future research should investigate the effects of a loading period on physical and mental performance.

2761 Board #222 May 29 9:30 AM - 11:00 AM
Nitrate And Nitrite Treatment Modulate Performance And Available Fuel Sources In Zebrafish Muscle And Liver

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 (No relevant relationships reported)

Treatment with nitrate, but not nitrite, improves exercise performance, in part, by increasing availability of metabolic fuels that require less oxygen for energy production. However, the mechanisms by which these inorganic anions produce performance effects is not well understood. **PURPOSE:** The purpose of this study is to quantify changes in the metabolic state in zebrafish muscle and liver with nitrate and nitrite treatment during exercise using gene expression and metabolomic methods. **METHODS:** Liver and muscle were collected from adult zebrafish fish exposed to sodium nitrate (606.9 mg NaNO₃/L water), sodium nitrite (19.5 mg NaNO₂/L of water), or control water for 21 days (n= 128-130). Tissues were analyzed by quantitative real-time PCR and ¹H-NMR untargeted metabolomics. **RESULTS:** Nitrate treatment significantly increased expression of peroxisome proliferator activated receptor- γ (*pparg*), a gene involved in regulation of lipid and glucose metabolism. In contrast, acetyl-CoA carboxylase (*acaca*), a gene that inhibits fatty acid oxidation, significantly decreased in the skeletal muscle of fish treated with nitrate or nitrite as compared to control skeletal muscle tissue. Nitrite treatment also significantly increased carnitine palmitoyl transferase 1b (*cpt1b*) expression in the liver, which is a primary regulator involved in long-chain fatty acid transport into the mitochondria. Preliminary NMR results show that, relative to control skeletal muscle, nitrate treatment in unexercised fish at rest induces significant increases in metabolic fuels, such as ATP and creatine phosphate, and fuel sources including β -hydroxybutyrate and glycolytic intermediates. After a graded exercise test, the same metabolites increased in control but were decreased in skeletal muscle of nitrate-treated, exercised fish. **CONCLUSIONS:** Our data are consistent with the hypothesis that nitrate treatment may alter lipid and carbohydrate metabolism of zebrafish, in part, through a PPAR- γ mediated mechanism in the liver, and may improve exercise performance through utilization of fuel sources that require less oxygen during exercise. In contrast, our data indicate that nitrite may increase oxygen cost of exercise, in part, by promoting dependence on fatty acid oxidation in the liver of zebrafish.

2762 Board #223 May 29 9:30 AM - 11:00 AM
Performance Enhancing And Pro Regenerative Effects Of Alpha Lipoic Acid Supplementation After Acute And Chronic Resistance And Endurance Training.

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 (No relevant relationships reported)

PURPOSE: Oxidative stress is an important key player in the initiation of training induced adaptations but also a risk factor with respect to over training and lack of regeneration. Alpha lipoic acid (ALA) has been described to be a powerful antioxidant. Therefore it was the aim of this study to investigate the effects of acute and chronic ALA supplementation on the regeneration and performance of athletes after intensive exercise. **METHODS:** In this double-blinded, randomised, controlled trial in cross-over design, 17 male resistance and endurance-experienced athletes successfully participated. The subjects were divided into two groups (ALA and Placebo) and underwent a standardized acute (3sets back squats of 12 reps each and 3 sets of low jumps with 15 reps each) and chronic training protocol (6 days of intensive resistance and endurance training). Between the acute and chronic training experiments was a 4-week break. At certain time points before and after exercise (T0, T1 (+24h) and T2 (+7d)) blood samples were taken and the concentrations of muscle damage (creatine kinase, myoglobin), inflammation (interleukin 6 and 10) and oxidative stress (ox LDL) markers were investigated. In addition, the maximum performance in the back squat was measured at all timepoints. **RESULTS:** In the 6 day chronic training intervention a clear inhibition of muscle damage and inflammation could be observed in individuals under chronic supplementation of ALA compared to the control group. Whereas performance in the back squat was significantly reduced after 6 day of chronic training in the placebo group no significant loss of performance could be detected in the ALA group. In contrast after an acute training a single application of ALA did not result in significant differences between the placebo and ALA groups with respect to all before mentioned markers and back squat performance. **CONCLUSIONS:** Based on these data we conclude that that ALA supplementation has only limited effects if given acute and directly after exercise but results in remarkably and significant pro-regenerative and performance enhancing effects after chronic supplementation. Mechanistically these effects seem to be mediated via a modulation of the immune response and less by antioxidative effects, which needs to be investigated in more detail in future investigations.

2763 Board #224 May 29 9:30 AM - 11:00 AM
Effects Of Combined Rhodiola And Cordyceps On VO₂Max, Blood Glucose, And Lactate

Cameron Swick, Karen Yagi, Cami Christopher, Jessica Bouchard, Jenna Rohlf, Nicole Conyers, Austin San, Tyra Saelee, Rachel Barnett, Peter Gault, Isaac Johnson, Kieran Kearney, Jun Kwon, Sarah Pope, Cannon Wong, Todd Hagobian, FACSM. *California Polytechnic State University, San Luis Obispo, CA.* (Sponsor: Todd Hagobian, FACSM)
 (No relevant relationships reported)

Rhodiola and Cordyceps are two common herbal supplements that have been shown to increase VO₂ max and exercise performance, but limited research has examined the combined effects. **PURPOSE:** To determine the combined effects of Rhodiola and Cordyceps (R+C) supplementation, compared to Rhodiola alone (R) and placebo (PL), on VO₂ max, blood glucose and lactate concentrations. **METHODS:** 13 physically active college students (7M, 6F; Mean ± SD; 21.08 ± 1.55 yrs, 22.60 ± 2.29 kg/m²) completed three conditions in a counterbalanced, crossover, double-blinded fashion; 1) PL (250 mg calcium), 2) R (250 mg Rhodiola), 3) R+C (250 mg Rhodiola + 225 mg Cordyceps). In response to each condition, VO₂ max (assessed by Bruce Protocol), blood glucose and lactate (via fingerstick) were examined using an ANOVA. **RESULTS:** There was no significant condition effect for VO₂ max between PL, R, and R+C (P=0.80; Mean ± SD; 50.42 ± 8.75, 51.08 ± 7.44, 50.76 ± 7.64 mL/kg/min). There was no significant condition x time interaction for blood glucose (P=0.99). However, compared to PL, blood glucose was significantly higher in R+C (P=.047; LSM ± SEM; 104.97 ± 2.91, 113.08 ± 2.91 mg/dL). There was no significant condition or condition x time interaction in blood lactate concentrations between conditions (Ps>0.05). **CONCLUSION:** Our preliminary data suggest that R+C had no effect on VO₂ max or blood lactate concentrations, but increased blood glucose concentrations. Future studies are needed to examine ventilatory threshold and other markers of exercise performance in response to these supplements.

2764 Board #225 May 29 9:30 AM - 11:00 AM
Effects Of Short-term Continuous Montmorency Tart Cherry Juice Supplementation In Participants With Metabolic Syndrome
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 (No relevant relationships reported)

PURPOSE: The prevention of cardiovascular disease (CVD) and type II diabetes mellitus (T2D) would be a major step in retarding rising global prevalence and incidence rates. Metabolic Syndrome (MetS) augments the incidence of CVD by 2-fold and T2D by 5-fold. Montmorency tart cherries are rich in phytochemicals and have previously been shown to improve cardio-metabolic biomarkers in humans. This study aimed to examine cardio-metabolic responses after 7 days Montmorency tart cherry juice (MTCJ) supplementation and also acute responses to a single-bolus, in humans with MetS.

METHODS: In a randomised, single-blind, placebo-controlled, crossover trial, twelve participants with MetS (50 ± 10 y; 6M/6F), consumed MTCJ or placebo (PLA) for 7 days. Blood-based (serum glucose, insulin, lipid profile) and functional (cardiac haemodynamics, arterial stiffness and resting metabolic rate) cardio-metabolic biomarkers were measured pre- and post-supplementation, and acute responses measured pre-bolus and up to 5 hours post-bolus on the 7th day. Comparisons were made by two-way, repeated measures ANOVA design.

RESULTS: 24-hour ambulatory systolic (PLA vs. MTCJ, 2 ± 1 vs. -5 ± 1 mmHg, $P = 0.016$), diastolic (2 ± 1 vs. -2 ± 1 mmHg, $P = 0.009$) blood pressure and mean arterial pressure (3 ± 1 vs. -2 ± 0 mmHg, $P = 0.041$) were significantly lower after 7 days MTCJ supplementation compared to PLA. Findings also showed a significant reduction in glucose (0.03 ± 0.07 vs. -0.50 ± 0.00 mmol.L⁻¹, $P = 0.038$), total cholesterol (0.04 ± 0.06 vs. -0.40 ± 0.07 mmol.L⁻¹, $P = 0.036$), LDL (0.26 ± 0.09 vs. -0.36 ± 0.14 mmol.L⁻¹, $P = 0.023$) concentrations and total cholesterol:HDL ratio (0.13 ± 0.00 vs. 0.02 ± 0.00 , $P = 0.004$) with concomitant lower resting respiratory exchange ratio values (0.01 ± 0.02 vs. -0.03 ± 0.00 , $P = 0.009$) after 6 days MTCJ consumption compared to PLA.

CONCLUSIONS: This study revealed for the first time MTCJ to significantly improve 24-hour BP, fasting glucose, total cholesterol and total cholesterol:HDL ratio, and also lower resting respiratory exchange ratio compared to a control in any human population. Responses demonstrated clinically relevant improvements on aspects of cardio-metabolic function, emphasising the potential efficacy of MTCJ in preventing further cardio-metabolic dysregulation in an 'at risk' population.

2765 Board #226 May 29 9:30 AM - 11:00 AM
THE EFFECT OF CALANUS FINMARCHICUS OIL (CALANUS® OIL) ON MAXIMAL OXYGEN UPTAKE: A RANDOMIZED CONTROLLED STUDY
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PURPOSE: to investigate the long-term effect of daily Calanus® Oil supplementation on maximal oxygen uptake (VO_{2max}) in healthy 30-50 year old human participants. VO_{2max} is the single best measure of human endurance capacity, as well as a predictor of longevity and cardiovascular disease mortality. Systematic exercise training increases VO_{2max} and has beneficial health effects. The copepod-based omega-3 rich Calanus® Oil supplementation has previously been shown to increase VO_{2max} in diet-induced obese mice. The present study is a follow-up study in healthy human participants.

METHOD: in a double-blinded study, 71 participants were randomized to receive 2 grams · day⁻¹ of Calanus® Oil or placebo supplementation for a total of 6 months. The participants underwent exercise testing and clinical investigations at baseline, 3 months and 6 months. The main study outcome was change in VO_{2max} from baseline to 6 months. Results are given as mean ± standard deviation.

RESULTS: a total of 58 participants (baseline age, years: Calanus® Oil, 39.7 ± 4.5 and placebo, 38.8 ± 5.3 ; baseline BMI, kg · m⁻²: Calanus® Oil, 24.8 ± 2.2 and placebo, 24.8 ± 2.8 ; baseline VO_{2max} , ml · kg⁻¹ · min⁻¹: Calanus® Oil, 50.4 ± 9.1 and placebo 50.2 ± 8.8) completed the 6-month test and were included in the final data analysis. There were no between group differences at baseline. There were no between group changes in VO_{2max} measured in L · min⁻¹ (Calanus® Oli, 3.78 ± 0.79 and placebo, 3.79 ± 0.90) or normalized to body weight (Calanus® Oil 50.1 ± 9.6 ml · kg⁻¹ · min⁻¹ and Placebo 49.5 ± 9.2 ml · kg⁻¹ · min⁻¹) from baseline to 6 months (6 month values). No other clinical measures changed over the 6-month study period.

CONCLUSION: Six months of Calanus® Oil supplementation did not change maximal oxygen uptake in physically fit, healthy, normal to overweight middle age men and women between 30-50 years of age.

2766 Board #227 May 29 9:30 AM - 11:00 AM
Polyphenol Rich Supplementation On Markers Of Recovery From Intense Resistance Exercise
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 Reported Relationships: **D.R. Hooper:** Industry contracted research; This research was funded by a research grant from Specnova, Inc..

PURPOSE: The purpose of this study was to assess whether polyphenol supplementation, previously shown to have anti-oxidative properties, reduces muscle damage and soreness and whether the recovery of physical performance is enhanced as a result.

METHODS: 15 men (mean age: 26.2 ± 5.3 years; height: 184.3 ± 8.2 cm; weight: 92.9 ± 15.6 kg; barbell back squat 1RM: 146.8 ± 30.6 kg) completed a randomized, cross-over, placebo controlled design where subjects performed 6 sets of 10 barbell back squats at 80% 1-repetition maximum and were assessed for markers of recovery immediately, 1-, 3-, 24- and 48-hours following the protocol on two occasions; once following 1 week of 500mg of tart cherry supplementation (TC) and once following a placebo (PL) supplement. Markers of recovery included plasma creatine kinase MB isoenzyme (CKMB), muscle soreness by visual analog scale, countermovement vertical jump height (CMJ) by forceplate, and grip strength by isokinetic dynamometer.

RESULTS: With regards to muscle damage, there was a statistically significantly ($p=0.003$) greater increase in CKMB concentration in the PL when compared to the TC group (PL: 21.1 ± 11.5 ng · ml⁻¹ vs. TC: 0.0 ± 11.3 ng · ml⁻¹) 60 min post. There was a statistically significantly ($p=0.015$) higher increase in muscle soreness in the PL when compared to the TC group (PL: 5.2 ± 2.9 cm vs. TC: 3.2 ± 1.3 cm) at 48 hours. There were no statistically significant differences in jump power or handgrip dynamometer strength, although there was a trend ($p=0.08$) towards significance (PL: -0.1 ± 3.4 kg vs. TC: 1.5 ± 2.9 kg) in grip strength change.

CONCLUSIONS: In conclusion, polyphenol supplementation was shown to reduce soreness following intense resistance exercise. In addition, polyphenols were shown to reduce CKMB, a marker of cardiac muscle damage. In this study, the damage protocol was not sufficient to cause reductions in power performance, and thus the supplement was unable to demonstrate reduced attenuations of performance as a result of the decreased damage.

2767 Board #228 May 29 9:30 AM - 11:00 AM
Effect Of Acute Beclomethasone And Prednisolone On 40-km And Recovery For Subsequent 10-km Cycling Time-trial
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 (No relevant relationships reported)

The World-Anti Doping Agency (WADA) stipulates that athlete use of glucocorticoid medication for asthma related conditions requires a therapeutic-use-exemption (TUE) during competition for oral administration, but not inhaled doses. It remains unclear if glucocorticoid therapy provides a competitive advantage for single, or repeated bout time-trial performance. **PURPOSE:** Compare two methods of acute glucocorticoid administration on 40-km time-trial and recovery for subsequent 10-km time-trial performed on the same day. **METHODS:** Six trained male cyclists (VO_{2max} ; 59.1 ± 3.8 ml · kg · min⁻¹) completed a 40-km time-trial four-hours after administration of prednisolone (0.5 mg · kg⁻¹ body mass, PRED), beclomethasone (1600µg, BEC), microcrystalline cellulose capsules (O-PLA), water vapour inhaler (I-PLA) or control (CON). Following one-hour recovery, participants completed a further 10-km time-trial. Subjective overall recovery score, measured using Acute Recovery Stress Score (ARSS) was completed pre-10-km time-trial. Physiological (Heart-rate; HR, oxygen-uptake; $\dot{V}O_2$) and metabolic response (blood lactate; blood glucose) during 40-km time-trial was recorded. Data was analysed using repeated measure ANOVAs, and Bonferroni post-hoc comparisons. **RESULTS:** No significant difference was seen in completion time (CT) for both 40-km (PRED: 3958 ± 213 s; BEC: 3969 ± 173 s; O-PLA: 4010 ± 169 s; I-PLA: 3978 ± 208 s; CON: 3968 ± 170 s; $p=0.22$) and 10-km (PRED: 950 ± 50 s; BEC: 952 ± 54 s; O-PLA: 956 ± 51 s; I-PLA: 960 ± 50 s; CON: 957 ± 54 s; $p=0.87$) time-trials. No condition time interaction was seen in physiological response (HR: $p=0.69$; $\dot{V}O_2$; $p=0.54$) during 40-km time-trial. PRED resulted in significant enhanced glucose concentration at all exercise time-points ($p>0.05$), but no condition time interaction was evident in blood lactate ($p=0.53$). Subjective overall recovery measured by ARSS was not different between conditions ($p=0.77$). **CONCLUSION:** Acute inhaled or oral glucocorticoid medication did not enhance 40-km time-trial performance. Furthermore, perceived recovery prior to, or measured performance during subsequent 10-km time-trial was not different between conditions.

2768 Board #229 May 29 9:30 AM - 11:00 AM
Effects Of A Single Dose Multi-Ingredient Pre-Workout Supplement On Aerobic Performance In Men And Women

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PURPOSE: To assess the effects of a single dose of a multi-ingredient pre-workout supplement (MIPS) on aerobic exercise performance, specifically exercise time and VO_{2max} .
METHODS: 41 college-aged adults (age: 21.8±2.5 y; BMI: 25.1±3.0 kg/m²; men=19; women=22) were recruited to participate in a randomized, double-blind, placebo-controlled, crossover study. All of the participants were tested in the same week, but separated by 48 hours, and were either provided the MIPS or the placebo (PLA) on each day. As per the manufacturer's instructions, following the consumption of the drink, the participants waited 25 minutes to begin the test. Aerobic exercise performance was assessed using the Modified Astrand Treadmill Protocol, during which maximal oxygen consumption (VO_{2max}) and maximal treadmill time were determined. At maximal treadmill time, heart rate (HR), respiratory exchange ratio (RER), and rating of perceived exertion (RPE) were collected. All data were analyzed using gender × trial ANOVAs. In the event of a non-significant interaction, data were analyzed as a single group using dependent t-tests. Alpha level was set to $p \leq 0.05$. All comparisons between PLA and MIPS trials were assessed using Cohen's d effect sizes. All data is presented as mean±standard deviation.
RESULTS: No significant gender × trial interactions were observed for any of the data. However, when assessed as a single group there was a significant difference in VO_{2max} ($p=0.038$) with MIPS (43.8±6.9 mL/kg/min) performing better than PLA (43.0±6.5 mL/kg/min). Furthermore, maximal treadmill time was significantly different ($p=0.016$) with MIPS (9.4±1.9 min) performing better than PLA (9.0±1.8 min). Cohen's d effect sizes revealed that the differences in VO_{2max} ($d=0.111$) and exercise time ($d=0.178$) were trivial. There were no significant differences between PLA and MIPS for HR, RER, or RPE.
CONCLUSIONS: A single dose of this MIPS improved maximal treadmill time and VO_{2max} ; however, these changes were not very large in magnitude. Future research should investigate the long-term effects of using this MIPS.

2769 Board #230 May 29 9:30 AM - 11:00 AM
Effects Of Cannabidiol Supplementation On The Skeletal Muscle Regeneration After Intensive Resistance Training

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Cannabidiol (CBD) is a non-psychotropic cannabinoid extracted from cannabis sativa and is mainly sold as a nutrition supplement. The pharmacological effects of CBD are a matter of discussion in research. Anti-inflammatory activities and effects on muscle relaxation of CBD have been demonstrated in studies. However, there is only limited information on the direct effects of CBD on skeletal muscle regeneration (SMR) after physical activity. The **purpose** of this study was to investigate effects of CBD on SMR after intensive resistance training (IRT).
Method: Participants ingested 60mg of CBD or placebo directly after IRT. The study was conducted as a randomized double-blind study in crossover design. Muscle damage as serum creatine kinase (CK) and myoglobin (Myo) as well as performance in 1RM back squat (1RM BS) before and at different times after exercise (+24h, +48h, +72h) are investigated. After the pre-performance tests, 3 sets of BS with 12 repetitions were performed with an intensity of 70%, followed by 3 sets of low jumps with 15 repetitions. Subsequently, the subjects received either a drink with CBD or a placebo drink. No further food was allowed to be consumed in the next 3h. After 24h, 48h and 72h further blood samples were taken and the performance in BS was examined. After two weeks of wash out period, the intervention was repeated. **Results:** CBD administration inhibits significantly the increase of serum CK 24h after exercise (CBD: 244.6U/L SD 65.5 to 332.5U/L SD 97.8, +87.88U/L; PL: 213.8U/L SD 95.0 to 479.9U/L SD 262.6, +265.89U/L) demonstrating a reduction of skeletal muscle damage. However, the 1 RM BS of the CBD group 24h after exercise was significantly lower in comparison to the PL group (CBD: 152.81kg SD 17.90 to 146.26kg SD 16.04, -6.56kg; PL: 150.31kg SD 18.63 to 146.56kg SD 16.85, -3.75kg).
In conclusion, the current results show a reduction of skeletal muscle damage 24h after training through CBD supplementation. However, the 1RM BS also deteriorates at the same time which is very likely caused by skeletal muscle relaxation effects of CBD. To investigate whether these findings can be interpreted as beneficial or adverse with

respect to skeletal muscle regeneration further investigations are currently ongoing to investigate skeletal muscle performance in a time dependent manner after CBD administration.

2770 Board #231 May 29 9:30 AM - 11:00 AM
Effects Of Exercise Training With Green Tea Extract On Cognition, Aerobic Capacity, And Metabolic Biomarkers

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 (No relevant relationships reported)

Green tea, a commonly used beverage, is gaining more attention in promoting overall health. Green tea extract (GTE) has been shown to have anti-inflammation and antioxidant functions. Regular exercise training is known to improve aerobic capacity, cognition, and metabolic-related biomarkers. However, it is not well known whether the combination of GTE supplementation during exercise training provides additive benefits. **PURPOSE:** To determine the effects of 6-wk of combined endurance and strength training with GTE supplementation on cognitive function, aerobic capacity and metabolic parameters in young sedentary individuals. **METHODS:** 16 individuals (4 M, 12 F) participated in this double-blind, randomized controlled study. All individuals participated in combined endurance and strength training for 6 wks (60 min/day, 3 days/week), and were randomized to receive either placebo (PLA, N=8, 2 M/6 F; 22.3 ± 2.5 yrs) or GTE (480 mg/day N=8, 2 M/6 F; 23.4 ± 3.6 yrs). Simple cognitive reaction speed, aerobic capacity, and blood metabolic biomarkers (blood glucose and insulin, cholesterol, HDL-C, LDL-C, uric acid and blood urea nitrogen) were measured. **RESULTS:** Improvement in simple cognitive reaction speed was significantly greater in the GTE group compared to the PLA group after training (PLA: -1.05% vs. GTE: 5.36%; $p < 0.05$). Although in both groups the exercise training markedly improved aerobic capacity (PLA: 6.24%; GTE: 7.67%) and increased circulating high density lipoprotein cholesterol (HDL-C) (PLA: 7.96%; GTE: 11.22%) compared to baseline values ($p < 0.05$), there were no differences in these variables between treatments. **CONCLUSIONS:** A 6-wk GTE supplementation may be able to amplify exercise training adaptations in cognitive performance in young sedentary individuals, but aerobic capacity and metabolic biomarkers were not affected after the intervention in this study population.

2771 Board #232 May 29 9:30 AM - 11:00 AM
Abstract Withdrawn

2772 Board #233 May 29 9:30 AM - 11:00 AM
Effect Of A Commercially-available Nitric Oxide Enhancing Supplement On Cardiometabolic Function
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 (No relevant relationships reported)

Post-prandial lipemia (PPL) is characterized by high triglycerides (TG), impaired vascular function, and an inauspicious cardiovascular response after the consumption of a meal. **PURPOSE:** We conducted a pilot study to examine if a commercially-available nitric oxide enhancing supplement (NOx) protects against impairments in cardiometabolic function induced by a high-fat meal (HFM). **METHODS:** Eight healthy males (23 ± 3 y, 28 ± 3 kg/m²) provided blood samples and had flow mediated dilation (FMD) assessed prior to (BL), and 1-, 3-, and 5-hours post consumption of a HFM and either 250 mg of NOx or placebo (PLA) during two randomly-ordered visits. Pulse wave velocity (PWV) and pulse wave analysis (PWA) were also performed on 6 of the 8 participants at BL, and 2- and 4-h post-HFM and supplement consumption. Two-way repeated measures ANOVAs were used to examine differences in blood TGs, glucose (GLU) and low density lipoprotein (LDL), as well as systolic (SBP) and diastolic (DBP) blood pressure, heart rate (HR), normalized aortic augmentation index (AIx75), PWV, and %FMD. Mean differences ± 95% CI are provided in the results section when appropriate. The type-I error rate was set a priori at 5%. **RESULTS:** No significant condition × time interactions were observed for any variable (all $p > 0.108$). Significant main effects for time were observed for TRG (BL<1-h [-36 ± 17 mg/dL; $p = 0.001$]; BL<3-h [-86 ± 79 mg/dL; $p = 0.03$]; 3-h>5-h [+40 ± 23 mg/dL; $p = 0.002$]), HR (BL<2-hour [-3.8 ± 3.6 bpm; $p = 0.04$]), and for DBP, LDL, and PWV. However, Bonferroni-corrected post-hoc comparisons revealed no differences among time points in DBP, LDL, or PWV (Figure 1). **CONCLUSION:** Our results confirm that a HFM induces multiple acute, negative cardiometabolic effects. However, our initial analyses indicate that the NOx supplement did not protect against these impairments.

2773 Board #234 May 29 9:30 AM - 11:00 AM

The Effects Of A Protease Enzyme Blend On The Amino Acid Response To Resistance ExerciseJaclyn E. Morimune¹, Jeremy R. Townsend¹, Megan D. Jones¹, Cheryle N. Beuning², Allison A. Haase², Claudia Boot², Laurel Littlefield¹, Ruth Henry¹, Autumn Marshall¹, Trisha VanDusseldorp³, Yuri Feito, FACSM³, Gerald Mangine³.¹Lipscomb University, NASHVILLE, TN. ²Colorado State University, Fort Collins, CO. ³Kennesaw State University, Kennesaw, GA. (Sponsor: Yuri Feito, FACSM)*(No relevant relationships reported)***PURPOSE:** The aim of the current study was to examine the efficacy of whey protein ingestion with or without a protease enzyme complex on amino acid (AA) availability following acute lower-body resistance exercise.**METHODS:** Ten resistance trained men (24.4±4.1yr, 179.1±8.6cm, 92.6±10.4kg) with at least one year of resistance training experience volunteered to participate in this placebo-controlled, randomized, cross-over designed study. Following an overnight fast, participants performed lower-body acute resistance exercises consisting of four sets each of the leg press and leg extension exercises (8-10 repetitions at 75% of 1RM) followed by consumption of one of three drinks of equivalent volume, taste, and appearance which consisted of either: (a) 26g whey protein + 250 mg protease supplement + whey (PW) (b) 26g whey protein (W), or (c) a non-caloric flavored water drink (PL). Blood samples were collected before exercise, immediately-post (0min), 30-, 60-, 90-, 120-, and 180-minutes post-exercise (30min, 60min, 90min, 120min, 180min respectively). Plasma amino acid samples were analyzed for essential (EAA), branched-chained (BCAA), and leucine concentrations via liquid chromatography-mass spectrometry (LC-MS). A 2-way repeated measures analysis of variance (ANOVA) was used to identify differences between treatments over time. Area under the curve was calculated via the trapezoidal technique and analyzed via a one-way ANOVA.**RESULTS:** Significant main effects for time ($p < 0.001$) and time x group interactions ($p < 0.001$) were found for leucine, BCAA, and EAA. PW drink resulted in significantly greater plasma leucine, BCAA and EAA concentrations at 30 min compared to PL ($p < 0.001$) while not different than W. Leucine was significantly elevated at 30min ($p = 0.007$) and EAAs at 180min ($p = 0.004$) compared to 0min for PW and W were both significantly elevated for leucine, BCAAs and EAAs compared to PL ($p < 0.001$).**CONCLUSION:** While no significant differences were found between the W and PW supplementation groups during the 3-hr period after resistance training; the PW group produced significantly greater leucine concentrations at 30min and for EAAs at 180min than PL compared to 0min. Results indicate that PW may provide a modest improvement of AA appearance in blood following acute resistance exercise.

2774 Board #235 May 29 9:30 AM - 11:00 AM

Acute Protease Supplementation Does Not Alter The Endocrine Response To Resistance Exercise In Trained MalesMegan D. Jones¹, Jeremy R. Townsend¹, Jaclyn Morimune¹, Laurel A. Littlefield¹, Trisha A. VanDusseldorp², Yuri Feito, FACSM², Gerald T. Mangine². ¹Lipscomb University, Nashville, TN. ²Kennesaw State University, Kennesaw, GA.

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*(No relevant relationships reported)*Proteases are enzymes which aid in the hydrolysis of proteins. Previous work has demonstrated protease supplementation may enhance recovery after high-intensity exercise by decreasing muscle damage and inflammation. While the mechanisms involved are not fully understood, it has been suggested that protease supplementation may alter the endocrine response to exercise, promoting a more favorable recovery state. **PURPOSE:** To determine if protease supplementation immediately after an exercise session influences circulating testosterone, cortisol, insulin, insulin-like growth factor-1 (IGF-1), and growth hormone (GH) concentrations. **METHODS:** Ten resistance trained males (24.1±4.1yr, 69.6±6.8 kg 179±8.6 cm) completed 3 acute lower-body resistance exercise sessions consisting of 4 sets of leg press and leg extension in a randomized, crossover fashion. Each exercise was performed at 75% of participant's previously determined one repetition maximum, for 8-10 repetitions, with 90 seconds of rest between sets. Following the exercise session, participants consumed one of 3 treatments (W: 26g whey; PW: 26g whey + 250mg of a protease enzyme blend; PL: non-caloric control). Blood draws were obtained at baseline (BL), immediately-post (IP), 1-hour (1H) and 3-hours post-exercise (3H) and analyzed for testosterone, cortisol, insulin, IGF-1, and GH. Data for each hormone were analyzed with a 2-way repeated measures analysis of variance (ANOVA), while area under the curve (AUC) values were analyzed with a one-way ANOVA. **RESULTS:** Significant main effects for time ($p < 0.05$) were observed for all hormones. There was a significant decrease in testosterone at IP ($p = 0.007$), 1H ($p < 0.001$), and 3H ($p < 0.001$). There was a significant decrease in cortisol at all time points ($p < 0.001$)compared to BL. There were significant increases in insulin, IGF-1, and growth hormone at all time points ($p < 0.001$) following exercise. Additionally, no interaction for any hormone concentrations or AUC values were seen between treatments in this study. **CONCLUSION:** There were no differential effects of W or PW on the post-exercise endocrine response compared to PL. Therefore, neither protease nor protein supplementation appear to alter endocrine response to resistance exercise in trained males.

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2775 Board #236 May 29 9:30 AM - 11:00 AM

The Effects Of 28 Days Of Carnosine Supplementation On Exercise-induced Muscle DamageHaruna Nagatsuka¹, Nanako Hayashi¹, Mikako Sato², Kazusige Goto¹. ¹Ritsumeikan University, Kusatsu, Japan. ²NH Foods Ltd., Tsukuba, Japan.

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*(No relevant relationships reported)*The chicken breast extract contains rich carnosine which plays an antioxidant role (Sato et al., 2012). Therefore, daily carnosine supplementation may attenuate exercise-induced muscle damage response. **PURPOSE:** To examine the effects of the long-term of carnosine supplementation on exercise-induced muscle damage.**METHODS:** Thirteen untrained male subjects were assigned into one of two groups; either carnosine group ($n = 7$; height: 175.2 ± 2.5 cm, body weight: 64.4 ± 1.8 kg, percentage body fat: $12.9 \pm 1.7\%$) or placebo group ($n = 6$; height: 175.1 ± 1.6 cm, body weight: 70.3 ± 4.6 kg, percentage body fat: $17.2 \pm 3.1\%$). They took 1.5g/day of carnosine in carnosine group or placebo supplement in placebo group for 28 days. Before and after supplementation period, the subjects completed a 80 min running (70% $\dot{V}O_{2max}$) to induce muscle damage and inflammatory response. Changes in drop jump (DJ) index, muscle thickness, sores of muscle and blood sample [myoglobin (Mb), creatine kinase (CK), and C-reactive protein (CRP)] were evaluated before exercise and during 24h of post-exercise.**RESULTS:** In both groups, DJ index and muscle thickness did not differ significantly before and after the supplementation period. Sores of muscle were significantly increased after exercise in both groups. However, in the carnosine group, no significant difference was observed between before and post-supplementation period ($p > .05$). Exercise increased significantly serum Mb, CK, CRP levels in both groups ($p < .05$). However, the carnosine group did not present significant difference between before and post-supplementation period ($p > .05$).**CONCLUSIONS:** Long-term (28 days) of carnosine supplementation (1.5/day) did not suppress exercise-induced muscle damage response following endurance exercise in untrained men.

2776 Board #237 May 29 9:30 AM - 11:00 AM

The Effects Of Acute Consumption Of A Brewed Cocoa Beverage On Endothelial Function

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(No relevant relationships reported)

Previous studies have shown that the polyphenol components of cocoa can improve the health and function of blood vessels. It is currently unknown whether consuming a brewed drink made from roasted cocoa beans has the same beneficial effects on blood vessel function.

PURPOSE: The purpose of this study was to assess the acute effects of consuming brewed cocoa on resting blood pressure and endothelial function using near-infrared spectroscopy (NIRS) to evaluate changes in tissue oxygen saturation (StO_2) following blood vessel occlusion.**METHODS:** A total of 15 healthy college-aged adults participated in this study. StO_2 levels were monitored continuously throughout the test using a NIRS device placed on the flexor digitorum profundus of the dominant arm. Baseline StO_2 levels were measured for 5 minutes following 10 minutes of supine rest, after which blood flow to the forearm was occluded for 3 minutes using a blood pressure cuff inflated to 50mmHg above resting systolic pressure, followed by a 5-minute period of reperfusion following release of the cuff. Subjects then consumed either plain water, or the cocoa treatment (40g of roasted cocoa brewed for 10 minutes), and all testing was repeated 90 minutes later. Subjects returned to the lab on a separate day to repeat the test using the opposite beverage.**RESULTS:** The change from baseline was not significantly different between water (W) and cocoa (C) for resting heart rate ($C = -6.6 \pm 6.5$ bpm, $W = -4.4 \pm 7.0$ bpm; $p = 0.29$), resting systolic blood pressure ($C = 0.9 \pm 4.5$ mmHg, $W = -2.2 \pm 7.4$ mmHg; $p = 0.10$), resting diastolic blood pressure ($C = -1.1 \pm 6.7$ mmHg, $W = 0.8 \pm 4.5$ mmHg; $p = 0.39$), pre-occlusion StO_2 ($C = 1.6 \pm 5.6\%$, $W = -1.9 \pm 6.9\%$; $p = 0.06$), minimum StO_2 during occlusion ($C = -0.6 \pm 10.5\%$, $W = -0.7 \pm 12.8\%$; $p = 0.98$), reperfusion maximum StO_2 ($C =$

0.5±3.6%, $W = -0.8 \pm 5.0\%$; $p = 0.40$), or reperfusion rate quantified as the slope of the StO_2 during the first 10 seconds of reperfusion ($C = 0.1 \pm 0.4\% s^{-1}$, $W = 0.06 \pm 0.4\% s^{-1}$; $p = 0.79$).

CONCLUSION: Consumption of a brewed cocoa drink does not significantly affect markers of endothelial function or blood pressure in healthy college-aged adults.

2777 Board #238 May 29 9:30 AM - 11:00 AM
Chronic Alcohol Consumption In Female Mice Yields Strain Dependent Differences In Muscle Atrophy

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(No relevant relationships reported)

Differences in alcohol preference between mouse strains is well known, yet there are no reports of whether alcohol non-preferring mice experience alcoholic myopathy. **PURPOSE:** To determine whether the intake and response to chronic alcohol feeding differs between alcohol preferring (C57BL/6) and non-preferring (CD2F1) mice. **METHODS:** Female C57BL/6 (n=16) and CD2F1 (n=6) mice aged 12-weeks-old were acclimated to a liquid diet (1 wk) prior to randomization into either a control (CON) or alcohol (EtOH) treatment group: B6-CON, B6-EtOH, CD2-CON, and CD2-EtOH. Alcohol was incorporated into the diet and daily consumption of EtOH was assessed relative to body weight. After 7 weeks the gastrocnemius (GAS), tibialis anterior (TA), and quadriceps (QUAD) muscles were excised, weighed and are expressed relative to body weight. Blood was collected from the vena cava and separated into plasma for blood EtOH concentration at time of sacrifice (BAC). The spleen and heart were also removed and weighed. Data were analyzed via 2-way ANOVA for variables across time, and unpaired t-tests were used to detect differences within each strain. **RESULTS:** A group x time interaction was observed for EtOH consumed ($F = 3.010$, $p < 0.001$), where B6-EtOH consumed a greater amount of EtOH compared to CD2-EtOH weeks 3-7 ($p < 0.038$). However, at time of sacrifice, no differences were observed for BAC between the strains ($p = 0.22$). Alcohol intake reduced GAS weight similarly in both strains (B6: $-9.67 \pm 4.15\%$; $p = 0.037$; CD2: $-12.07 \pm 3.19\%$; $p = 0.019$), and muscle weights also did not differ between strains following alcohol intake ($p = 0.06$). QUAD weight was also reduced by alcohol consumption in the CD2 mice ($-17.68 \pm 4.56\%$; $p = 0.02$), while no significant atrophy was observed in the B6 mice. Conversely, B6 mice had a significant reduction in heart weight following chronic alcohol intake ($p = 0.014$; $-13.03 \pm 4.58\%$), while the CD mice showed no effect. Finally, alcohol feeding did not alter spleen weight or TA weight in either strain ($p > 0.05$). **CONCLUSION:** The non-alcohol preferring CD2F1 mice experienced a greater loss of muscle mass in response to chronic alcohol feeding, despite consistently consuming a lower dose of alcohol. Future work will be needed to determine what molecular pathways contributed to the enhanced catabolic effect of alcohol in this strain of mice.

2778 Board #239 May 29 9:30 AM - 11:00 AM
Pistachios May Promote Recovery From Strenuous Exercise

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(No relevant relationships reported)

Among nuts, pistachios are considered a rich source of leucine. They are also a good source of antioxidants. These are compounds known to promote muscle protein synthesis and reduce inflammation respectively. Therefore, we hypothesize that pistachios may confer favorable effects to athletes following strenuous exercise.

PURPOSE: to determine if pistachio nut consumption for two weeks prior to and during three days of recovery from vigorous, eccentrically biased exercise improves muscles soreness, vertical jump height and muscle strength in a dose (0, 1.5 oz and 3.0oz per day) dependent manner.

METHODS: Using a randomized, crossover approach, nine active men (N=9), (25.5 ± 5yrs, 175.3 ± 5.6 cm, 76.0 ± 9.4 kg, $VO_2 \text{ peak} = 53.3 \pm 9.1 \text{ ml/kg/min}$) engaged in three, 40-minute downhill runs after 2-weeks of each dose intervention, with a minimum 3-week washout period between trials. Muscle soreness, vertical jump height and muscle strength were assessed pre-exercise (baseline) and 24-hr, 48-hr and 72-hr post exercise, and subjects continued consuming their specified daily dose throughout the recovery period. Data were analyzed using a 3 x 4 repeated measures ANOVA with post-hoc Paired T-tests when appropriate.

RESULTS: Subjective measures of delayed onset muscle soreness for the RTA were significantly higher in the control trial than the 3.0oz/d trial at 72-hr ($p < .03$). Vertical Jump height decreased 24 hours after the downhill run for the 0oz/d trial only ($p < .03$; 95% CI 0.12 to 1.38). Although no significant differences were detected between

the 0 oz/d trial and the other trials, average muscle torque during leg flexion at two different speeds was higher ($p < 0.05$) at the 48 hour time-point for the 3.0 oz/d trial versus the 1.5 oz/d trial.

CONCLUSIONS: Preliminary analysis suggest that pistachio consumption tended to promote several markers of recovery; however, since blinding research participants was not possible, we cannot eliminate the potential role that a placebo effect may play.

2779 Board #240 May 29 9:30 AM - 11:00 AM
Optimization Of Heart-Brain-Axis Signaling Improves Mental And Physical Performance

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PURPOSE: Dynamic changes in heart rate variability (HRV) are considered as markers for autonomic nervous system (ANS) balance and psychological mood states, including depression, anxiety, overtraining, and burnout. HRV is reduced in both depression and heart disease, suggesting common physiological mechanisms. Reduced HRV suggests poor stress adaptation, while increased HRV is associated with vigor (physical energy, mental acuity & emotional well-being). This study assessed the effects of nutritional supplementation on "Heart-Brain-Axis" dynamics whereby nutrition may impact physical (heart) and psychological (brain/mood) parameters in a coordinated manner.

METHODS: Before and after 30-days of supplementation, subjects performed a HRV assessment (emWave Pro; HeartMath Institute) and completed a validated Profile of Mood States (POMS) survey to assess Global Mood (GM) and related subscales: Vigor (V), Tension (T), Depression (D), Anger (A), Fatigue (F), Confusion (C). The supplement (MentaHeart; Amare Global) contained 5 natural ingredients previously shown to have health benefits, including Palm fruit bioactives (redox balance), Astaxanthin (antioxidant), Bergamot (cholesterol), Coenzyme Q10 (cardiac energetics), and Black cumin seed (inflammation).

RESULTS: Following 30-days of supplementation, HRV was improved 11% (SDNN; 47.5msec Pre versus 58.2msec Post) and 19% (RMSSD 3.7 Pre versus 4.4 Post), indicating superior ANS tone and enhanced stress resilience. Psychological Mood State (POMS) parameters showed dramatic improvements following supplementation, with reductions in negative mood states: T (-49%), D (-76%), A (-39%), F (-51%), and C (-62%); with corresponding increases in positive mood states: GM (+23%) and V (+22%).

CONCLUSIONS: Supplementation resulted in a meaningful 11-19% increase in HRV (suggesting a "physical" heart benefit) and also improved mood state parameters (suggesting a "mental" brain benefit). While previous studies have shown individual ingredients to improve general heart/brain health, these data are the first to show that targeted multi-nutrient supplementation supports the multi-faceted psychophysiological "Heart-Brain-Axis" with simultaneous and coordinated improvements in both physical and mental performance.

2780 Board #241 May 29 9:30 AM - 11:00 AM
Astaxanthin Formulation Leads To Greater Lipid Oxidation & Increased Exercise Tolerance In Elderly

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Purpose: Natural anti-oxidant and anti-inflammatory products have been found to increase fat oxidation and endurance in animals and humans when combined with exercise training. Here, we test this approach as a treatment for the reduced lipid oxidation and associated lower endurance in human aging using a formulation combining natural anti-inflammatory and anti-oxidant products (AX: astaxanthin, 12 mg; tocotrienol, 10 mg; and zinc, 6 mg). **Methods:** We conducted a randomized, double-blind, placebo-controlled study in the elderly of a daily oral dose (16 weeks) of AX formulation with 12 weeks of exercise training, 3x/week for 40-60 min of increasing intervals of incline walking, targeting 80% HRmax. Cardiovascular endurance and fat oxidation was calculated from respiratory exchange ratio via Balke treadmill test. Tibia anterior (TA) muscle strength and fatigue resistance was measured as force time integral (FTI) in ankle dorsiflexion exercise to fatigue. TA resistance to fatigue was also determined by number of contractions. **Results:** After 12 weeks of training both groups improved treadmill time, only AX group delayed time reach to anaerobic threshold (218±15s vs. 311±32s). Total fat oxidation improved in both group, but AX improved ($\Delta 80.4 \pm 19.4\%$) more compare to training alone ($\Delta 39.2 \pm 10.2\%$). TA fatigue resistance measured by total contractions ($\Delta 184 \pm 77$) and FTI ($\Delta 102 \pm 30$ N) improved only in the AX group. **Conclusion:** AX supplementation

combined with interval training improved whole body fat use significantly more than training alone. Delayed anaerobic threshold in AX group suggested higher exercise capacity. This increased fatigue resistance of the TA in addition to the greater exercise capacity suggests that this metabolic effect is occurring at the level of the individual muscle. The increased fat oxidation and delayed anaerobic threshold may be due to sustained fat use at lower rates of exercise that leads to carbohydrate sparing and ultimately increased carbohydrate availability at more intense exercise levels. The combination of whole body exercise and single muscle fatigue testing removed the training effect (neuromuscular adaptation) that is commonly seen in exercise training. These results indicate that AX supplementation results in greater metabolic adaptation than endurance training alone.

2781 Board #242 May 29 9:30 AM - 11:00 AM
Influence Of Post-exercise Nutrient Intake On Recovery And Subsequent Exercise Performance In Youth Cyclists

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PURPOSE: The purpose of this study was to determine if chocolate milk (CM) consumption after high-intensity cycling affected post-exercise recovery and subsequent exercise performance in youth cyclists, compared to carbohydrate (CHO) and placebo (PL) beverages.

METHODS: Eight youth cyclists (15-18 y, $\dot{V}O_{2peak} = 61.8 \pm 7.7$ mL \cdot kg⁻¹ \cdot min⁻¹) completed two exercise sessions on three separate occasions. The first exercise session (EX1) included 30 min of constant-load cycling, and 60 min of standardized high-intensity intervals. Subjects consumed a recovery beverage (PL, CHO or CM) immediately following EX1 and again 2 h after EX1. A standardized lunch was consumed 4 h post-EX1, and a second exercise session (EX2) was completed 7 h after EX1. EX2 consisted of 30 min of constant-load cycling followed by a simulated 30 km time trial (TT). Ratings of muscle soreness, and mental and physical energy/fatigue were obtained prior to EX1, 4 h post-EX1, and pre-EX2. TT power output (W) was used to assess subsequent exercise performance.

RESULTS: Changes in muscle soreness over time were not significantly different between treatments. However, soreness was significantly elevated in PL from pre-EX1 (44 \pm 23 mm) to 4 h post-EX1 (67 \pm 22 mm) and pre-EX2 (68 \pm 20 mm). Soreness tended to be elevated in CHO from pre-EX1 (37 \pm 26 mm) to 4 h post-EX1 (52 \pm 28 mm; $p = 0.051$) but not at pre-EX2, and soreness was not elevated at any post-exercise timepoint in CM. Physical fatigue ratings increased significantly from pre-EX1 to pre-EX2 in PL, but not CHO or CM. In addition, changes in physical fatigue after exercise tended to be less pronounced with CM versus other treatments (p -values for treatment \times time effects: 0.03 - 0.19). Average TT power was similar between PL (181 \pm 27 W), CHO (197 \pm 39 W) and CM (195 \pm 38 W).

CONCLUSIONS: CM ingestion after exercise may confer recovery benefits in youth cyclists, as demonstrated by the absence of elevated muscle soreness and fatigue ratings post-exercise. However, significant treatment \times time effects were not consistently observed across all soreness/fatigue measurements. Subsequent cycling performance was not significantly different between treatments. However, TT performance effects (~8% higher power in CM/CHO versus PL) may be functionally relevant if upheld in trials with larger sample sizes.

2782 Board #243 May 29 9:30 AM - 11:00 AM
Abstract Withdrawn

2783 Board #244 May 29 9:30 AM - 11:00 AM
The Effects Of Sliver Perch Essence On Body Weight And Endurance Capacity

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PURPOSE: To investigate the influence of sliver perch essence (SPE) on the anti-fatigue effect and body weight gain (BW). **METHODS:** Thirty-six Wistar rats were weight-matched and assigned into three groups, including: control (water placebo, $n = 12$), L-SPE (6.2 ml/kg BW/day, $n = 12$), and H-SPE (31 ml/kg BW/day, $n = 12$), and SPE were orally administered for 32 consecutive days. The swimming exhaustive test (with 3% BW load attached on the tail) was used to evaluate the swimming endurance performance in response to SPE supplementation. All data were expressed as mean \pm SEM, and ANOVA was used to examine the differences in swimming capacity and BW

change among groups. Duncan multiple range t-test was used as post-hoc test. $P < 0.05$ was considered statistically significant. **RESULTS:** After SPE supplementation, the BW gain was not different among the three groups. However, the BW gain slowed down after the 22nd day, the weight gain of the H-SPE group was significantly lower than that of the control group (11.34%, $p = 0.038$). When normalizing with caloric intake, both L-SPE (-19.75%) and H-SPE (-18.9%) showed significantly less weight-gain compared to control group ($p = 0.016$ and $p = 0.022$, respectively), but there was no difference between L-SPE and H-SPE. The swimming time to exhaustion was significantly higher in the L-SPE but not H-SPE than in the control group ($p = 0.031$). **CONCLUSION:** The results showed that 32-days of SPE supplementation can promote the swimming endurance capacity and attenuate the weight gain in the rodent models.

Keywords: anti-fatigue, calorie, swim, weight gain

E-34 Free Communication/Poster - Cold/Hyperbaric Physiology

Friday, May 29, 2020, 9:30 AM - 12:00 PM
 Room: CC-Exhibit Hall

2784 Board #245 May 29 10:30 AM - 12:00 PM
Effects Of A Demand-valve Scuba Regulator On Cardiovascular Function Under Normobaric Conditions: Preliminary Findings

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PURPOSE: An increased number of diving fatalities related to cardiac events, leading to loss of air and drowning have been reported (Divers Alert Network, 2018). These events are often preceded by acute physiological stress, such as when presented with situations that increase physiological workload (emergency event, strong current, etc.). Greater cardiorespiratory response, including significant increases in heart rate and cardiac output, often occur as a result of increased stress. Examining equipment factors that influence cardiorespiratory stress during diving has been limited. Therefore, the purpose of this preliminary investigation was to examine the effect of a scuba regulator on cardiorespiratory measures in a group of volunteer participants.

METHODS: Ten participants ($x = 21.5$ yrs.) completed two sub-maximal exercise tests (YMCA Protocol) under sea-level atmospheric conditions on a Monark (Vansbro, Sweden) cycle ergometer until 85% of calculated maximal heart rate was observed. Heart rate, blood pressure, rating of perceived exertion (RPE), and pulse oxygen levels were all collected. The first submaximal test was collected under typical conditions (control). After one week, each participant completed a second submaximal test while breathing compressed air from a demand valve scuba regulator (Dive Rite, FL) connected to an 80 cu/ft aluminum scuba cylinder. All procedures were approved by a university institutional review board prior to data collection.

RESULTS: A descriptive analysis of the data indicated all variable means for the regulator condition (except RPE) were within two standard deviations of the respective mean values for the control condition and therefore considered non-significant. Subsequent post-hoc analysis determined minimum sample sizes required for future research to detect if true differences between groups exist for each variable.

CONCLUSIONS: Preliminary data suggest that breathing from a demand valve scuba regulator does not appear to affect exercise tolerance or increase cardiorespiratory stress at submaximal workloads under normobaric environmental conditions. Future sample size requirements from this preliminary investigation have been determined through statistical analysis and further research with a larger sample appears warranted.

2785 Board #246 May 29 10:30 AM - 12:00 PM
Self-paced Aerobic Exercise Performance Is Attenuated Following Four Hours Cold Water Immersion

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It is common for special warfare operators to complete land-based missions following prolonged transport dives. Time to exhaustion during high intensity aerobic exercise is attenuated following cold water submersion, which can be exacerbated when breathing oxygen (O₂). However, the high intensity time to exhaustion model may not be operationally relevant. **PURPOSE:** We tested the hypothesis that self-paced exercise performance following four hours cold water immersion is reduced compared

to a non-immersed control, and that performance would be further reduced when breathing O₂ during immersion. **METHODS:** Eight subjects (4 men and 4 women; age: 25±2y; Body Fat (%): 19.3±5.1; $\dot{V}O_{2max}$: 46±4 mL/kg/min) completed a baseline (CON) performance and two, 4 hour cold water immersion visits (20°C) breathing air or 100% O₂. During CON visit and following immersion, subjects completed a 60 minute loaded ruck-march with 20% body mass (data not shown) followed by a self-paced 5 km run on a motorized treadmill. Core temperature, heart rate, and rating of perceived exertion (RPE) were recorded every 500 m during the run. **RESULTS:** 5 km run time was reduced following immersion while breathing 100% O₂ ($p=0.006$) and air ($p=0.007$) compared to the CON (32±6 min vs. 32±5 min vs. 28±4 min, respectively). However, there was no difference between air and O₂ ($p=0.86$). Core temperature increased during the 5 km run ($p<0.001$), but was not different between conditions ($p=0.96$). Heart rate increased during the 5 km run ($p<0.001$), but was not different between conditions ($p=0.49$). Finally, RPE increased during the run ($p<0.001$), but was not different between conditions ($p=0.73$). **CONCLUSION:** These findings suggest that prolonged cold water immersion attenuates self-paced aerobic endurance performance, but does not appear to be further affected by breathing gas type (i.e., air vs. 100% O₂). However, the mechanisms for this attenuated post-immersion performance remain largely unknown.

2786 Board #247 May 29 10:30 AM - 12:00 PM
Effects Of Environmental Condition And Body Fat Percentage On Metabolic Efficiency During Cycling Exercise

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 (No relevant relationships reported)

PURPOSE: To examine the effects of environmental condition and body fat percentage on metabolic efficiency during cycling exercise.

METHODS: Recreationally active men consisting of 4 low-fat (LF; 10.9% ± 2.5; 23.8 ± 3.1yrs; 182.6 ± 7.1cm; 80.7 ± 4.5kg; 4.03 ± 0.34L·min⁻¹) and 4 high-fat (HF; 15.9% ± 2.2; 23.3 ± 1.9yrs; 180.9 ± 4.3cm; 79.6 ± 5.9kg; 3.63 ± 0.13L·min⁻¹) completed 2 experimental trials in 5°C/20% RH (LT) and 22°C/45% RH (MT) in a counterbalanced fashion. Participants completed 60-min of cycling at 60% $\dot{V}O_{2max}$. Metabolic efficiency was calculated during cycling at 3min, 15min, 30min, 45min, and 60min. Data were analyzed using a three-way repeated measures mixed-design ANOVA. **RESULTS:** A time x BF interaction was observed ($F=4.147$; $p<0.001$). Post hoc analysis indicated a main effect of time in LF ($F=11.983$; $p<0.001$) and HF ($F=24.086$; $p<0.001$) individuals. Specifically, significant decreases in metabolic efficiency were observed at 15min, 30min, 45min, and 60min compared to 3min ($p < 0.05$) in LF individuals, with no further reductions observed at 45min ($p=0.732$) and 60min ($p=0.598$) compared to 30 min. In HF individuals, significant decreases in metabolic efficiency were observed at 15min, 30min, 45min, and 60min compared to 3min ($p < 0.05$), with further reductions observed at 45min ($p=0.021$) and 60min ($p < 0.001$) compared to 15min, and at 60min compared to 30min ($p=0.005$) and 45min ($p=0.002$). Furthermore, a condition x time interaction ($F=3.351$; $p=0.026$) was observed. A main effect of time was observed for the LT condition ($F=22.436$; $p<0.001$) and MT condition ($F=20.850$, $p<0.001$), with significant decreases at 15min, 30min, 45min, and 60min compared to 3min ($p < 0.05$) during both the LT and MT conditions. Furthermore, paired samples t-test indicated significantly lower metabolic efficiency in the MT condition compared to the LT condition at 45min (MT; 19.17 ± 1.6%; LT; 20.2 ± 1.6%; $p=0.20$) and 60min (MT; 18.88 ± 0.63%; LT; 19.16 ± 0.68% $p=0.49$). **CONCLUSIONS:** Data suggests that individuals with a higher % BF may experience greater decreases in metabolic efficiency throughout prolonged cycling exercise at moderate intensity. Additionally, metabolic efficiency appears to decrease throughout cycling exercise, with cold environments resulting in greater efficiency compared to MT conditions.

2787 Board #248 May 29 10:30 AM - 12:00 PM
Brain Derived Neurotrophic Factor Response To Aerobic Exercise In The Cold

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PURPOSE: To examine changes in brain derived neurotrophic factor (BDNF) concentration in both plasma and serum following exercise in the cold. **METHODS:** Six recreationally active men (26 ± 3 yrs; 180.3 ± 5.8 cm; 85.3 ± 8.4 kg; 48.6 ± 5.7 ml·kg⁻¹·min⁻¹) completed an exercise protocol under two conditions: moderate temperature (MT; 23°C/45%RH) and low temperature (5°C). The protocol consisted of a 60-minute cycling trial at 60% $\dot{V}O_{2max}$, a 15-minute rest, and a time-to-exhaustion trial at 90% $\dot{V}O_{2max}$ (TTE). Blood was collected before (T1) and after

(T2) the 60-minute trial, immediately after TTE (T3), and one hour post-TTE. Plasma and serum concentrations of BDNF were measured via ELISA. Changes were analyzed using separate condition by time mixed-model regression for each dependent variable. **RESULTS:** No significant condition × time interaction ($F = 1.626$, $p = 0.201$) or main effect of time ($F = 0.626$, $p = 0.603$) was observed for changes in serum BDNF concentrations; however, a significant main effect of condition ($F = 7.685$, $p = 0.009$) was observed. When collapsed across time, serum BDNF concentration was significantly lower during LT (2718.8 ± 1172.2 pg/mL) compared to MT (7240.5 ± 1134.2 pg/mL; $p = 0.009$). No significant condition × time interaction ($F = 0.117$, $p = 0.950$), main effect of time ($F = 0.511$, $p = 0.677$) nor main effect of condition ($F = 0.000$, $p = 0.988$) was observed for changes in plasma BDNF concentrations. **CONCLUSIONS:** The results of this study suggest that exercise in a cold environment (5°C) blunts serum BDNF concentration. However, plasma concentrations of BDNF were not affected by environmental condition nor exercise. Previous research has found no relationship between serum and plasma BDNF, suggesting that these are independent measures of diverse physiological relevance. Peripheral BDNF is predominantly stored in platelets (~99%), with only a small amount of free BDNF present in plasma. Due to the smaller amount of platelet-associated BDNF in plasma, plasma concentrations of BDNF may reflect the amount of free BDNF. Therefore, exercise in a cold environment may decrease BDNF release from platelets while having no effect on free BDNF.

This study was partially funded by the Kent State University Research Council.

2788 Board #249 May 29 10:30 AM - 12:00 PM
Effects Of Exercise Training In A 7°C Environmental Temperature Exercise Training Period

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 (No relevant relationships reported)

Purpose: To determine the impact of cold environmental temperature on endurance exercise training adaptations. **Methods:** Two groups of twelve untrained male subjects completed sixteen 1-hour of cycling sessions in either 7°C or 20°C environmental temperature. Fitness assessments before and after acclimation occurred in standard room temperature. Muscles biopsies were taken from the vastus lateralis before training and after training to assess molecular markers related to mitochondrial development. **Results:** PGC-1 α mRNA was higher in 7°C than 20°C in response to acute exercise before training ($p=0.012$) but not after training ($p=0.813$). PGC-1 α mRNA was lower after training ($p<0.001$). BNIP3 was lower after training in the 7°C than the 20°C group ($p=0.017$), but not before training ($p=0.549$). No other differences occurred between temperature groups in mRNA of VEGF, ERR α , NRF1, NRF2, TFAM, PINK1, Parkin, or BNIP3L ($p>0.05$). PGC-1 α protein and mtDNA were not different before training, after training, or between temperatures ($p>0.05$). Cycling power increased during the daily training ($p<0.001$) but was not different between temperatures ($p=0.169$). $\dot{V}O_{2peak}$ increased with training ($p<0.001$) but was not different between temperature groups ($p=0.460$). **Conclusions:** These data indicate that cold environmental temperatures alter PGC-1 α gene expression acutely, but this difference is not manifested throughout a training period as increased fitness.

2789 Board #250 May 29 10:30 AM - 12:00 PM
Effect Of Continuous Cold-Water Immersion Recovery Protocol On Locomotion Performance During A Congested-Fixture Handball Tournament

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Cold water immersion (CWI) is a commonly recommended recovery technique for athletes. Few studies, however, have analyzed the effects of CWI protocols, specifically in internal and external load in congested fixture tournament. The purpose of this study was to explore the effectiveness of continuous cold water immersion (CCWI) protocols and passive recovery on kinematic performance of handball players. A total of 32 (19 women and 13 men), members of eight clubs took part of a congested tournament (3 days, a match per day, total of twelve matches). Inertial measurement devices were attached to each player's back at the inter-scapular T2-T4 level. External load (relative distance, accelerations, maximum acceleration, maximum and average speed, total impacts, accelerations/decelerations difference, and player load) and internal load (maximum and average heart rate) were assessed using these devices. Participants were randomly divided into two recovery groups: a) CCWI group (12°C for 12min), sitting during immersion with their legs completely extended, and the

water reaching navel height, and b) control group (23°C, 12min passive, sit rest in similar body position). Mixed analysis of variance (ANOVA) was used, to verify the possible differences between matches and recovery protocols for each variable. There were no differences in internal or external load variables between recovery groups during tournament in men or women (see figure 1.). Continuous cold water immersions and passive recovery are both effective to maintain the external and internal physical demands during a congested tournament in handball.

Variable	Men	Women
Relative distance (m/min)	($F_{(2,37)}=.272, p=.764, \omega_p^2=-.04$)	($F_{(2,49)}=.186, p=.831, \omega_p^2=-.02$)
Accelerations	($F_{(2,37)}=.02, p=.981, \omega_p^2=-.06$)	($F_{(2,49)}=.865, p=.428, \omega_p^2=0$)
Maximum acceleration (m/s ²)	($F_{(2,37)}=.302, p=.742, \omega_p^2=-.05$)	($F_{(2,49)}=.073, p=.93, \omega_p^2=-.3$)
Maximum speed (km/h)	($F_{(2,37)}=.1.021, p=.372, \omega_p^2=0$)	($F_{(2,49)}=.439, p=.648, \omega_p^2=-.02$)
Average speed (km/h)	($F_{(2,37)}=.279, p=.758, \omega_p^2=-.04$)	($F_{(2,49)}=.059, p=.946, \omega_p^2=-.3$)
Maximum heart rate (bpm)	($F_{(2,37)}=.01, p=.995, \omega_p^2=-.06$)	($F_{(2,49)}=.466, p=.63, \omega_p^2=-.02$)
Average heart rate (bpm):	($F_{(2,37)}=.103, p=.903, \omega_p^2=-.06$)	($F_{(2,49)}=.511, p=.603, \omega_p^2=-.01$)
Total impacts (n)	($F_{(2,37)}=.13, p=.879, \omega_p^2=-.06$)	($F_{(2,49)}=.016, p=.984, \omega_p^2=-.3$)
Acceleration/deceleration difference (m/s ²)	($F_{(2,37)}=.1.292, p=.289, \omega_p^2=0$)	($F_{(2,49)}=.725, p=.489, \omega_p^2=0$)
Player load (au)	($F_{(2,37)}=.097, p=.908, \omega_p^2=-.02$)	($F_{(2,49)}=.172, p=.843, \omega_p^2=-.02$)

E-35 Free Communication/Poster - Hypoxia/Altitude Physiology

Friday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

2790 Board #251 May 29 10:30 AM - 12:00 PM EFFECT OF LIGHT-MODERATE EXERCISE AT ACUTE NORMOBARIC HYPOXIA ON ELECTROENCEPHALOGRAM AND PHYSIOLOGICAL RESPONSES

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(No relevant relationships reported)

It is well known that hypoxic stress causes various physiological responses and/or adaptations. Hypoxia also affects brain activities such as cognition, judgment and exercise performance, and it is thought that the influence on electroencephalogram (EEG) is great. However, there are few researches related to the change of EEG to hypoxia *per se* and exercise at hypoxia, and it is thought that the mechanisms underlying the physiological responses including brain activity of hypoxic stress *per se* and exercise at hypoxia were not fully understand. **PURPOSE:** The purpose of this study was to examine that effect of light-moderate exercise at acute normobaric hypoxia on EEG and physiological responses. **METHODS:** Eleven college-age male subjects were participated in this study. They completed the light-moderate exercise (50-65%HRmax) at both normoxia and normobaric hypoxia (14.5% hypoxia). We measured EEG of left forehead, heart rate (HR), and oxygen saturation (SpO₂) before and after exercise. EEG measurement was carried out in a quiet environment, and subjects measured with their eyes closed. The measured EEG was classified into 3 frequency bands. In other words, it was classified into θ wave 4 to 7.5 Hz, α wave 8 to 13 Hz, β wave 13.5 to 30 Hz. The average value (μ V) of the amplitude of the EEG and the total amplitude of the EEG in the entire frequency band (3 to 30 Hz) were obtained for each measurement for 10 minutes. Repeated measures ANOVA were performed across treatments. **RESULTS:** SpO₂ at rest and during moderate exercise in hypoxia was significantly lower than that of normoxia (hypoxia; 89.0±2.2% at rest, 82.1±4.4% during exercise, normoxia; 96.8±1.5% at rest, 96.6±1.5% during exercise, p<0.05). HR at rest and during moderate exercise in hypoxia was significantly higher than that of normoxia (p<0.05). The average value of α wave tended to increase after exercise in normoxia from 3.08±0.79 to 3.26±0.96 μ V. On the other hand, α wave tended to slightly decrease after exercise in hypoxia from 2.96±0.85 to 2.84±0.82 μ V. The average value of θ and β wave did not change after exercise at both environments.

CONCLUSIONS: From these results, light-moderate exercise in hypoxia could attenuate α wave expression by decreasing SpO₂. It would be affect the exercise performance and acclimatization at altitude, as well as cognition.

2791 Board #252 May 29 10:30 AM - 12:00 PM Resistance Training Alleviates Hypoxia-induced Skeletal Muscle Atrophy Of Rats By Inhibiting FoxO1-mediated Autophagy Pathway

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PURPOSE: The aim was to investigate the effects of resistance training on hypoxia-induced muscle atrophy and the regulation of FoxO1-mediated autophagy. **METHODS:** SD rats were divided into the normoxic control group (C), the normoxic resistance training group (R), the hypoxic control group (H), and the hypoxic resistance training group (HR). Group R and HR were trained by incremental load ladders every other day; Group H and HR lived in a hypoxia with 12.4% O₂ for 4 weeks. After autophagy was confirmed by testing the expression of autophagy regulatory protein and autophagy key protein, autophagy PCR chip was used to determine the function of autophagy and the interaction with FoxO1, then the localization and expression of FoxO1 were tested. **RESULTS:** The lean body mass (LBM) (260.50±9.35 vs. 226.83±8.33), EDL wet weight (165.33±10.59 vs. 143.83±13.85) and FCSA (16.13±1.92 vs. 13.52±1.27), as well as the protein expression levels of Myosin (1 vs. 0.75±0.15) and Atrogin1 (1 vs. 1.29±0.22) in group H were significantly different from group C (P<0.05); The EDL wet weight (153.50±6.12) in group HR was significantly higher than group H, and Atrogin1 (0.73±0.14) expression was significantly decreased (P<0.05). The expression (11.26±4.72 vs. 83.72±13.82) and the nuclear localization of FoxO1 (56.28±3.47 vs. 65.39±4.29) was significantly increased (P<0.05) under hypoxia; The expression (12.83±4.95) and nuclear localization (52.82±5.32) of FoxO1 were decreased (P<0.05) in group HR. The expression of Beclin1 (1 vs. 1.27±0.11) and LC3II/I (1 vs. 1.44±0.14) was increased in group H; the expression of LC3II/I (1.23±0.08) was decreased in HR group. PCR microarray showed the number of differentially expression genes in autophagy was higher in group H than C, and the function was concentrated in “Genes involved in autophagic vacuole formation”; the number of autophagy genes was decreased in group HR/H, and the function was concentrated in “Co-regulators of autophagy and apoptosis”. The interaction and Pathway analysis between genes in group R/C, H/C, and HR/H and FoxO1, found that the regulation of autophagy by FoxO1 was concentrated in autophagy prophase. **CONCLUSIONS:** The alleviation of muscle atrophy by resistance training under hypoxia may be related to the regulation of autophagy by FoxO1. Supported by NNSF of China (31771317)

2792 Board #253 May 29 10:30 AM - 12:00 PM The Impact Of Three Consecutive Days Of Endurance Training In Hypoxia On Hepcidin Responses.

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(No relevant relationships reported)

Endurance exercise in hypoxia resulted in similar hepcidin elevation compared with exercise in normoxia (Govus et al. 2014; Goto et al. 2017). However, how consecutive days of endurance training in hypoxia affects hepcidin elevation remains unclear. **PURPOSE:** The purpose of the present study was to determine the effect of three consecutive days of endurance training in hypoxia on hepcidin response. **METHODS:** Nine active healthy males completed two trials on different days, consisting of either three consecutive days of endurance training in hypoxia (F_{O₂}: 14.5%) or normoxia (F_{O₂}: 20.9%). They performed 90-min sessions of endurance training consisting of high-intensity endurance interval exercise (10 × 4 min pedaling at 80% of VO_{2max} with 2 min of active rest at 30% of VO_{2max}) followed by 30 min continuous pedaling at 60% of VO_{2max} during three consecutive days (days 1-3). Venous blood samples were collected after an overnight fast during experimental periods (days 1-4) to determine the serum hepcidin, iron, ferritin and haptoglobin concentrations. **RESULTS:** Pedaling workload during endurance training were significantly lower in the HYP (interval exercise: 166 ± 4.3 W) than in the NOR (194 ± 7.6 W, P < 0.0001). Serum iron (P < 0.0001) and ferritin (P = 0.005) concentrations on days 2-4 significantly increased in both trials, whereas there was no significant difference between the two trials. Serum haptoglobin concentrations did not significantly change throughout the experimental periods in either trial. Moreover, NOR showed significantly greater serum hepcidin elevation on the days 2-4 compared with day 1 (day1: 13.9 ± 8.6 ng/mL, day2: 30.4 ± 9.9 ng/mL, P = 0.004). However, no significant difference was observed in serum hepcidin concentrations between the NOR and HYP.

CONCLUSION: Three consecutive days of endurance training in hypoxia did not affect further hepcidin elevation compared with endurance training in normoxia.

2793 Board #254 May 29 10:30 AM - 12:00 PM
The Effects Of Hypoxic Training At Different Exercise Intensities On Endurance Performance
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Almost of endurance performance difference among athletes can be explained by running economy (RE). Short-term training under hypoxic conditions is useful in improving the RE; thus, enhancing endurance performance. However, the type of exercise intensity under hypoxic conditions effectively enhancing the RE and endurance performance has not been well documented. **PURPOSE:** We aimed to compare the changes in the RE and endurance performance between different exercise intensities by 5-day hypoxic training. **METHODS:** Twenty-two well-trained male distance runners were divided into these three training groups: low-intensity in normoxia (NOR, $FIO_2=20.9\%$), low-intensity in hypoxia (HL, $FIO_2=14.5\%$), and high-intensity in hypoxia (HH, $FIO_2=14.5\%$). They trained for five consecutive days (day 1-5), all groups performed short-time (5 rep*30 s) maximal sprint training in the morning, the NOR and the HL performed long-time low-intensity (2 rep*30 min at <4mM) endurance training and the HH performed long-time high-intensity (10 rep*2 min at 4mM) endurance training in the afternoon. Low-intensity (230 m/min) the RE (RE230), high-intensity (>4mM) the RE (RE4mM), and time-to-exhaustion at 100% of VO_{2max} intensity (TTE) on days 0, 8, and 14 were measured. **RESULTS:** A significant enhancement of the TTE and the RE230 was observed from day 0 to day 14 (267 ± 56 s to 374 ± 83 s and 0.99 ± 0.05 kcal/kg/km to 0.97 ± 0.06 kcal/kg/km; $P<0.05$); whereas, no significant enhancement of the RE4mM was observed (1.09 ± 0.08 kcal/kg/km to 1.08 ± 0.09 kcal/kg/km; $P>0.05$) in the HL. There was no significant enhancement of the TTE (443 ± 151 s to 513 ± 105 s; $P>0.05$), the RE230 (1.02 ± 0.03 kcal/kg/km to 1.01 ± 0.04 kcal/kg/km; $P>0.05$), and the RE4mM (1.18 ± 0.03 kcal/kg/km to 1.15 ± 0.05 kcal/kg/km; $P>0.05$) in the HH. Similarly, there was no significant enhancement of the TTE (432 ± 90 s to 393 ± 100 s; $P>0.05$), the RE230 (0.99 ± 0.06 kcal/kg/km to 0.99 ± 0.04 kcal/kg/km; $P>0.05$), and the RE4mM (1.10 ± 0.08 kcal/kg/km to 1.11 ± 0.06 kcal/kg/km; $P>0.05$) in the NOR. **CONCLUSION:** Our main finding was that the HL enhanced the RE at low-intensity and the TTE. However, the HH did not enhance the RE at high-intensity and TTE. These results indicate that increasing the exercise time than increasing exercise intensity is necessary to enhance endurance performance by hypoxic training.

2794 Board #255 May 29 10:30 AM - 12:00 PM
EFFECTS OF 3-WEEK NATURAL ALTITUDE TRAINING ON IMMUNOGLOBULIN LEVELS IN AMATEUR ADOLESCENT ATHLETES
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PURPOSE: Although the effects of exercise on immunoglobulin have been widely studied in adults, the available evidence in children and adolescents exposed to high altitude environment is more sparse. To determine the effects of altitude training on IgA, IgM, IgG in amateur adolescent athletes.

METHODS: Twenty-one male amateur adolescent runners (age: 15.3 ± 0.7 years, height: 164.7 ± 5.4 cm, weight: 51.3 ± 6.1 kg, training period: 0.9 ± 0.2 years) in plain area (190m), with no previous altitude training experience, voluntarily participated in the study. All subjects were exposed to an altitude of 1890m (Liupanshui, China) for 3 week and altitude exposure consisted of 6 d/wk of training (4-5 h/d). The change of IgA, IgG, IgM were measured in the plain, and the first day, the first week, the second week, the third week after arrival at the high altitude research station.

RESULTS: The IgA level (2.13 ± 0.82 vs. 1.96 ± 0.74 , 2.00 ± 0.83 , 1.97 ± 0.79 , 1.99 ± 0.77 g/L, $p>0.05$) of the athletes decreased slightly in altitude environment, but there was no significant difference at different time. The IgG level of the athletes decreased slightly after arriving at the altitude (10.89 ± 1.98 vs. 10.53 ± 1.57 g/L, $p>0.05$), decreased significantly at the first weekend (10.89 ± 1.98 vs. 10.17 ± 2.25 g/L, $p<0.01$), began to rise in the second week, and was still significantly lower than the basic value at the third weekend (10.89 ± 1.98 vs. 10.38 ± 1.99 g/L, $p<0.01$). During the whole period of altitude training, the IgA level of the athletes was the lowest at the first weekend. The change of IgM level was similar to that of IgG, which decreased significantly at the first

weekend and was significantly lower than other time points (1.21 ± 0.46 vs. 1.19 ± 0.42 , 1.14 ± 0.41 , 1.23 ± 0.47 , 1.20 ± 0.44 g/L, $p<0.05$), and recovered to the basic value at the second and third weeks.

CONCLUSION: In the first week of high altitude, the level of immunoglobulin in amateur adolescent athletes will be significantly reduced, which suggests that the amateur adolescent athletes in the pursuit of high altitude training should pay attention to the monitoring and regulation of immunity function. IgG and IgM are more sensitive to hypoxia stimulation, and can be used as one of the sensitive indexes to monitor the immune function of the body during altitude training.

2795 Board #256 May 29 10:30 AM - 12:00 PM
Pre-acclimation, Training, And Nutrition For 14-day Lightning Summit Of Mt. Everest
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Typical acclimatization protocols for summiting Mt. Everest involve sleeping and hiking at successively higher altitudes for more than 45 days. Prolonged exposure to hypoxia on the mountain increases the risk for Acute Mountain Sickness, hypothermia, accidents and non-successful summits. Reducing the time of exposure could decrease this risk and improve summit success. **Purpose:** This study examined the efficacy of a pre-trip acclimation training protocol for completing a novel 14-day rapid ascent of Mt. Everest. **Methods:** This was a 12-week case study design examining nutrition, exercise training and hypoxia exposure from a single healthy experienced female mountaineer (Age 33 yrs) preparing to summit Mt. Everest. Pre-post measurements of body composition via DXA, heart rate (HR), SpO₂, sleep quality, hematology (hematocrit & hemoglobin), graded exercise test, and nutritional intake values were analyzed. **Results:** Simulated hypoxia gradually increased from 1800 to 5800 m over the 12 weeks (13.9 ± 0.9 hr/day). Over the 12 week protocol hypoxia tent HR increased from 52 to 64 bpm and SpO₂ decreased from 93 to 77%. Lake Louise AMS symptoms were mild at 0.5 ± 0.6 on a scale of 0-3. Blood Hb increased from 13.3 to 17.6 g/dl and Hct from 42.9 to 52.5% from baseline to summit day. Body mass (61.6 to 52.5 kg), body fat (26.6 to 15.3%), fat free mass (43.2 to 42.7 kg), and fat mass (16.4 to 8.1 kg) decreased over the 12 weeks. Fat utilization increased and carbohydrate utilization and blood lactate decreased across absolute workloads post-acclimation. Average daily energy intake was 1902 ± 18 kcals which consisted of 1.8 ± 0.3 CHO g/kg/day, 1.9 ± 0.2 FAT g/kg/day and 2.4 ± 0.2 PRO g/kg/day. In addition, 7 days of intermittent fasting during light exercise days (16-20 hrs) and 25 sessions of post-exercise 20-40 min sauna exposure occurred during the 12-week period. On May 10, 2019 (Day 1) the subject traveled from San Francisco to Everest Base Camp (5200m) (Day 2). The subject spent the next 7 days acclimatizing at altitudes of 5200-7500 m. On May 22, 2019 (Day 12) the subject successfully summited Mt. Everest (8848 m) and arrived back at the airport in Tibet on Day 13, arriving back in San Francisco on May 24th. **Conclusion:** A 12-week pre-acclimation protocol at sea level successfully prepared the subject to summit Mt. Everest in 14 days.

2796 Board #257 May 29 10:30 AM - 12:00 PM
Extravascular Lung Water And Lung Diffusing Capacity In Response To Ultra-endurance Exercise Performed At Moderate Altitude
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Purpose: Strenuous exercise performed at altitude increases cardiac output and pulmonary arterial and capillary pressures to levels that may exceed a tolerable alveolar-capillary load, thereby evoking fluid leakage into the interstitial space. Accordingly, this study aimed to determine whether running an ultramarathon at moderate altitude increases extravascular lung water (EVLW) and whether this inhibits the transfer of gas across the alveolar-capillary membrane. **Methods:** Cardiac biomarkers (cTnI & BNP), exhaled nitric oxide (ExNO), echocardiographic signs of EVLW, and lung (DLco) and alveolar-capillary membrane (Dm) diffusing capacity for carbon monoxide (determined via a single-breath DLco/DLno method) were

assessed in 53 runners (10 Females; Age:41±10y BMI:23±2kg/m²) before, 1-4h and 24h after a 100km (CCC: 6,100m of ascent, altitude range of 1,035-2,584m) or 170km (UTMB: 10,000m of ascent, altitude range of 1,035-2,565m) mountain ultramarathon. **Results:** Participants finished the ultramarathon in 27±12h with an average heart rate of 124±13bpm. Cardiac biomarkers were increased acutely after the race (cTnl: 0.01±0.00 vs. 0.04±0.01ng/ml, p<0.01; BNP: 21±2 vs. 123±12pg/ml, p<0.01), while ExNO decreased (25.6±2.0 vs. 14.5±1.3 ppb, p<0.01). Signs of EVLW increased after the race (average comet tails count: 2±1 vs. 7±1, p<0.01) while DLco decreased (31.6±1.0 vs. 28.6±0.9 ml/min/mmHg, p<0.01) but Dm remained unchanged (171.4±7.6 vs. 167.2±8.8 ml/min/mmHg, p>0.05). Cardiac biomarkers, ExNO, EVLW and Dm were similar to baseline values after 24h of recovery, while DLco remained mildly reduced (30.6±1.6 ml/min/mmHg, p<0.05). **Conclusions:** These data suggest a mild and transient increase in cardiac biomarkers and extravascular lung water occur after completing an ultramarathon at moderate altitude, but this has minimal impact on the transfer of gas across the alveolar-capillary membrane, despite an overall reduction in lung diffusion. In some subjects an exaggerated increase in extravascular lung water and decrease in alveolar-capillary membrane diffusion was observed, suggesting that some individuals may have an increased propensity for developing mild exercise-induced pulmonary edema at altitude.

2797 Board #258 May 29 10:30 AM - 12:00 PM
Resting And Exercising Heart Rates Increase With Acute Altitude Exposure In Sacred Valley, Peru
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(No relevant relationships reported)

As one of the Seven Wonders of the World, Machu Picchu is a popular international destination. Being at high altitude and the physical demands of hiking in the region make acclimation to the change in altitude a challenge for individuals coming from low altitude. Understanding how individuals might respond to acclimation at various areas within the Sacred Valley region of Peru may be beneficial for electing specific logistics of a similar trip, particularly if physical exertion is planned. **PURPOSE:** To identify the changes in heart rate (HR) and blood pressure during acute exposure to altitude and acute acclimation. **METHODS:** Eight individuals (males = 3, 24.8 ± 5.4 years) living at low altitude recorded resting heart rate and blood pressure throughout the course of a 10-day trip in the Sacred Valley, Cusco, Peru. In addition, the subjects completed four Rockport Walk Tests (RWT): prior to travel (180 m), two moderate to high altitude locations (2792 and 3400 m), and return to low altitude (154 m). Repeated measures ANOVAs with post-hoc testing identified differences between RWT completion HR, time, and maximal oxygen estimation (VO_{2max}) and also between resting HR and blood pressure during 9 different altitude changes. **RESULTS:** The RWT had significant differences in estimated VO_{2max} estimations between 3400 m (45.7 ± 1.1 ml·kg⁻¹·min⁻¹) and return to low altitude (154 m, 49.1 ± 1.6 ml·kg⁻¹·min⁻¹, p = .03) and HR from the RWT had differences between both low altitude tests and high altitude tests (differences ranged from 29.6 - 34.7 bpm, p < .05). There were no differences in RWT completion time. Resting HR was the only resting measure to show changes and only after the highest ascent (4830 m) was HR increased (p < .05) from prior travel measures (180 m) (+28.4 ± 4.5 bpm), 2792 m (+30.4 ± 4.5 bpm), 4300 m (+18.1 ± 2.4 bpm), and return to low altitude (+27.0 ± 4.2 bpm). **CONCLUSION:** Both resting and exercising heart rates are affected by acute altitude exposure, despite several days of moderate to high altitude exposure. When planning trips to high altitude regions for short periods (≤ 10 days), elevated heart rates should be expected.

2798 Board #259 May 29 10:30 AM - 12:00 PM
Association between AMS Score, leg Muscle Strength And SpO₂ On One-day Rapid Ascent Of Mount Fuji
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(No relevant relationships reported)

Previous studies reported that mountain sickness in climbers is associated with heart rate, peripheral capillary oxygen saturation (SpO₂), and acute mountain sickness (AMS) score. These results supported the hypothesis that monitoring the SpO₂ can help prevent mountain sickness. In addition, because the muscle groups in the lower limbs are involved, it was hypothesized that the degree of fatigue during climbing, SpO₂, and leg muscle strength are related to blood circulation. **PURPOSE:** To examine the association between the AMS score, leg extension strength, and SpO₂ on a 1-day rapid ascent of Mount Fuji. **METHODS:** Sixteen subjects (10 male and 6 female, height: 168±8.1 cm, weight: 66.5±10.5 kg, age: 21±2.3 years) participated in the present study. Before and after climbing, the subjects underwent a leg extension strength analysis, and their heart rate and SpO₂ were measured using a pulse oximeter while climbing. To determine their AMS scores, we also conducted a questionnaire survey on the climbers' headaches, loss of appetite/nausea, fatigue/weakness, dizziness/lightheadedness, and sleep disorders. **RESULTS:** The average climbing time was 6 hours and 12 minutes to ascend and 2 hours and 57 minutes to descend Mount Fuji. All subjects with high AMS

scores tended to have low SpO₂ at the mountaintop. There was a positive correlation between leg muscle strength and SpO₂ at Mount Fuji's summit in male subjects, but not in females. In addition, there was no correlation between the AMS score and leg strength in both male and female subjects. **CONCLUSIONS:** Our results suggested that subjects with high AMS scores had low SpO₂ at the mountaintop. In addition, there is a positive correlation between leg muscle strength and SpO₂ at the mountain's summit in male subjects, but not in females.

2799 Board #260 May 29 10:30 AM - 12:00 PM
Are There Differences In Oxygen Consumption Between A Breathing Restrictive Mask And Hypobaric Hypoxia?

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PURPOSE: To determine the acute effects of a breathing restrictive mask (M) set to 2743 m (M only) during steady-state cycling compared with 1) wearing the mask set to 914 m at 1829 m of hypobaric hypoxia (H) (M+H combined = 2743 m) and 2) 2743 m of hypobaric hypoxia (H only) for subjects living at moderate altitude. **METHODS:** Nine subjects (5 males, 4 females; 25.9 ± 6.9 yr, 49.1 ± 7.1 ml · kg⁻¹ · min⁻¹) provided consent and completed four 1-hour sessions. Subjects completed a maximal oxygen consumption (VO_{2max}) cycling test to determine a 60% VO_{2max} workload at their altitude of residence Albuquerque's (~1570m). The following 3 sessions were randomized by condition: 1) M only, 2) M+H, and 3) H only. Sessions were separated by 48 hrs. After a warm-up, subjects cycled at 60% of their VO_{2max} workload for 20 min. Oxygen consumption was recorded every five minutes. Repeated measures ANOVA with Bonferroni's pairwise comparisons (p < 0.05) were applied to determine significant differences between the three conditions and if the three conditions' VO₂ differed from 60% of the baseline VO_{2max}. **RESULTS:** The average (±SD) VO₂ measured for the set workload (60% VO_{2max}) for each condition were: 29.6 ± 4.1, 34.3 ± 4.9, 31.4 ± 5.1, and 28.8 ± 4.5 ml · kg⁻¹ · min⁻¹ for baseline, H only, M+H, and M only, respectively. There was a main effect for condition between the 3 trials and the baseline 60% VO_{2max} workload, F_(3,21) = 6.20, p = 0.003. Compared to baseline 60% VO_{2max}, only H was significantly different (p = 0.022). Comparisons between the VO₂ for the three experimental conditions were significant (F_(2,14) = 8.714, p = 0.003) with H being higher than M (p = 0.028) and the other pairings being similar (p > 0.05). **CONCLUSION:** Individuals living at moderate altitude should use the 914 m mask setting rather than the 2743 m setting since the higher setting elicits a lower VO₂ at the same workload, thereby reducing the training stimulus. However, it is still best to use hypobaric hypoxia for training purposes as only H resulted in an increased VO₂ during exercise compared to baseline. Neither mask condition differed in submaximal VO₂ comparisons for the same workload at 1570m. This could explain why previous studies have not found post-training differences in VO_{2max} between control and mask groups.

2800 Board #261 May 29 10:30 AM - 12:00 PM
Transcriptional Activation Of Hypoxia Sensitive Genes Following Repeated Sprint Exercise In Hypoxia

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(No relevant relationships reported)

Repeated sprint training in hypoxia (RSTH) utilizes short supramaximal efforts followed by incomplete rest intervals. RSTH has been shown to improve repeated sprint performance compared to repeated sprint training in normoxia. Because of the relatively short exposure to hypoxia compared to live high, train low approaches, the benefits of RSTH have been attributed to local muscular adaptations rather than hypoxia-induced erythropoiesis. Repeated activation of the hypoxia sensitive transcription factors HIF-1α and PGC-1α, and regulation of their gene targets related to angiogenesis (VEGF), mitophagy (BNIP3, PINK1), and glucose metabolism (PDK-M, GLUT4) may underlie these muscular adaptations. **PURPOSE:** To investigate the transcriptional activation of HIF-1α, PGC-1α and several HIF-1α-target genes following repeated sprint exercise in normoxia and hypoxia. **METHODS:** Eight recreationally active males (n=8) and one female (n=1) performed 20, 10s all-out sprints in normoxia (1600m) and hypobaric hypoxia (4600m) on a cycle ergometer on two days separated by 2 weeks. Skeletal muscle samples from the vastus lateralis were analyzed for mRNA levels of HIF-1α, PGC-1α, BNIP3, PINK1, VEGF, PDK-M, and GLUT4 pre, post and 3h post exercise in hypoxia and normoxia. Comparisons between condition and time were made using two-way repeated measures ANOVAs. **RESULTS:** There was a significant increase in mRNA levels for HIF-1α (fold change: 2.6±1.8) and VEGF (fold change: 3.0±1.6) 3h post-exercise in hypoxia (p<.05) but not normoxia. PGC-1α, was higher 3h post-exercise in both hypoxia (fold change: 9.2±4.6) and normoxia (fold change: 6.2±3.8; p<.05). No significant effect of time or group

was observed for BNIP3, PINK1, PDK-M, or GLUT4. **CONCLUSIONS:** Acute sprint exercise in both hypoxia and normoxia induces an increase in the transcription of PGC-1 α . However, hypoxia sensitive genes HIF-1 α and VEGF were only greater following sprint exercise in hypoxia. Collectively, these findings suggest that sprint exercise stimulates mitochondrial biogenesis, but an additional hypoxic stress is required to induce changes in hypoxia sensitive genes. The downstream effect of these transcriptional activations may increase angiogenesis and mitochondrial signaling in response to RSTH, which may in part explain the benefits of RSTH.

2801 Board #262 May 29 10:30 AM - 12:00 PM

The Effect Of Elevation Training Mask On Skeletal Muscle Oxygenation During Walking

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Elevation training masks are commonly used to enhance training and performance. While these masks do not generate a hypoxic environment, they are used to train the respiratory system, a common limiting factor in performance in both trained and sedentary individuals. There is limited evidence as to how these masks affect respiration or skeletal muscle oxygenation. **PURPOSE:** The purpose of this study was to determine how resisted inspiration affects respiration and muscle oxygenation during walking. **METHODS:** 8 subjects between 18-35 years of age were recruited to walk at 1.6 m/s for 10 minutes with (RI) and without (CON) resisted inspiration. Masks were connected to the metabolic cart and a Moxy monitor was placed on the lateral head of the gastrocnemius to measure muscle oxygenation (SmO) throughout the duration of walking trials. The last 5 minutes of each condition were analyzed and presented as mean \pm SD. Student t-test was used to determine significance at $p < 0.05$. **RESULTS:** RI had no effect on VO₂ (CON: 14.17 \pm 0.96 RI: 14.23 \pm 2.94, $p=0.95$) or VCO₂ (CON: 13.02 \pm 0.89 RI: 13.18 \pm 2.61, $p=0.89$). RI caused an average increase of 4.9% in subjects heart rate and induced a significant decrease in respiration rate (CON: 25.93 \pm 1.59 RI: 18.63 \pm 3.84, $p=0.0006$). This coincided with no change in total hemoglobin (ThB) in the skeletal muscle (CON: 12.58 \pm 0.61 RI: 12.57 \pm 0.60, $p=0.98$) and an increase in 7 out of 8 subject's SmO with restricted breathing (CON: 41.94 \pm 20.15 RI: 48.52 \pm 23.08). Despite increased SmO, subjects reported a higher RPE in the RI condition. **CONCLUSIONS:** During walking, elevation training masks increase skeletal muscle oxygenation. This could be in part due to a longer inspiration allowing for improved blood oxygen saturated. An increased heart rate across most subjects despite no change in ThB could suggest a shift in the hemoglobin dissociation curve allowing more oxygen dissociation in the muscles. Future studies should examine the effect of elevation training masks on muscle oxygenation during higher intensity exercises.

2802 Board #263 May 29 10:30 AM - 12:00 PM

Is Normobaric Hypoxia Effective For Sustaining Previously Acquired Altitude Acclimatization-induced Improvements In Mood State?

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PURPOSE: Mood state has been shown to improve with high altitude (HA) acclimatization to 4300 m. The purpose of this study was to determine if these acclimatization effects on mood state persist during reintroduction to 4300 m altitude (RA) after 12 days at sea level (SL) and whether or not normobaric hypoxia (NH) treatment is an effective countermeasure to prevent de-acclimatization. **METHODS:** Seventeen SL residents (age= 22 \pm 6 yr, weight= 75.2 \pm 13.3 kg; mean \pm SD) completed in the following order: 1) 4 days of baseline SL testing; 2) 12 days of HA acclimatization at 4300 m; 3) 12 days at SL post-HA acclimatization where each received either NH (n=9, FiO₂=0.122) or Sham treatment (n=8; FiO₂=0.207); and 4) 24-hour reintroduction to 4300 m altitude (RA) in a hypobaric chamber (460 Torr). Mood state was assessed using the Automated Neuropsychological Assessment Metrics Mood Scale (ANAM-MS), which includes the measurement of 7 mood dimensions: vigor, restlessness, depression, anger, fatigue, anxiety and happiness. The test was administered in the afternoon (~2-3pm) on 5 occasions at SL, once after 2h at HA (HA1), 20h at HA (HA2), 11 days at HA exposure (HA11), and following 4 h of RA (RA4). **RESULTS:** As there were no group differences between NH and Sham mood test scores at any of the time points, data were combined. Fatigue increased ($P < 0.05$) from SL (0.44 \pm 0.58) to HA1 (1.16 \pm 1.17) and HA2 (1.93 \pm 1.26) and then decreased ($P < 0.05$) from HA2 to HA11 (0.67 \pm 0.78) and remained low at RA4 (0.58 \pm 0.72). Vigor decreased ($P < 0.05$) from SL (2.80 \pm 1.42) to HA1 (1.54 \pm 1.19) and HA2 (1.33 \pm 1.31), and then remained unchanged ($P > 0.05$) from HA2 to HA11 (1.46 \pm 1.58), and

this effect persisted at RA4 (1.33 \pm 1.05). Anxiety increased ($P < 0.05$) from SL (0.17 \pm 0.31) to HA1 (0.49 \pm 0.97), decreased ($P < 0.05$) from HA1 to HA2 (0.07 \pm 0.17), remained unchanged from HA2 to HA11 (0.19 \pm 0.60), and remained low at RA4 (0.14 \pm 0.30). All other mood states remained unchanged from SL to HA and then HA. **CONCLUSION:** These results suggest that HA-induced improvements in mood state are retained during RA after 12 days at SL whether or not NH treatment is utilized. *Authors' view not official US Army or DOD policy. Funding USAMRDC.*

2803 Board #264 May 29 10:30 AM - 12:00 PM

Serially-applied Ischemic Preconditioning Mediation Of Cardiopulmonary Compensations And Oxygen Kinetics During Exercise At Normobaric Hypoxia

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INTRODUCTION: Ischemic preconditioning (IPC) involves brief, repetitive manually-imposed blood flow restriction of the limbs, capable of enhancing local blood flow and oxygen kinetics. As oxygen availability is of concern with increasing altitude, an evaluation of IPC's potential to influence physiological compensations is defensible. **PURPOSE:** To investigate the use of acute versus repeated IPC to influence cardiopulmonary compensation and oxygen kinetics during exercise performed at normobaric hypoxia (NH). **METHODS:** Six recreationally trained males (21 \pm 4 y, 178.6 \pm 4.4 cm, 81.1 \pm 13.0 kg, 15.0 \pm 5.6 % BF, VO_{2peak}: 43.6 \pm 4.7 mL \cdot kg⁻¹ \cdot min⁻¹ at 210 \pm 32 W) received 5-min of bilateral occlusion and reperfusion using automated cuffs (200 mmHg) placed on the upper thighs for a total of 40 min. This acute exposure (AI) was preceded by 45-min of passive recovery, 30-min of passive NH (14.2 \pm 0.1%) exposure, and six 6-min discontinuous exercise bouts (2 each at 40, 60, 80% NH PPO). To evaluate a potential dose-response relationship, the same subjects also completed a 7-day IPC (RI) procedure after a sufficient washout. Muscle oxygen saturation (SmO₂) was measured using a portable NIRS-based sensor placed over the vastus lateralis. Cardiac hemodynamics were measured continuously using impedance cardiography. Continuous ventilatory and metabolic data were collected using a metabolic cart. Superficial femoral artery volumetric flow was calculated using arterial diameter and velocity measures collected using a Doppler ultrasound. **RESULTS:** Both AI and RI elicited greater SmO₂ at supine rest (MD: 12.2 \pm 2.5%, $p = .004$; MD: 12.8 \pm 1.7%, $p = .001$) and seated rest (MD: 10.3 \pm 3.9%, $p = .045$; MD: 11.2 \pm 2.8%, $p = .010$) compared to a non-IPC NH procedure. At 80% NH PPO, AI and RI similarly attenuated decrement of SmO₂ compared to non-IPC NH (40.6 \pm 20 and 40.2 \pm 17.9 vs. 32.8 \pm 19.5%). Minute ventilation was also heightened following both IPC conditions at 80% compared to sham NH (106.4 \pm 17.3 and 106.5 \pm 10.9 vs 97.9 \pm 11.1 L \cdot min⁻¹), however neither were able to produce a meaningful change in peripheral oxygen saturation (83 \pm 4 and 84 \pm 3 vs. 84 \pm 4%). **CONCLUSIONS:** Preliminary data suggest that both acute and repeated IPC prior to exercise performed at NH may be capable of enhancing ventilation and subsequently working muscle oxygen saturation.

2804 Board #265 May 29 10:30 AM - 12:00 PM

Respiratory Muscle Training For Aerobic Endurance Performance At 3,658m Altitude

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Increased ventilation is one effect of altitude hypoxia. This increases the work and energy cost of ventilation. Therefore, during sustained aerobic exercise this may lead to respiratory muscle fatigue and secondary locomotor muscle fatigue. **PURPOSE:** Determine if resistive or endurance respiratory muscle training (RRMT and ERMT, respectively) vs. sham RMT (SRMT) improves exercise performance during acute exposure at 3,658 m. We hypothesize that ERMT would augment time to exhaustion more than RRMT and SRMT. **METHODS:** Twenty-four subjects (age: 24 \pm 3 y; body fat: 16 \pm 6 %; VO_{2max}: 38 \pm 6 mL \cdot kg⁻¹ \cdot min⁻¹) cycled to exhaustion (55% VO_{2max}) in a hypobaric chamber at a 3,658 m before and after four weeks of respiratory muscle training (RMT). Prior to training, subjects completed a VO_{2max}, pulmonary function, and respiratory endurance tests (RET). Subjects were randomly assigned to SRMT (n=8), RRMT (n=8), or ERMT (n=8). All RMT consisted of three, 30-min training sessions per week for four weeks. The SRMT group completed a 5-sec inspiration, 5-sec breath hold, and 5-sec expiration every 30-sec. The RRMT group completed a maximal inspiration and expiration against 60% of maximal inspiratory (P_{imax}) and expiratory pressure (P_{Emax}) every 30-sec. The ERMT breathed into bag that maintained isocapnia continuously for 30 min (bag volume=55% vital capacity; breath frequency=0.6*maximal voluntary ventilation/bag volume). **RESULTS:** There were no differences in pre-RMT anthropometrics, pulmonary function, VO_{2max}, or cycle

time to exhaustion between groups (all $p > 0.05$). There were no changes in forced vital capacity after RMT ($p = 0.85$). The RRMT group increased P_{imax} and P_{Emax} after RMT ($p = 0.009$ and $p = 0.04$, respectively). The ERMT group increased RET after RMT ($p = 0.04$). There was no difference in $\dot{V}O_{2\text{max}}$ after RMT in any group. There was no difference in cycle time to exhaustion after RMT ($p = 0.14$) or between groups ($p = 0.4$). **CONCLUSIONS:** Four weeks of RRMT and ERMT training selectively improved pulmonary function tests. Both RRMT and ERMT improved cycle time to exhaustion at simulated 3,658 m (12,000 ft) altitude.

2805 Board #266 May 29 10:30 AM - 12:00 PM
Measures Of Autonomic Cardiac Function Are Associated With Acute Mountain Sickness At High Altitude.

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Purpose: Evidence suggests acute mountain sickness (AMS) aligns to heart rate variability (HRV) suppression at high altitude. This study explored associations between measures of autonomic cardiac function and AMS scores in normobaric hypoxia (NH) and during ascent to very high altitude in the natural environment. **Methods:** Thirty participants (17 male and 13 female, aged 20-62 years) trekked from 2800m to 5350m (Himalaya, Nepal) over 14 days. Short term temporal and spectral measures of HRV were recorded at rest (paced breathing, 12 breaths per minute), in NH ($F_{I_2} = 0.124$, ~4100m) and in hypobaric hypoxia (HH) at 4356m and 5350m, during ascent. RMSSD and 60 second heart rate recovery (HRR60) following stepping exercise (3 min at 50-60% maximal aerobic capacity) were accepted measures of parasympathetic neural activity. The heart rate response (ΔHR) to an orthostatic postural challenge (two minutes supine followed by two minutes standing), reflective of sympathetic neural activity, was measured at the same time points ($\Delta HR = HR$ [peak stand] - HR [mean supine]). AMS diagnosis was confirmed for scores ≥ 5.0 (Lake Louise Survey, LLS) or ≥ 0.70 (Environmental Symptoms Questionnaire, ESQ-c) at least once during the ascent. Institutional ethical approval was gained. **Results:** Data analysis reflects 24 participants. Eleven (46%) developed AMS. Peak LLS AMS scores ranged between 1-5, 0-10 and 2-11 units in the AMS group at 2800m, 4356m and 5350m respectively, and 0-4 for the non-AMS group. No significant interaction ($P = 0.161$) nor a main effect for altitude ($P = 0.093$) was observed, however a significantly greater LLS score was observed in the AMS group at 5300m ($P < 0.001$). Peak LLS scores at 2800m correlated with RMSSD (NH) ($r = .483$, $P = .020$) and at 4300m correlated with RMSSD at 4300m ($r = -.487$, $P = .025$). Postural ΔHR at 2800m correlated significantly with the ESQ-c and peak LLS scores at 4300m ($r = -.601$, $P = .002$ and $r = -.579$, $P = .004$), and the ΔHR at 4300m correlated with ESQ-c and LLS scores at 4300m ($r = -.570$, $P = .005$ and $r = -.471$, $P = .023$). HRR60 (NH) correlated with LLS score at 4300 m and peak LLS score at this altitude ($r = -.495$, $P = .026$ and $r = -.450$, $P = .047$ respectively). **Conclusion:** AMS-susceptible individuals show vagal suppression at high altitude. Vagal measures may be useful indicators for AMS susceptibility at very high altitude.

2806 Board #267 May 29 10:30 AM - 12:00 PM
Intra-individual Variability In The Acute Erythropoietic Response To Consecutive Hypoxic Exposures

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PURPOSE: Altitude training has become a standard strategy used by athletes to legitimately increase hemoglobin mass and induce favorable changes in sea-level endurance performance. While the acute erythropoietic response to a fixed level of hypoxia (altitude) varies considerably between individuals, it is generally assumed there is consistency within an individual for repeated exposures. Therefore, we aimed to document within-subject variation in the acute erythropoietic response to consecutive exposures to a fixed-level of continuous normobaric hypoxia. **METHODS:** Seven subjects (men $n = 4$, women $n = 3$) completed three exposures to 12hr of continuous normobaric hypoxia simulating an altitude of 3,000m/9,900ft ($F_{I_2} = 0.14$), with each exposure separated by 28 to 56 days. Each visit was performed at the same time of day, with close controls placed on hydration and environmental conditions. Serum concentrations of erythropoietin (EPO) were measured at baseline prior to hypoxic exposure (0hr), and then following 6hr, and 12hr spent in continuous hypoxia. The relative change in serum EPO was taken as the percentage

difference from 0hr to 6hr (ΔEPO_{0-6}) and 0hr to 12hr (ΔEPO_{0-12}). A two-way repeated measures ANOVA was used to evaluate the effects of hypoxic exposure time on EPO concentrations.

RESULTS: Twelve hours of continuous hypoxic exposure had a significant effect on the EPO response ($P < 0.001$), with serum concentrations increasing by an average of $+55 \pm 33\%$ (range: 14-110%) after 6hr and $+83 \pm 33\%$ (range: 31-125%) after 12hr compared to baseline. Within individuals, ΔEPO_{0-6} varied by $33 \pm 23\%$ (range: 4-77%) and ΔEPO_{0-12} by $58 \pm 28\%$ (range: 4-90%) between consecutive hypoxic exposures. **CONCLUSIONS:** Practically, our data demonstrate that athletes traveling to altitude training camps may not have a consistent hematological response given the wide intra-individual variability observed in serum EPO concentrations to repeated fixed hypoxic doses.

2807 Board #268 May 29 10:30 AM - 12:00 PM
Magnitude Of Deacclimatization From Moderate Altitude Following Three Days At Sea Level

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Chronic hypoxia elicits a multitude of physiologic responses leading to an increase in total hemoglobin mass (THM), an enhanced hypoxic ventilatory response (HVR), and many more. The magnitude of the acclimatization observed in these parameters is hypoxia dose-dependent, with changes at moderate altitude being less than at high altitude. Accordingly, high altitude has been the largest focus in this area with much less attention on moderate altitude, particularly as it pertains to deacclimatization. This is relevant as many more people reside at moderate altitude permanently or for weeks/months at a time for training, deployment, or recreation. These individuals will inevitably visit sea level (SL) for a short period of time for leave, competition, or leisure and then return to moderate altitude. It is not known how much, if any, deacclimatization in THM or HVR occurs when fully acclimatized individuals travel to SL for 3 days.

Purpose: Test the hypothesis that following 3 days at SL THM will be significantly altered and HVR will remain unchanged.

Methods: To Date, seven healthy participants (22.1 ± 1.1 years, 5 females) have completed the study. All visits (6 total) were conducted in Flagstaff, AZ (altitude 2,100m). Three visits prior to descent to, and 66.3 ± 1.5 hours in, Phoenix, AZ (altitude 330m) and three upon return from SL. Visit 1 included consent and screening. In 4 visits, THM was quantified using the optimized carbon monoxide rebreathing technique and poikilocapnic HVR was determined using a step-down decrease in inspired oxygen fraction from 0.21 to 0.09. Pre-SL measurements were averaged and used to compare to post-SL measurements. A one-way ANOVA was computed on THM and HVR between pre- and post-SL measurements using GraphPad Prism. Significance was set at $p = 0.05$.

Results: At present, we have found no significant effect on THM ($p = 0.07$). HVR was unchanged from pre- to post-SL ($p = 0.49$).

Conclusion: Following three days at SL, THM and HVR were unchanged. Our data suggest that 3 days at SL may not be sufficient to significantly alter HVR or THM. However, THM did decrease by 5% post-SL ($p = 0.07$) so a greater sample size may alter our findings.

2808 Board #269 May 29 10:30 AM - 12:00 PM
Hypoxia-induced Increase Of Heartrate Is Attenuated In Endurance Trained Men

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PURPOSE: To study differences of the cardiovascular response to acute hypobaric hypoxia between endurance trained (ET) and untrained (UT) healthy men.

METHODS: After at least 10 min of rest, heart rate (HR), pulmonary blood flow (PBF), and mean arterial blood pressure (MAP) were assessed at baseline in normoxia (424 m) in 19 ET and 19 UT ($\dot{V}O_{2\text{max}} 66.3 \pm 5.7$ vs. 44.8 ± 7.1 mL/min/kg, $p < .001$; body mass 71 ± 7 vs. 80 ± 8 kg, $p < .001$; age 31 ± 7 vs. 38 ± 9 years; $p < .006$; mean \pm sd). Afterwards, participants were transported by train from 750 m to 3450 m within 2 h. All measurements were repeated 3 h, 24 h, and 48 h after ascent. HR was measured via pulse-oximetry and PBF by inert gas rebreathing (Innocor, Innovision, DK). Stroke volume (SV) was calculated as PBF/HR. MAP was measured via auscultatory method in a seating position. To analyze differences between groups (UT vs. ET), between timepoints of measurements in norm- and hypoxic conditions, and interactions

between time and group, a mixed model (MM) was calculated. Differences within groups between baseline and particular timepoints in hypoxia were calculated with paired t-tests (TT).

RESULTS: All variables except of MAP changed significantly over time ($p_{MM} \leq .006$), but only for HR the time course was different between ET and UT (group*time: $p_{MM} = .023$). This was due to an attenuated HR-increase in ET (8%; $p_{TT} = .008$) after 3 h in hypoxia being half as high than in UT (16%; $p_{TT} = .000$). At the same timepoint, average SV remained stable in ET (+2%; $p_{TT} = .570$), but tended to decline in UT (-7%; $p_{TT} = .137$). Consequently, PBF increased by 11% after 3 h at high altitude in both ET and UT ($p_{TT} = .010$ and $.027$) without being different between groups at any timepoint ($p_{MM} = .117$).

CONCLUSIONS: While cardiovascular response to hypoxia was generally similar, ET showed an attenuated increase in HR after initial exposure to hypoxia. The HR attenuation might be attributable to a higher parasympathetic activity in ET that has been documented before and is a general characteristic of ET.

2809 Board #270 May 29 10:30 AM - 12:00 PM
Relationships Between Ventilatory And Heart Rate Responses To Hypobaric Hypoxia: Influences Of Acetazolamide

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(No relevant relationships reported)

Acetazolamide (AZ) is often used for prevention and/or treatment of acute mountain sickness (AMS), particularly during rapid ascent to altitudes > 3000 m. Although it is known that AZ augments ventilation (V_E), it is unclear how this may affect chemoreflex relationships among ventilatory variables and control of heart rate (HR).

PURPOSE: The purpose of the study was two-fold: 1) establish the effect of AZ and hypobaric hypoxia (HH) on V_E and HR; and 2) estimate the effect of AZ on the chemoreflex relationship between V_E and HR.

METHODS: After completing familiarization testing at sea level (SL), 10 male volunteers (22 ± 3 yr; height: 176.0 ± 7.1 cm; weight: 77.5 ± 11.5 kg) completed two 30 hr HH exposures (~3500 m); one while taking AZ (500 mg/day) and one while taking a placebo, in a single-blind crossover design in random order. Ventilation and gas exchange, including HR, V_E , and end-tidal partial pressure of carbon dioxide (P_{etCO_2}), were measured three times at rest, once at SL and then at ~2 and 24 hours into exposure to simulated altitude. A linear mixed model with a random intercept per subject was utilized to evaluate the influences of AZ and HH on HR, V_E , and P_{etCO_2} .

RESULTS: V_E increased and P_{etCO_2} decreased ($p < 0.05$ for all) with both HH and AZ. HR increased with HH ($p < 0.001$), but there was no further effect of AZ ($p = 0.15$). HR was related to both V_E ($p = 0.009$) and P_{etCO_2} ($p < 0.001$) in all subjects. AZ shifted the relationships between HR, V_E , and P_{etCO_2} , but there was no interaction between AZ and HH ($p > 0.10$ for both). Overall, while AZ augmented V_E it did not affect the slope of the relationship between HR and V_E , but rather shifted the relationship to lower V_E values.

CONCLUSION: During exposure to HH, activation of the chemoreflex augments both ventilation and sympathetic outflow to the heart causing increased HR. Our present findings that V_E tended to be lower for a given level of HR during AZ trials, suggest that AZ may have an influence to shift the relationship between these two chemoreflex-mediated events.

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2810 Board #271 May 29 10:30 AM - 12:00 PM
The Effects Of Exercise Training In Hyperoxia Compared To Normoxia On Cardiorespiratory Fitness: A Meta-analysis

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PURPOSE: Previous studies have indicated that supplemental oxygen (i.e. hyperoxia) may acutely enhance exercise performance, providing benefits for patients with limited physical capacity. However, the evidence for superior long-term adaptations of regular hyperoxic exercise in clinical populations is limited. Therefore, this systematic review and meta-analysis aimed to evaluate the effects of chronic exercise in hyperoxia compared to normoxia in patients diagnosed with chronic diseases.

METHODS: Databases were systematically searched for randomized controlled trials in accordance with PRISMA until May 20th, 2019. Eligibility criteria included adult patients with various chronic diseases (i.e. cardiovascular, pulmonary, neurological, metabolic, musculoskeletal or cancer) engaging in regular supervised exercise training

in hyperoxia compared to an exercising normoxic control group. The outcome of interest included maximal power output (PO), peak oxygen consumption (VO_{2peak}) and maximal distance in the 6-minute walk test (6MWD). Standardized mean differences (SMD) were calculated and a random-effects model was used to pool effect sizes using R (3.6.1). **RESULTS:** Out of the identified 4038 studies, 11 articles were deemed eligible. A total of 132 patients (64.3 ± 3.2 yrs., 36% women) and 131 patients (64.9 ± 3.6 yrs., 33% women) were included in hyperoxia and normoxia groups, respectively. The majority of patients were diagnosed with chronic obstructive pulmonary disease (COPD, 94.1%) while 18 patients were diagnosed with coronary artery disease. The average duration of interventions was 8.9 ± 5.1 weeks. The observed effects for PO (SMD -0.33; 95% CI -0.67, 0.01; $p = 0.06$), VO_{2peak} (SMD -0.24; 95% CI -0.54, 0.05; $p = 0.11$) and 6MWD (SMD -0.21; 95% CI -0.78, 0.36; $p = 0.46$) showed no statistical significant difference between the two conditions. **CONCLUSION:** There is no evidence for beneficial chronic adaptations in cardiorespiratory fitness, when exercise is performed in hyperoxia. However, the studies to date have only examined patients diagnosed with COPD and coronary artery disease. Future studies should identify the optimal dose-response mechanisms to bridge the gap between acute responses and chronic adaptations in hyperoxic exercise.

2811 Board #272 May 29 10:30 AM - 12:00 PM
Effect Of Acetazolamide Versus Heat Acclimation On Oxygen Saturation During Sleep At Altitude

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(No relevant relationships reported)

Reduced oxygen at high altitude can alter breathing at night which can disrupt sleep. Acetazolamide (AZ) has been shown to augment breathing and oxygen saturation (SpO_2) during sleep. However, it is unclear whether heat acclimation (HA), which has been suggested to have beneficial effects in hypoxia, may provide benefits similar to AZ. **PURPOSE:** To determine if there is a difference in average SpO_2 ($avgO_2$), time below 88% SpO_2 (T_{BL88}), and average pulse rate (PR) between treatments with AZ versus HA. **METHODS:** Seventeen unacclimated healthy men (age: 22 ± 4 years; mass: 75 ± 12 kg; height: 172 ± 8 cm; body fat: $22 \pm 6\%$) participated in at least one of two ($N = 6$ completed both) 30-hour altitude studies: Study 1) AZ (250 mg twice/day for three days) vs placebo or Study 2) pre-HA altitude exposure, followed by an 8-day exercise-HA protocol (treadmill walking: 120 min, 3.1 mph 2% grade, 40°C, 40% RH), and then a post-HA altitude exposure. Both studies were identical in regards to altitude (3,500 m), ascent rate, exposure time, and sleep assessment. For analysis, PL and pre-HA acted as the control conditions (CON) and AZ and post-HA as the experimental conditions (EXP). $avgO_2$, T_{BL88} , and average PR were recorded during sleep via wrist pulse oximeter. A linear mixed model with subjects as a random effect was used to compare treatments (AZ and HA), and conditions (CON and EXP) with total sleep time as a covariate for T_{BL88} . **RESULTS:** There was a significant interaction between the condition and treatment-type for $avgO_2$ ($p < .001$) and T_{BL88} ($p < .001$) during sleep, but no interaction was found for average PR ($p = .49$). Pairwise comparisons were performed for the former two variables within each study treatment. $avgO_2$ was greater in the AZ treatment (difference = 5.7%; 95% C.I. [4.2, 7.2]), and a non-significant increase in $avgO_2$ was found post-HA (difference = 0.9%; 95% C.I. [-0.3, 2.2]). Additionally, T_{BL88} was reduced in the AZ treatment (difference = -207.7 min; 95% C.I. [-283.2, -132.2]), while there was a non-significant increase in T_{BL88} post-HA. PR was higher in CON (72 bpm) than EXP (69 bpm). **CONCLUSION:** Our data confirms AZ increases SpO_2 during sleep at altitude, however, we were unable to observe a similar improvement in oxygen saturation after HA.

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2812 Board #273 May 29 10:30 AM - 12:00 PM
Flow Mediated Vasodilation In Response To 3-Weeks Of Moderate Altitude Exposure

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(No relevant relationships reported)

The effects of moderate altitude on the cardiovascular system is an extensively researched subject, but no definitive timeline regarding the vascular acclimatization for flow mediated vasodilation (FMD) measurements is currently available in the scientific literature. It has been suggested that 3 wks might be sufficient (Frick et al., 2006).

However, if this amount of time is not sufficient it will complicate data interpretation. **PURPOSE:** To assess the timeline of acclimatization to moderate altitude (2,130 m), specific to FMD in healthy young males. **METHODS:** After spending ≥ 4 weeks at lower altitude (331-1,197 m), 5 male subjects (18.6 ± 1 yr; 71.8 ± 8.7 kg; 1.8 ± 0.04 m; 22.8 ± 1.9 kg/m²) were tested within 1 wk ± 1 day of arrival to moderate altitude (V1) and were tested again at 2 wks (V2) and 3 wks (V3) after their initial arrival. Heart rate (HR), blood pressure (BP; systolic, SBP; diastolic, DBP), and brachial artery diameter were measured (using Brachial Analyzer) during baseline (BL) and after 5

min of forearm cuff occlusion (250 mmHg). FMD was assessed as the percent increase in diameter after the cuff occlusion. **RESULTS:** When comparing V1, V2, and V3, HR was no different between the visits (63±10 vs. 57±11 vs. 64±20 bpm; p=0.52 for V1 vs. V2 vs. V3, respectively). SBP was significantly higher in V1 compared to V2 and V3 (116±6 vs. 106±11 vs. 106 ±12 mmHg; both p<0.05). DBP was no different (63±9 vs. 57±9 vs. 59±6 mmHg; p=0.43). BL diameter was also not different between the visits (8.1±1.5 vs. 7.5±1.5 vs. 7.5±1.2 mm; p=0.69). FMD showed a trend toward a difference between the three visits (5.1±1.1 vs. 6.5±1.6 vs. 5.0±1.5%; p=0.07).

CONCLUSION: After 3 wks of exposure to moderate altitude, it appears that FMD may continue to fluctuate. This suggests that additional measurements beyond 3 wks should be obtained to determine a better timeline for when vascular acclimatization has been achieved. This will allow better guidance for FMD measurements obtained in subjects at altitude.

Supported by the State of Arizona Technology and Research Initiative Fund (TRIF)

2813 Board #274 May 29 10:30 AM - 12:00 PM
3 Weeks Hypoxic Training Improves Pwv, No, Angiotensin II And Endothelin In Acute Hypoxic Exposure

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 (No relevant relationships reported)

PURPOSE: To observe the acute hypoxic responses when the subjects exposed to a normobaric hypoxic environment and acute hypoxic exercise (4800m), and analyze the improvement of acute hypoxic response after 3 weeks hypoxic training. **METHODS:** Male subjects (N=53, 20.64±1.39 years) were trained four times per week in a normobaric hypoxic environment for three weeks (1st week: 2500m, 2nd week: 3500m, 3rd week: 4500m). Daily training session included 30 min cycling, 30 min rest, 30 min running and 30 min rest. Individual exercise intensity kept in moderate at SpO₂. Resting BP, PWV, plasma NO, AngII and ET in normoxia(NOR) and acute hypoxia (HYP) were measured at the baseline. BP and PWV were measured before and immediately after the 20min cycling with constant load 80W (60rpm) both at the NOR and HYP conditions. All tests were measured again after 3 weeks hypoxic training. Pre- and post- data were analyzed by paired-samples T test. **RESULTS:** 1) At the first hypoxic exposure, DBP significantly decreased (68.6±10.5 vs. 74.0±8.0, mmHg, p<0.05), and plasma NO (57.7±13.5 vs. 66.1±14.2, umol/L, p<0.05) and AngII(101.6±28.1 vs. 116.3±31.2, pg/ml, p<0.01) significantly decreased. SBP increased while DBP decrease immediately after 20min cycling in NOR compared with HYP (SBP: 157.7±18.2 vs.167.9±21.6,mmHg, p<0.05; DBP: 76.5±8.8 vs. 70.7±7.5,mmHg, p<0.05).2) After 3 weeks training, RbaPWV and LbaPWV in HYP significantly decreased (RbaPWV:1292.9±155.7 vs. 1407.9±218.5, cm/s, p<0.05; LbaPWV: 1307.3±166.6 vs. 1387.9±219.3, cm/s, p<0.05), NO(56.6±11.6 vs. 66.1±14.2, umol/L, p<0.05) and AngII(103.3±18.7 vs. 116.3±31.2, pg/ml, p<0.05) in NOR was decreased, however AngII(117.1±23.2 vs. 103.3±18.7, pg/ml, p<0.05) and ET(132.9±29.9 vs. 114.4±31.9, umol/L, p<0.05) increased when exposure in HYP compared with NOR.**CONCLUSIONS:** 3 weeks hypoxic training improved vascular responses, relieved adverse reactions of hematologic system in acute hypoxic exposure.

2814 Board #275 May 29 10:30 AM - 12:00 PM
Abstract Withdrawn

2815 Board #276 May 29 10:30 AM - 12:00 PM
Increased Oxyhemoglobin Binding Affinity Improves Cerebrovascular Responses To Hypoxia In Sprague-Dawley Rats

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 (No relevant relationships reported)

PURPOSE: This study evaluated the effect of increased oxyhemoglobin (O-H) affinity on cerebrovascular response to normobaric hypoxia.

METHODS: Cerebrovascular response was assessed in 18 mechanically-ventilated Sprague-Dawley rats during acute exposure to normobaric hyperoxia (FiO₂ 1.0), normoxic air (FiO₂ 0.21), and hypoxic air (FiO₂ 0.10). Prior to exposure, the rats were administered GBT-1118 (GBT, 100mg/kg) or normal saline via oral gavage. Pial microcirculation was assessed and quantified through a cranial window created in the parietal bone of anesthetized rats. Cardiopulmonary parameters were measured throughout the exposures. Oxyhemoglobin binding affinity (p50) was assessed following the final gas exposure using a Hemox Analyzer.

RESULTS: The mean p50 of GBT- and saline-treated animals was 31.46 and 37.63, respectively, demonstrating increased O-H affinity with GBT (p=0.0017). During steady state normoxia (FiO₂ 0.21), mean pial artery diameter decreased from baseline (FiO₂ 1.0) by 0.26% in saline animals compared to a 3.99% increase in GBT animals (p=0.1807). Additionally, GBT-treated animals demonstrated an 11.7% increase in blood O₂ saturation (p<0.0001), an 11.4% increase in peak CO₂ (p=0.0692), and an 8% increase in heart rate (HR) (p=0.015) compared to saline controls. During steady state hypoxia (FiO₂ 0.10), mean pial artery diameter decreased from baseline by 23.83% in saline animals compared to a 3.78% increase in GBT animals (p<0.0001). Additionally, GBT-treated animals demonstrated an 11.4% increase in blood O₂ saturation (p=0.012), a 14.1% increase in peak CO₂ (p=0.074), and a 9.3% decrease in HR (p=0.018) compared to saline controls.

CONCLUSIONS: Collectively, the data show that impairments in cerebrovascular and cardiopulmonary function resulting from exposure to severe hypoxia can be mitigated through increased O-H binding and subsequent increases in blood oxygenation.

2816 Board #277 May 29 10:30 AM - 12:00 PM
Mood State Is Related To Acute Mountain Sickness At Both 3000m And 4050m Altitude

Peter S. Figueiredo, Ingrid V. Sils, Janet E. Staab, Charles S. Fulco, Stephen R. Muza, FACSM, Beth A. Beidleman, USARIEM, Natick, MA. (Sponsor: Stephen Muza, FACSM)
 (No relevant relationships reported)

PURPOSE: The purpose of this study was to further explicate the relationship between changes in mood states, assessed using the Automated Neuropsychological Assessment Metrics Mood Scale (ANAM-MS), and severity of acute mountain sickness (AMS) without the confounding factors of acetazolamide, climbing rate and environmental conditions.

METHODS: Nineteen healthy lowlanders (16 men, 3 women; mean±SE; 22 ±1yr, 76.6 ±3.1 kg, 173.2 ±2.1cm, 46.0 ±1.2 ml · kg⁻¹ · min⁻¹) were randomly exposed to either 3000m (526mmHg) or 4050m (460mmHg) in a hypobaric chamber for 20h. Seven mood states (anger, anxiety, happiness, fatigue, depression, restlessness, and vigor) were assessed using the ANAM-MS; a series of 42 questions answered on a 0-6 Likert Scale. AMS severity was assessed using the AMC-Cerebral Factor Score (AMS-C) of the Environmental Symptoms Questionnaire. Both tests were administered on 8 occasions at sea level (SL), and after 2h and 20h at each altitude (HA2 and HA20). The SL baseline scores for ANAM-MS and AMS-C were calculated as the mean of the 7th (morning) and 8th (afternoon) assessments.

RESULTS: There were no differences between altitude groups in mood at SL, HA2 or HA20 so data were combined. There was differences between altitude groups in AMS-C score so data was analyzed separately. No mood state changed significantly from SL to HA2. However, fatigue and restlessness increased (P<0.05) from SL (0.57 ±0.13; 0.07 ±0.03) to HA20 (1.41 ±0.32; 0.52 ±0.20), respectively. In addition, vigor decreased (P<0.05) from SL (1.97 ±0.30) to HA20 (0.88 ±0.21). Happiness, anxiety, depression and anger did not change over time. AMS-C was elevated (P<0.05) at 4050m (1.82 ±0.27) compared to 3000m (0.22 ±0.29) at HA20. Restlessness (r=0.66; P=0.037) and anxiety (r=0.65; P=0.044) correlated with AMS-C at HA20 in the 4050m group. Fatigue (r=0.77; P<0.016) and anger (r=0.95; P=0.0001) correlated with AMS-C at HA20 in the 3000m group.

CONCLUSION: ANAM-MS ratings of fatigue, restlessness and decreased vigor emerge as low as 3000m due to hypobaric hypoxia alone. Mood disturbances were related to AMS severity; subjects with the highest ratings of fatigue and anger at 3000m, and restlessness and anxiety at 4050m possessed the highest AMS-C scores in their respective groups. *Authors' views not official U.S. Army or DoD policy. Funding: USAMRDC*

E-36 Free Communication/Poster - Microgravity/Space PhysiologyFriday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall**2817 Board #278 May 29 10:30 AM - 12:00 PM
gravitational Transitions Increase Blood-brain Barrier Permeability In Humans**Damian M. Bailey¹, Damien Lanelle², Jean-Eudes Trihan³, Nicola Marchi⁴, Benjamin Stacey¹, Kazuki Tamiya⁵, Takuro Washio⁵, Eduoard Taillon⁴, Christoph Hirtz⁴, Sylvain Lehmann⁴, Shigehiko Ogoh, FACSM², Herve Normand². ¹University of South Wales, Pontypridd, United Kingdom. ²Normandy University, Caen, France. ³Centre Hospitalo-Universitaire, Poitiers, France. ⁴University of Montpellier, Montpellier, France. ⁵Toyo University, Saitama, Japan.

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(No relevant relationships reported)

Scientific Abstract

While spaceflight-associated neuro-ocular syndrome (SANS) related to intracranial hypertension (IH) is considered NASA's top health risk for long-duration spaceflight, the underlying mechanisms remain unclear. **PURPOSE:** To examine if repeated bouts of micro- and hypergravity during parabolic flight (PF) would increase blood-brain barrier (BBB) permeability subsequent to the combined effects of cerebral hyperperfusion (hemodynamic) and systemic oxidative-nitrosative (molecular) stress. **METHODS:** Six participants (5♂, 1♀) aged 29 ± 11 years were examined before, during and after PF. Six gender and age-matched (27 ± 6 years) controls were subject to the same procedures/experimental timeline with the exception of PF. Duplex ultrasound was employed to measure blood flow in the anterior (internal carotid artery, ICA) and posterior (vertebral artery, VA) circulation, with venous blood assayed for biomarkers specific to oxidative-nitrosative stress (electron paramagnetic resonance spectroscopy/ozone-based chemiluminescence) and structural integrity of the neurovascular unit (NVU, chemiluminescence/ELISA). **RESULTS:** PF was associated with a selective increase in VA flow during the most marked gravitational transition from micro- to hypergravity ($P < 0.05$). Increases in oxidative-nitrosative stress, gliovascular GFAP and S100 β were observed after PF ($P > 0.05$), the latter proportional to the increase in VA flow, whereas biomarkers of neuronal-axonal damage (neuron-specific enolase, neurofilament light-chain, ubiquitin carboxy-terminal hydrolase L1 and tau) remained stable ($P > 0.05$). **CONCLUSION:** Collectively, these data are the first to demonstrate that acute gravitational transitions result in minor BBB disruption due to the combined effects of hemodynamic-molecular stress thereby proposing an alternative candidate mechanism and biomarkers for the reported neurological sequelae underlying SANS.

**2818 Board #279 May 29 10:30 AM - 12:00 PM
A Wearable Garment To Mitigate Low Back Pain In Astronauts**

Curtis Neeld, Meagan Gardner, Joshua Elorreaga, Jason Hogle, Alexis Quintana, Charles Swieczkowski, Nicholas Levine, Sheri Drago, Brandon Rigby, David Nichols, FACSM. Texas Woman's University, Denton, TX. (Sponsor: David Nichols, FACSM)

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(No relevant relationships reported)

The microgravity environment can have detrimental impacts on human health. Muscle atrophy, declines in bone mass, wedging of vertebral bodies, loss of normal spinal curvature, and decreased functional capacity are all consequences of prolonged microgravity exposure. Atrophy of the muscles along, and around, the spine is one of the primary contributors to the development of low back pain in space. **PURPOSE:** To design and fabricate a low-cost, diurnally worn upper-body garment with integrated neuromuscular electrical stimulation to prevent and mitigate low back pain in astronauts. **METHODS:** A custom fitted, upper-body garment that contained a neuromuscular electrical stimulation system was originally designed in modeling software (Solidworks Premium 2018, Waltham, MA). The garment was fabricated using highly durable, anti-microbial material (88.7% polyester, 8.6% lycra, 2.7% silver ion fiber). An elastic belt for additional compression to maximize contact between skin and electrodes was also incorporated. Four hydrogel electrodes were placed over motor points of the erector spinae and multifidus musculature. The wireless electrodes sent signals to a controller, all of which were integrated into the garment. A frequency of 50 Hz, pulse width of 200 μ s, amplitude of 14 to 21 mA, and an on/off time of 20 sec was used during testing. Four participants with low back pain wore the garment and recorded pain levels, via a visual analog scale, at strategic times before and after

the performance of the following exercises in our laboratory: isometric base, I's, T's, and Y's, shoulder adduction and flexion, hamstring curls, inverted rows, pull-ups, and seated wood choppers. A Friedman's ANOVA was used to test for differences in subjective pain measures with a significance of 0.05. **RESULTS:** No differences in pain were found at baseline (4.5 ± 0.6) when compared to pain following an exercise bout immediately after baseline (5.0 ± 0.8), after 8 hours of continuous wear (3.3 ± 1.5), and immediately following the exercise bout after this 8-hour timepoint (3.3 ± 1.5 ; $p = 0.112$). **CONCLUSION:** Further testing is needed to determine if the integration of neuromuscular electrical stimulation into a diurnally worn upper-body garment may mitigate atrophy of the erector spinae and multifidus muscles, resulting in decreased low back pain.

**2819 Board #280 May 29 10:30 AM - 12:00 PM
Effects Of 10-days Bed-rest On Nitric Oxide Metabolites And Microvascular Function Assessed By Near-infrared Spectroscopy**SIMONE PORCELLI¹, Letizia Rasica¹, Lucrezia Zuccarelli², Benedetta Magnesa², Cristina Degano², Marina Comelli², Giorgio Manferdelli¹, Mauro Marzorati¹, Irene Mavelli², Andrea Pilotto¹, Mia Burleigh³, Bostjan Simunic⁴, Rado Pisot⁴, Marco Narici⁵, Bruno Grassi, FACSM². ¹National Research Council, Segrate (MI), Italy. ²University of Udine, Udine, Italy. ³University of the West of Scotland, Glasgow, United Kingdom. ⁴Science and Research Centre, Koper, Slovenia. ⁵University of Padova, Padova, Italy. (Sponsor: Bruno Grassi, FACSM)

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(No relevant relationships reported)

Purpose: Prolonged periods of bed-rest (BR), experimental simulation of microgravity, greatly affect oxidative metabolism by acting at several levels of the O₂ pathway. Short duration (10 days) of horizontal BR negatively affects in-vivo functional biomarkers related to skeletal muscle oxidative metabolism without affecting mitochondrial respiration ex-vivo. The impairment of muscle oxidative metabolism can partially derive from reduced O₂ delivery, altered peripheral O₂ diffusion and a mismatch between O₂ delivery and O₂ consumption, likely related to an altered nitric oxide signaling. Aim of this study was to evaluate the effects of 10 days of BR on microvascular reactivity indexes determined at skeletal muscle level by near infrared spectroscopy and nitric oxide metabolites.

Methods: Measurements were carried out on 10 recreationally active young males (age 23 ± 5 years [mean±SD]) before (PRE) and after (POST) 10 days of horizontal BR. Pulmonary O₂ uptake ($\dot{V}O_2$) and other respiratory, cardiovascular and skeletal muscle variables were determined during an incremental exercise on a cycle ergometer. Microvascular endothelial function was assessed during vascular occlusion test (VOT) by evaluating the slope of re-oxygenation rate (SLOPE 2) and the area under the curve (AUC) over the baseline of 5min reperfusion phase of delta[oxy(Hb+Mb)] signal obtained from vastus lateralis muscle. Plasma nitrite concentration was determined by chemiluminescence.

Results: Peak $\dot{V}O_2$ was lower in POST (41.5 ± 6.5 ml kg⁻¹ min⁻¹) vs. PRE (44.5 ± 7.4 , $P < 0.01$). SLOPE 2 was significantly slower in POST (5.3 ± 0.8 % s⁻¹) compared to PRE (6.4 ± 0.7 , $P < 0.01$). AUC was significantly reduced in POST (11025 ± 2145 % s) compared to PRE (13094 ± 1940 , $P < 0.01$). Plasma nitrite concentration diminished from PRE (85.4 ± 35.0 nM) to POST (65.5 ± 45.6 , $P < 0.01$).

Conclusions: These preliminary data suggest that after 10 days of horizontal BR whole-body impairment of oxidative metabolism during exercise is associated with reduced level of nitrite and an altered microvascular endothelial function. Further analyses of systemic functional variables as well as biochemical data obtained during the bed-rest campaign, and not yet analysed, will help us to define sites of limitation to muscle oxidative metabolism along the O₂ pathway.

E-37 Free Communication/Poster - Genetics, Immunology and Endocrinology in AdultsFriday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall**2820** Board #281 May 29 10:30 AM - 12:00 PM**Gene Expression Differences In Three-dimensional Myobundles Compared To Two-dimensional Myocultures**Alexander Byron Sklivas¹, Dante Goss, II¹, Nenad Bursac², Alastair Khodahukus², Tim Kovacs², Deborah Muoio³, Lauran Madden², George A. Truskey², William E. Kraus, FACSM², Monica J. Hubal, FACSM¹. ¹Indiana University-Purdue University Indianapolis, Indianapolis, IN. ²Duke University, Durham, NC. ³Duke University, Durham, IN. (Sponsor: Monica Hubal, FACSM)

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(No relevant relationships reported)

Purpose: Traditional two-dimensional (2D) *in vitro* models of human skeletal muscle are limited in their ability to fully mimic *in vivo* muscle, as *in vivo* muscle exists in a complex three-dimensional (3D) structure. We have developed a novel engineered three-dimensional (3D) myobundle *in vitro* model that we believe more closely models skeletal muscle behavior. Here, we determined baseline gene expression differences among three models: the 3D myobundles, 2D cell cultures, and explant biopsies. **Methods:** Previously collected skeletal muscle (vastus lateralis) biopsy samples from adult men and women (n = 6) were used. Each sample was used to generate the following groups: explant (RNA from biopsy), 2D (RNA from differentiated myotubes) and 3D (RNA from 3D myobundles seeded from each primary sample). 200ng of isolated RNA for each sample was used to generate global gene expression profiles (HumanHT-12 v4.0 Gene Expression BeadChip Arrays). Data were processed using Illumina Genome Studio and imported into Partek Genomics Suite for statistical analysis. Differential gene expression was assessed via 2-way ANOVA (group*ID) with the following *post-hoc* comparisons: 2D/biopsy, 3D/biopsy and 3D/2D. Resultant lists were filtered at p<0.01 and fold change >|1.5|. Biological pathway analyses of differentially regulated gene sets were done using Ingenuity Pathway Analysis. **Results:** ANOVA detected 3754 genes different between 2D/biopsy, 3273 genes different between 3D/biopsy and 488 genes different between 3D/2D cultures. Biological pathway analysis identified representation of the following canonical pathways in our gene set: calcium signaling (26 genes; z-score=1.508, -log p-value=13.9), integrin signaling (28 genes; z-score=-2.711, -log p-value=13.5), and actin cytoskeleton signaling (29 genes; -log p-value=12.3). **Conclusion:** The 3D cell myobundle system produced relatively fewer differences from biopsies as compared to 2D cell cultures, but some significant differences from biopsy samples remain. Comparison of 3D to 2D culture systems shows transcriptional changes that align with increases in calcium signaling, while downregulations in the actin cytoskeleton and integrin signaling demonstrate significant structural differences between the two *in vitro* models tested.

2821 Board #282 May 29 10:30 AM - 12:00 PM**Changes In TSH, T4 And Prolactin Levels With Cycling And Running**Costas Chryssanthopoulos¹, Roxane Tenta², Evangelia Tzeravini¹, Elias Zacharogiannis¹, Alexander Kokkinos¹, Maria Maridaki¹, Michael Koutsilieris¹, Anastassios Philippou¹. ¹National and Kapodistrian University of Athens, Athens, Greece. ²Harokopio University, Athens, Greece. Email: chryssan@phed.uoa.gr

(No relevant relationships reported)

Several studies have examined the changes in TSH, T4 and Prolactin levels during cycling and running, however, to the best of the authors' knowledge, none of the existing studies compared directly cycling and running on the same individuals. **PURPOSE:** To compare changes in TSH, T4 and Prolactin levels as a consequence of cycling and running exercise on the same individuals. **METHODS:** Ten active males (25.4 ± 11.0 years old, 175.8 ± 6.9 cm, body fat percentage 15.6 ± 3.6%, mean ± SD), following an overnight fast, cycled (C) or ran (R) for 30 min at about 80% maximal heart rate (HRmax). Venous blood samples were taken before and immediately after exercise. Data were analyzed using two-way ANOVA, whereas post-pre exercise changes were compared by two tailed t-test. **RESULTS:** The two-way ANOVA revealed no differences at any level (time, mode and interaction) before exercise for serum TSH (C: 4.4 ± 7.2 vs. R: 2.7 ± 2.1 μU/ml⁻¹), T4 (C: 1.2 ± 0.2 vs. R: 1.1 ± 0.2 ng/dl⁻¹) and Prolactin (C: 20.0 ± 4.4 vs. R: 20.7 ± 5.5 ng/ml⁻¹) compared to post exercise [TSH: 6.7 ± 11.5 (C) vs. 3.8 ± 3.1 (R) μU/ml⁻¹; T4: 1.3 ± 0.4 (C) vs. 1.2 ± 0.2 (R)

ng/dl⁻¹; Prolactin: 20.9 ± 5.0 (C) vs. 20.3 ± 6.0 (R) ng/ml⁻¹]. No differences were also observed when post-pre exercise values were compared with the exception of a higher percentage change as a result of exercise in C (39 ± 36 %) compared to R (37 ± 20 %) for serum TSH (p=0.01).

CONCLUSIONS: After 30 min cycling or running at about 80% HRmax no significant changes in the levels of serum TSH, T4 and Prolactin were elicited compared to pre-exercise in male active individuals.

2822 Board #283 May 29 10:30 AM - 12:00 PM**The Effect Of A Ketogenic Diet On The Exercise Induced Immune Response**Riencke Terink¹, Renger Witkamp¹, Huub Savelkoul¹, Maria Hopman, FACSM², Marco Mensink¹. ¹Wageningen University & Research, Wageningen, Netherlands. ²Radboud UMC, Nijmegen, Netherlands. (Sponsor: Maria Hopman, FACSM)

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(No relevant relationships reported)

ABSTRACT - Purpose: Ketogenic diets are popular amongst athletes, they improve fat oxidation capacity and training with low carbohydrate (CHO) availability can possibly enhance training adaptation. However, performance improvements are not observed and training with low CHO availability may increase the susceptibility to illness and infection. Therefore, the aim of this study was to examine the effect of a (short and longer) ketogenic diet on the exercise induced immune response. **Methods:** in this cross-over study, 14 well trained male athletes (age 32.9±8.2 years, VO2max 57.3±5.8 ml/kg/min) were assigned to two weeks on a low CHO ketogenic (LC) diet (< 10En% CHO) and two weeks on a high CHO (HC) diet (> 50En% CHO) in a random order, with a wash-out period of >2 weeks in between. Test days were planned after 2 days and 2 weeks on both diets. During test days athletes cycled for 90 minutes at 70% VO2max and blood samples were taken at baseline, directly after exercise and 2hr after exercise. Blood samples were analysed for cortisol, immune cell differential count and homing factors. **Results:** Total work load performed during the exercise test was lowest after 2 days on the LC diet (938.6±162.5 kJ) and improved after 2 weeks (1003.2±128.6 kJ, p=0.03), but was still lower compared to the HC diet (~1040 kJ, p>0.05). Cortisol response after exercise was higher after 2 days on the LC diet (822±215 nmol/L) compared to the response after 2 weeks on the LC diet (669±243 nmol/L) and compared to both test days during the HC diet (609±208 and 555±173 nmol/L, both p<0.001). Immune cell differential count, for T-cells, Th cells, Cytotoxic T cells, NK T cells, B cells and monocytes was significantly different between diets (p < 0.05). Differences between diets were more pronounced after 2 days on the diets compared to 2 weeks on the diets. The CCR7+ homing factor on CD4+ cells (which guides cells to lymph nodes) was higher during the LC diet, compared to the HC diet (p < 0.05) **Conclusions:** The short term ketogenic diet caused a higher stress response and more pronounced differences in cell differentiation, compared to the HC diet. In addition, homing of CD4+ cells to the lymph nodes was stronger on the LC diet compared to the HC diet.

2823 Board #284 May 29 10:30 AM - 12:00 PM**Adrenocorticotropin And Interleukin-6 Responses After A Single Bout Of Aerobic Exercise In Young Adults**

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(No relevant relationships reported)

Exercise is a stress stimulus leading to endocrine and immunological changes in the human body. There are interactions between the Hypothalamo-Pituitary-Adrenal (HPA) axis and the immune system in response to exercise, depending on the characteristics of exercise (type, duration, intensity and frequency). **PURPOSE:** This study examined adrenocorticotropin (ACTH) and interleukin-6 (IL-6) responses to a selected aerobic exercise protocol performed under inhibition or stimulation of the HPA axis in healthy adult volunteers. **METHODS:** twelve healthy volunteers (8 males and 4 females, age: 30.6±4.4 yrs, body mass: 77.3±12.3 kg, height: 1.77±0.07 m), performed a single bout of 30 min aerobic exercise at 70%VO₂max on a treadmill, on three different conditions [control (C), HPA axis inhibition (HPA-I, induced by glucocorticoid administration), HPA axis stimulation (HPA-S, induced by ACTH administration)], following standard diet. Blood samples were collected before (t0), at the end of the exercise bout (t30), and 30 min later (t60) and serum ACTH and IL-6 were measured. Two-way ANOVA was used for statistics and data is presented as mean±SE. **RESULTS:** In C condition, IL-6 increased at the end (p<0.05) and 30 min after exercise (p<0.001) (1.7±0.1; 3.1±0.5; 3.02±0.6 pg/ml; at t0, t30 and t60, respectively). ACTH significantly decreased 30 min after exercise (p<0.05) (23.4±2.3; 21.5±2.4; 16.9±1.6 pg/ml; at t0, t30 and t60, respectively). In HPA-I, IL-6 increased at the end (p<0.05) and 30 min after exercise (p<0.001) (1.6±0.1; 2.4±0.4; 2.9±0.6 pg/ml; at t0, t30 and t60 respectively), while ACTH remained unchanged (p>0.05) (4.0±; 4.1±0.1; 4.3±0.2 pg/ml; at t0, t30 and t60, respectively). Under HPA-S condition, IL-6 increased 30 min after exercise (p<0.01) (1.7±0.2; 2.6±0.3; 3.5±0.7 pg/ml; at t0, t30

and t60 respectively). There were no significant changes in IL-6 between the three conditions, while ACTH was lower in HPA-I compared to C condition at all time points ($p < 0.001$). **CONCLUSION:** The rapid increase of IL-6 in response to aerobic exercise is not affected by the modification of HPA axis, while the specific aerobic exercise regimen influenced circulating ACTH yet not under exogenous inhibition of the HPA axis. Further studies are needed to characterize how those responses are regulated by the characteristics of exercise.

2824 Board #285 May 29 10:30 AM - 12:00 PM

Acute Resistance Exercise Elicits Bdnf But Not Cathepsin B In Well-trained Men

Zac P. Robinson, Trevor K. Johnson, Daniel J. Belcher, Colby A. Sousa, Joseph P. Carzoli, Nishant P. Visavadiya, Andy V. Khamoui, Michael Whitehurst, FACSM, Michael C. Zourdos. *Florida Atlantic University, Boca Raton, FL.*
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PURPOSE: The aim of this study was to examine if multi-joint RE exercises (back squat, bench press, and deadlift) to volitional failure elicited a circulating response of biomarkers associated with neuroprotection and if differences in biomarker changes existed between exercises. Further, we examined if the pre- to post-exercise changes in BDNF and IL-6 were related. **METHODS:** Thirteen males (age: 24.5 ± 3.8 yrs, body mass: 84.01 ± 15.44 kg, height: 173.43 ± 8.57 cm, training age: 7.1 ± 4.2 yrs) performed 4 sets to failure at 80% of a one-repetition maximum (1RM) on the squat, bench press, and deadlift in successive weeks. The bench press was always performed second and the order of the squat and deadlift was counterbalanced. The measured biomarkers are brain derived neurotrophic factor (BDNF), insulin-like growth factor 1 (IGF-1), cathepsin B (CatB), and interleukin 6 (IL-6). Biomarkers were assessed immediately pre- and post-exercise. **RESULTS:** There was a main time effect ($p < 0.01$) for BDNF. In the deadlift ($p = 0.01$) and bench press ($p = 0.01$) conditions BDNF significantly increased, however, no significant change was observed the squat condition ($p = 0.21$). There was a main time effect ($p < 0.01$) for IL-6 with a significant increase in the squat ($p < 0.01$), but not the bench press ($p = 0.88$) and deadlift conditions ($p = 0.24$). No main time effect was observed for either CatB ($p = 0.62$) or IGF-1 ($p = 0.56$). No significant correlations were observed between the acute change in BDNF and IL-6 ($p > 0.05$), however, this relationship was nearly significant in the deadlift condition ($p = 0.058$). **CONCLUSION:** In summary, acute multi-joint RE elicits a significant increase in circulating BDNF. This investigation is the first to report the lack of a transient change of CatB to an acute RE protocol.

2825 Board #286 May 29 10:30 AM - 12:00 PM

Treadmill Walking Increases Percent Of Circulating Monocytes (CD14+) Expressing CX3CR1 In Older Adults

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(No relevant relationships reported)

CX3CR1 is a chemokine receptor for the chemokine CX3CL1. Expression of CX3CR1 may influence the inflammatory response of the innate immune system. The **PURPOSE:** of this study was to examine the relationship between CX3CR1 expression on circulating monocytes with physical activity level and mode of exercise in healthy, older adults. **METHODS:** Twenty-four healthy older adults (63.0 ± 5.0 years) were recruited for this study. Participants were divided into two groups based on self-reported physical activity level: physically active (PA) and physically inactive (PI). Participants completed a randomized complete crossover trial of 30 minutes moderate-vigorous intensity cardiorespiratory endurance (CRE) or resistance exercise (RE) on two separate visits. Blood samples were collected from each person at rest (PRE), immediately after exercise (POST), and 1-hr recovery after exercise (RECOV). Monocyte cell surface markers were measured by flow cytometry. **RESULTS:** PA participants ($N = 12$, est. $\dot{V}O_{2\max} = 45.3 \pm 16.8$ mL \cdot kg $^{-1}$ \cdot min $^{-1}$) had a higher estimated $\dot{V}O_{2\max}$ than the physically inactive participants ($N = 12$, est. $\dot{V}O_{2\max} = 35.0 \pm 11.1$ mL \cdot kg $^{-1}$ \cdot min $^{-1}$). Percent of circulating monocytes expressing CX3CR1 was higher ($p < 0.05$) in CRE RECOV ($92.3\% \pm 2.5$) than CRE POST ($90.1\% \pm 2.98$). No other differences ($p \geq 0.05$) were observed within the PA group between PRE, POST, and RECOV timepoints for the CRE or RE modes of exercise. No differences ($p \geq 0.05$) were observed within the PI group for time or mode of exercise. No differences ($p \geq 0.05$) were observed between the CRE and RT modes of exercise within the PA group or the PI group at each PRE, POST, and RECOV timepoints. **CONCLUSION:** Differences in monocyte expression of CX3CR1 were observed between the POST and RECOV stage following a 30-minute CRE (treadmill) exercise intervention within the PA group. Time differences were observed between PA and PI groups. No other differences in CX3CR1 were observed within PA and PI groups following a 30-minute moderate-vigorous exercise intervention. Further research is needed to determine potential differences if CX3CR1 physical activity status and mode of exercise influence the inflammatory response of an acute exercise bout.

2826 Board #287 May 29 10:30 AM - 12:00 PM

Resistance Training On Specific MicroRNAs In Physiological Adaptations In Older Adults

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PURPOSE: MicroRNA (miRNA) as the novel regulator in resistance training induced functional and physiological adaptations remains poorly understood. The goal of the present study was to analyze the response of a panel of circulating miRNAs to resistance training-mediated adaptations.

METHODS: Ten healthy older adults (age: 67.6 ± 2.2 years, BMI: 22.8 ± 2.6 kg/m 2 , 7 female, 3 male) without previous resistance training experience were recruited. Blood samples were collected at baseline (PRE) and after 12 week of resistance training (POST). Next-generation sequencing (NGS) was used to determine circulating microRNA responses to chronic resistance training.

RESULTS: Physical function, including grip strength, chair stand test, and walking capacity, was improved in older adults after 12-week training. Serum levels of leptin (18.1 ± 20.0 vs. 14.9 ± 17.6 ng/ml, $P = 0.029$) and TNF α (4.4 ± 0.6 vs. 4.0 ± 0.6 pg/ml, $P < 0.001$) were significantly decreased after 12-week training. After 12 week of resistance training, 11 adipogenesis, 3 anti-adipogenesis, 5 myogenesis, and 5 inflammation associated miRNAs were changed significantly in older adults (Fold change > 2 , $P < 0.05$). Log $_{2}$ fold change of miRNA-125-1-3p was inversely correlated with delta walking time ($R = -0.685$, $P = 0.029$) and change in IGF-1 ($R = -0.644$, $P = 0.044$). **CONCLUSIONS:** Resistance training alters specific circulating miRNAs to account for functional and physiological adaptations in older adults.

2827 Board #288 May 29 10:30 AM - 12:00 PM

Genetic Predictions Of Bone Mineral Density In Ultramarathon Runners: For Men, But Not For Women

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BACKGROUND: Various genetic markers have been identified as influencing bone mineral density (BMD). In a prior study in the UK Biobank, 22,866 SNPs were selected using LASSO based on ability to predict calcaneal bone mineral density. Kim in PLoS ONE 2018 tested this genetic risk score against other models and found it to have the best correlation with BMD.

PURPOSE: Given the prevalence of low BMD and low energy availability in female and male endurance runners, this study investigated the correlation between this genetic risk score and BMD of runners at the Western States endurance race.

METHODS: 51 runners at a 100-mile race underwent a genetic evaluation using an Affymetrix PMRA array including approximately 800,000 SNPs, which includes all those required for the Kim BMD genetic risk score. These runners also underwent dual-energy x-ray absorptiometry. We calculated Pearson's correlation coefficients between the genetic risk score and spine, hip, femoral, and forearm BMD.

RESULTS: 17 female and 34 male participants had a mean age, respectively, of 41.8 and 46.8 years (range 26.4-76.2). BMI ranged from 17.2-25.2 kg/m 2 (female) and 19.3-39.4 kg/m 2 (male). For the male runners, the genetic risk score significantly correlated with z-scores of the lumbar spine, total hip, femoral neck, forearm, and total body ($r = 0.52-0.58$, $p < 0.005$). For female athletes, all correlations were 0 or negative and non-significant ($r = 0.0$ to -0.30 , $p = 0.24-0.99$). See Table 1.

CONCLUSIONS: The BMD genetic risk score was significantly correlated with BMD in the male, but not female ultramarathon runners in this study. The sample size for women ($n = 17$) is too small to draw robust conclusions, but we speculate that for female athletes, environmental and hormonal factors, such as low energy availability or menstrual irregularities, may decrease the influence of genetic factors.

Correlation Between Genetic Risk Score and Bone Mineral Density					
	Spine Z-Score R, p-value	Total Hip Z-Score R, p-value	Femoral Neck Z-Score R, p-value	Forearm Z-Score R, p-value	Total Body Z-Score R, p-value
Women: Genetic Risk Score	0, 0.99	-0.16, 0.53	-0.06, 0.83	-0.3, 0.24	-0.11, 0.68
Men: Genetic Risk Score	0.52, 0.0016	0.64, <.0001	0.53, 0.0013	0.58, 0.0003	0.58, 0.0003

E-38 Free Communication/Poster - Concussion II

Friday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

2828 Board #289 May 29 9:30 AM - 11:00 AM

Football Years Played Has A Dose-response Relationship With Odds Of Having Chronic Traumatic Encephalopathy And Severity Of Disease

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(No relevant relationships reported)

PURPOSE:

Chronic traumatic encephalopathy (CTE) is a neurodegenerative disease associated with exposure to contact and collision sports, including American football. We hypothesized that, as duration of American football played increased, CTE neuropathological risk and severity would correspondingly increase. To account for selection bias, we adjusted for known predictors of selection into brain banks using inverse probability weighting (IPW); because of unique criteria, we also conducted simulation to further evaluate the effect of selection bias. **METHODS:** In a convenience sample of 266 deceased American football players from the VA-BU-CLF and Framingham Heart Study (FHS) Brain Banks, we estimated the association of years of football played with CTE pathological status and severity. To be eligible the VA-BU-CLF Brain Bank, donors needed a history of CCS, military service, or domestic violence, regardless of whether symptoms manifested during life. All brains from either brain bank were processed and analyzed using identical methods. Neuropathologists were blinded to the participant's CCS exposure and clinical history.

RESULTS:

In models adjusted for age at death, there was a dose-response relationship between longer duration played with CTE status and severity; each additional year of play corresponded to 30% higher odds of having CTE at death (95%CI, 1.19-1.41; $P=3.8 \times 10^{-9}$) and 14% higher odds of having severe CTE at death (95%CI, 1.07-1.22; $P=3.1 \times 10^{-4}$). Participants with CTE were 1/10th as likely to have played <4.5 years (negative likelihood ratio [LR]=0.102, 95%CI, 0.100-0.105) and were 10X as likely to have played >14.5 years (+LR=10.2, 95%CI, 9.8-10.7). Simulation demonstrated that years played remained adversely associated with CTE status across all values of selection regression scenarios.

CONCLUSIONS:

Duration played was significantly associated with odds of CTE at death, with odds increasing 30% every year, doubling every 2.6 years and increasing by >10-fold every nine years. Among those with CTE, duration played also was also significantly associated with having severe CTE pathology and greater NFT burden. Duration played was a good classifier of CTE status based on ROC curve analysis.

2829 Board #290 May 29 9:30 AM - 11:00 AM

Vestibular/ocular Motor Screening: Evaluation Of A Novel Prototype For Injury Assessment

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The Vestibular/Ocular Motor Screening (VOMS) is a common tool to evaluate sport-related concussion (SRC). Unfortunately, it is possible that conventional assessments can be subjective and elicit inconsistent results between raters with respect to how each rater perceives the position of their hands. If this occurs, it may alter the distance the eye must travel during pursuits and saccades, to complete sections of the exam and could influence symptom reporting. **PURPOSE:** The purpose of this study was to examine the differences in the VOMS using the traditional method (TRAD) versus using a clinical prototype (PRO) within 72 hours of a sport-related concussion. **METHODS:** 11 SRC (Female = 4, Male = 7, average age = 19 years) completed the VOMS assessment using the TRAD method and 11 SRC (Female = 4, Male = 7, average age = 22 years) completed the VOMS using the PRO method. For the TRAD method, arm position was not controlled and each trained rater was asked to administer the exam normally. For the PRO, it consisted of an adjustable, vertical pole affixed to a tripod stand with a leg of the stand that extended to 36 inches. At the upper end of the vertical pole, a second pole was affixed via a pivot clamp. The length of this pole was 36 inches with 2 white 14 point markers affixed to either end. One end of this part of the prototype contained a secondary pole that had a slide rule device that can be extended out to the end of the nose when aimed at the face to allow for the measurement for NPC. All SRCs were assessed within 72 hours post-injury. Mann-Whitney U tests assessed the differences between both methods of assessment for total symptom severity changes and NPC distance.

RESULTS: The results indicate that using the TRAD method (average=12±8 symptoms severity) elicited a significantly greater amount of change score symptom severity when compared to the PRO (average=5±4 symptoms severity; $p=.016$, Cohen's $d=1.1$). However, no significant difference was noted on NPC between TRAD (average=8.5±7.1cm) and PRO (average=13.1±9.8cm; $p=.32$, Cohen's $d=0.6$). **CONCLUSION:** The TRAD elicited a greater change in symptom severity but no changes were observed in NPC. A standardized measurement tool may reduce the distance that the eyes travel during the assessment which could elicit less overall symptoms on the VOMS and avoid human error due to subjective evaluation.

2830 Board #291 May 29 9:30 AM - 11:00 AM

Predicting Protracted Concussion Recovery To Inform Proactive Care: A Genetic Fuzzy Machine Learning Approach

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Poor prognostic accuracy of sport-related concussion (SRC) recovery times has limited proactive clinical care. Currently, clinicians consolidate a battery of assessments and combine their own practical knowledge to develop prognosis and treatment plans. Machine learning may provide a useful method to augment clinicians' prognostic decision making: a critical first step to enhance proactive care.

Purpose: Determine utility of a novel genetic fuzzy system (GFS) machine learning approach, FuzzyBolt, to predict protracted recovery after SRC.

Method: Data from 76 pediatric patients (age 14.44 ± 2.54 years; 28 F) were obtained from 186 combined clinic visits following initial SRC. Recovery time was indexed from the physician-recorded full clearance to return to play date in the medical record and then classified as less than or equal to 28 days (N=88) vs. greater than 28 days (N=98)—the consensus pediatric threshold for persistent symptoms. A GFS model classified protracted recovery on patients that were less than 28 days in recovery. GFS uses fuzzification, rule-inference and defuzzification to make decisions, and FuzzyBolt provides an efficient method of optimizing model parameters via genetic algorithms. The model used 36 inputs, including ordinal and binary variables related to patient demographics, standardized Post-Concussion Symptom Inventory responses, and self-reported responses from a clinic-based Head Injury Questionnaire.

Results: Data were split, via stratified sampling, into a training set (80%; 61 athletes with 151 visits) and a hold-out validation set (20%; 15 athletes with 35 visits). Each patient visit was considered a unique case, with visits from the same patient never part of both the training and validation sets to reduce the risk of over-fitting and inflation of non-generalizable prediction accuracy. The FuzzyBolt model correctly predicted 12 of 16 protracted (and 16 of 19 typical) recovery cases, for an overall classification accuracy of 80%.

Conclusion: This is the highest prediction accuracy, to date, for any published prognostic model of concussion recovery. It is a first step toward promoting early allocation of resources for patients at high-risk for protracted recovery, and demonstrates a novel technique to empower a data-driven solution to improve outcomes in these athletes.

2831 Board #292 May 29 9:30 AM - 11:00 AM

Predictors Of Sport-related Concussion Non-disclosure In Collegiate Athletes

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Sport-related concussion (SRC) non-disclosure continues to be a barrier to injury identification, despite recent National Collegiate Athletics Association educational initiatives to increase favorable reporting behaviors. Therefore, understanding factors associated with SRC non-disclosure in collegiate athletes is warranted. **PURPOSE:** To examine predictors of SRC non-disclosure in collegiate athletes. **METHODS:** A multisite cross-sectional design was used. Collegiate athletes (n = 741; males = 448, females = 293; mean age = 19.89 ± 1.32 years) completed a 15-minute survey that included personal and sport demographics, diagnosed and non-disclosed SRC history, and pressure from external sources (i.e., coaches, teammates, family/parents, fans) to continue to play following a head impact. Age, sex (male/female), sport type (contact/non-contact), SRC history (yes/no), and degree of pressure from external sources (1-strongly disagree to 7-strongly agree) were potential predictor variables

of SRC non-disclosure. Univariate logistic regression analyses determined the odds of SRC non-disclosure (yes/no) for each predictor. Significant univariate predictor variables were used in the multivariate logistic regression analysis. Significance was set *a priori* at $p \leq .05$. **RESULTS:** A total of 116 (15.65%) collegiate athletes reported not disclosing a potential SRC. Following univariate logistic regression analysis, sex ($p = .004$), sport type ($p = .002$), SRC history ($p < .001$), pressure from teammates ($p < .001$), pressure from coaches ($p < .001$), pressure from parents/family ($p < .001$), and pressure from fans ($p < .001$) were entered into a multivariate logistic regression. Previous history of SRC (OR, 2.66, [95% CI 1.74-4.08]; $p < .001$), being a male (OR, 1.69 [95% CI, 1.04-2.75]; $p = .033$), and experiencing pressure to play following a head impact from a coach (OR, 1.36 [95% CI 1.16-1.59]; $p < .001$) were significant predictors of SRC non-disclosure. **CONCLUSIONS:** SRC non-disclosure behaviors are influenced by intrinsic and extrinsic factors and may be magnified in athletes with a history of SRC, males, and athletes that experience pressure from coaches. To reinforce favorable reporting behaviors, future educational initiatives should consider these predictive factors.

2832 Board #293 May 29 9:30 AM - 11:00 AM
The Relationships Between King-devick And SCAT5 Scores In High-school Athletes

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Preseason testing is important when developing concussion-related safety programs in high-school athletes. However, the relationships between many commonly-used and valid-baseline assessments are unknown

PURPOSE: To determine the relationships between King-Devick (KD) and the Sport Concussion Assessment Tool - 5th Edition (SCAT5), commonly used as part of a pre-season concussion-safety program for high-school athletes. **METHODS:** SCAT5 and KD baseline scores from high-school athletes ($n = 404$, 28 = female, aged 16 ± 1 years) were recorded and later analyzed. KD testing required participants to complete two, error-free trials, which were reported to the nearest 0.0 s and a single SCAT5 assessment completed one-on-one with a physician or athletic trainer. The SCAT5 test is composed of several relevant neurocognitive components (concentration, current number of symptoms, symptom severity, orientation, memory, neurological screening, balance, and recall). Due to the dichotomous nature of the neurological screening component, those data were excluded from this analysis ($n = 9$ scored in the abnormal category). Pearson-product moment correlations were calculated between the best-baseline KD score and SCAT5's component tests, including a composite score. The composite score was calculated as a sum of z-scores from each individual test making up the SCAT5. **RESULTS:** The mean \pm standard deviation of the KD test were 52.5 ± 13.3 s. Pearson-product moment correlations revealed a weak-negative relationship with the SCAT5 component - Concentration ($r = -0.12$, $p = 0.02$). However, no other meaningful relationships were detected [number of symptoms ($r = -0.04$, $p = 0.48$), symptom severity ($r = -0.06$, $p = 0.22$), orientation ($r = -0.07$, $p = 0.14$), memory ($r = -0.02$, $p = 0.63$), balance ($r = -0.04$, $p = 0.39$), recall ($r = 0.01$, $p = 0.88$), and composite z-score ($r = -0.05$, $p = 0.30$)] **CONCLUSIONS:** These data show that KD and SCAT5 scores are generally unrelated in this sample of high-school athletes. Clinically, the data support the true utility of neurocognitive testing resides in one's ability to use the same test to directly compare pre- vs. post-test scores in diagnosing and monitoring recovery in athletes suspected of having a concussion. King-Devick provided access to testing services - free of charge.

2833 Board #294 May 29 9:30 AM - 11:00 AM
A New Objective Visual Test For Concussion

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 Reported Relationships: **A.J. Cohen:** Ownership/interest/stock; Founder, CEO and shareholder.

PURPOSE: A wide variety of assessment tools are currently available to help clinicians assess Sports Related Concussion (SRC). Currently, the most widely available tools are neither objective nor portable and are therefore not ideal for assessment at the site and time of a suspected injury. **METHODS:** A portable system was developed to deliver a measurement of the steady-state visual-evoked potential (SSVEP). This system involved a smartphone housed in a Google Cardboard frame, which delivered a 15Hz flicker visual stimulus while an electroencephalography (EEG) headset recorded EEG signals. 65 rugby union players were tested during their regular season and were stratified into healthy, concussed and recovered groups based on clinical examination. Their SSVEP response was quantified into a signal-to-noise ratio (SNR). The SNRs of players in each study group were summarized. Additionally, the SNRs of individual players who had baseline, post-injury and post-recovery readings

were analyzed. **RESULTS:** 65 participants completed a baseline evaluation to measure their SSVEP. Twelve of these participants sustained a medically diagnosed concussion and completed SSVEP re-testing within 72 hours. Eight concussed players received follow-up SSVEP testing after recovery. Concussed participants had a lower SNR (2.20 [2.04-2.38]) when compared to their baseline (4.54 [3.79-5.10]). When clinically recovered, participant SNR was not significantly different to their baseline (4.82 [4.13-5.18]). The baseline SNRs of the players who experienced a concussion during the season were not different to those of players who did not experience a concussion (4.80 [4.07-5.68]). **CONCLUSIONS:** This is the first study to identify differences in SSVEP responses in male amateur rugby union players with and without concussion. It is also the first SSVEP demonstration for concussion evaluation at point-of-care. SSVEPs are significantly attenuated in the presence of concussion in these male athletes. Individuals returned to their baseline SSVEP following clinical recovery from the concussive injury. The use of SSVEPs has the potential to be a supplemental aid for the assessment and management of concussion.

2834 Board #295 May 29 9:30 AM - 11:00 AM
Validity And Reliability Of The Balance Error Scoring System BESS In Deaf Neurosensory Athletes

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Purpose: People with hearing impairment have motor and vestibular deficit, which affects the function of static balance. It has been demonstrated the importance of the performance of static balance in athletes in relation to the sports performance, the presence of injuries and as part of the training for the prevention of them. The objective of this study was to determine the reliability and validity of the BESS scale in athletes with hearing impairment of neurosensory origin practicing basketball and soccer in the Bogotá league. **Materials and Method:** Validation study of a diagnostic test instrument, in which translation of the protocol into Colombian Spanish and reverse translation was performed by certified translators. The determination of content validity was carried out by means of expert consensus. The inter, intra evaluator and the test-retest reliability, by Friedman test. By means of the comparison with stabilometry the criterion validity was done. By means of the comparison with stabilometry the criteria validity was done, through the Pearson correlation coefficient. The data base was managed in Excel and the data processing was done with the software R version 3.5. Facto mine R for the process analysis of main components. **Results:** It was achieved to adapt the BESS to Colombian Spanish for soccer and basketball players, as well as its adaptation into Colombian sign language. According to the consensus of experts, the agreement percentage is 95.3 based on the criterion of coherence, relevance and sufficiency evaluated in the protocol. The intra-rater reliability showed variations in the qualification due to the subjectivity of the test administered. On the other hand, the inter-rater reliability showed p values >0.05 for the firm stance feet together, unsteady feet together and unstable one foot. The reliability test-retest reflects stability in the qualification in short periods of time with p values >0.05 for all positions and total rating of BESS. The criterion of validity showed a strong Pearson correlation coefficient with p value of 0.57 for the BESS total compared with stabilometry. **Conclusions:** The BESS is a valid static balance assessment method to be applied in the sports field for deaf professional soccer and basketball athletes. Moreover, this test is not sensitive to change in short periods.

2835 Board #296 May 29 9:30 AM - 11:00 AM
The Diagnostic And Prognostic Utility Of Dual-task Tandem Gait For Pediatric Concussion

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 (No relevant relationships reported)

Background: Tandem gait performance is part of the Sports Concussion Assessment Tool (SCAT), but its diagnostic and prognostic value has not been fully assessed in pediatric concussion. **Purpose:** To determine the diagnostic and prognostic value of single-task and dual-task tandem gait by comparing performance of subjects with concussion relative to controls, as well as subjects who developed Persistent Post Concussion Symptoms (PPCS) and those who did not (No PPCS). **Methods:** Subjects seen within 21 days of concussion and uninjured controls completed a single/dual-task tandem gait test battery and modified Balance Error Scoring System (mBESS) test. During the tandem gait test, subjects walked in a heel-toe manner along a 3m strip of fabric down and back as fast as possible. During dual-task trials, they completed a concurrent cognitive task. Outcomes included tandem gait time to completion, cognitive accuracy, and mBESS errors. Subjects with concussion were followed until symptom resolution and sub-grouped into those who developed PPCS (>28 d time to symptom resolution) vs. No PPCS. **Results:** We evaluated 29 subjects with concussion

who developed PPCS (mean age=15±2 years; 62% female; tested 12±6 days post-injury), 58 subjects with concussion who did not develop PPCS (mean age=14±3 years; 36% female; tested 8±5 days post-injury), and 58 controls (mean age= 16±1 years; 42% female). Subjects with concussion performed significantly worse than healthy controls on single-task tandem gait (24.4±12.6 vs. 14.9±3.6 s; $p<0.001$; area under curve [AUC]=0.85), dual-task tandem gait (33.3±14.9 vs. 20.6±7.1 s; $p<0.001$; AUC=0.84), dual-task cognitive accuracy (82.1±12.5 vs. 89.1±18.9 %; $p=0.01$; AUC=0.61), and mBESS (6.5±4.9 vs. 3.8±3.4 errors; $p=0.001$; AUC=0.68). The PPCS sub-group performed dual-task tandem gait significantly slower than the No PPCS group (38.8±17.7 vs. 30.6±12.7 s; $p=0.016$; odds ratio=1.04), but PPCS and No PPCS groups were not significantly different on other measures. **Conclusions:** Pediatric patients with concussion have impaired performance on balance and gait measures compared to healthy controls. Dual-task tandem gait test specifically showed diagnostic value for pediatric concussion and prognostic value in differentiating subjects who developed PPCS compared to those who did not.

2836 Board #297 May 29 9:30 AM - 11:00 AM
Clinical Predictors Of Prolonged Recovery From Sport-related Concussion: Importance Of Early Clinical Care

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Initiation of clinical care may play a critical role in promoting recovery following sport-related concussion (SRC). There has been no research on the role of time to first clinic visit on recovery following SRC in pediatric athletes. Rapid recovery may be especially important in pediatric populations, as prolonged recovery may lead to developmental challenges and/or impact schoolwork and learning capacity. **PURPOSE:** To investigate the association of time to first clinic visit (≤ 7 days compared to 8-20 days from injury) in relation to other pre- (e.g., sex; concussion, migraine history) and post-injury (e.g., symptoms, impairment) predictors to prolonged recovery (>30 days) in pediatric athletes with SRC.

METHODS: This study was a retrospective review of medical records from a concussion-specialty clinic representing 164 pediatric athletes (aged 12-17) with diagnosed SRC between April 2016-January 2019. Participants were separated into EARLY (≤ 7 days) and LATE (8-20 days) time to first clinic visit cohorts. Participants completed the Post-concussion Symptom Scale (PCSS), Immediate Post-concussion Assessment and Cognitive Testing (ImPACT), Vestibular/Ocular Motor Screening (VOMS), and demographics/medical history. Adjusted odds ratios (OR) were derived from a backwards stepwise logistic regression (LR) with normal (≤ 30 days) or prolonged (>30 days) recovery as the outcome. Time to first clinic visit, pre-injury factors, and post-injury clinical assessments were included as predictors.

RESULTS: There were no differences in age or cognitive performance between EARLY and LATE. EARLY had a higher PCSS score (29.4±19.6) than LATE (22.2±18.3; $p=0.018$). LATE had a higher proportion of females (55%) than EARLY (28%; $p<0.001$). The LR ($R^2=0.14$, $p<0.001$) identified days to first clinic visit ($OR=2.9$; $p=0.007$), as the strongest predictor of recovery >30 days. Vestibular dysfunction ($OR=1.1$; $p=0.040$) and PCSS score ($OR=1.04$; $p=0.004$) were also predictors of recovery >30 days. **CONCLUSIONS:** Among all pre- and post-injury predictors, days to first clinic visit was the most robust predictor of prolonged recovery. Vestibular dysfunction and PCSS score also predicted prolonged recovery. The findings highlight the importance of early intervention and care following SRC in pediatric populations.

2837 Board #298 May 29 9:30 AM - 11:00 AM
Association Between Post-concussion Intra-individual Variability In Sleep And Step Counts: An Exploratory Study

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Evidence supports transient increases in intraindividual variability (IIV) in sleep post-concussion, a time when physical activity may be reduced. Acute and chronic physical activity impacts sleep, including reducing wake after sleep onset (WASO) and increasing total sleep time (TST).

PURPOSE: To determine the association between IIV in sleep and physical activity in concussed individuals and matched controls one and two weeks post-injury.

METHODS: Twenty college students were physician-diagnosed with a concussion. Eleven concussed individuals with symptom duration ≥ 14 days (23.6±8.6 days) were included in this analysis to examine sleep across two full weeks post-injury.

Non-concussed controls ($n=11$) were well-matched on age, sex, physical activity, and subjective sleep quality. A wrist-worn ActiGraph monitor was provided during initial evaluation (within 72 hours post-injury for concussed) and worn continuously until symptom resolution (duration matched for non-concussed controls). Intraindividual coefficient of variations were calculated for the first week and second week post-injury for each sleep outcome: sleep onset latency (SOL), WASO, TST, sleep efficiency, and number of awakenings. Daily total step counts were also obtained from the ActiGraph monitor and averaged across each week (STEPS). Pearson correlations were conducted per group and separately during weeks 1 and 2 post-injury ($\alpha = 0.05$) to examine associations between STEPS and IVV in sleep.

RESULTS: Across week 1 post-injury, concussed individuals with a greater step count (week 1 average: 12,214±2000 steps) experienced greater IVV in WASO ($r = 0.67$, $p = 0.023$) and less IVV in TST ($r = -0.68$, $p = 0.022$). No significant associations existed in other sleep outcomes or in the matched control group across week 1. No associations were evident in either concussed or control groups for week 2.

CONCLUSIONS: Concussed individuals who were more active across week 1 post-injury experienced greater night-to-night sleep fragmentation variation but experienced a more consistent nighttime sleep duration schedule. The findings from this exploratory study warrant examining associations between sleep IVV and physical activity in a larger study of concussed and non-concussed individuals.

2838 Board #299 May 29 9:30 AM - 11:00 AM
Is Heading The Ball Dangerous In Youth Girls Who Play Soccer?

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In United States at least 1.6 million of girls under 12 years old play soccer. The participation of girls in the sport of soccer continues to increase in the United States, currently soccer is in the third position of preference among high school women.

At this age at least one in two girls will receive a subconcussive impact on the head area in any game situation. Subconcussive impacts are impacts to the head or body that cannot be diagnosed as a concussion on clinical grounds or with neuroimaging studies (MRI, CT-Scan or PET Scan). A subconcussive impact may alter different cognitive functions that could be related to learning without this being able to be identified. Accelerometers are reliable instruments for assessing the magnitude and direction of head impact live in full play. The ImPACT Pediatric® is a neurocognitive test that provide pre and post information of changes before and after receiving an impact on a game. **PURPOSE:** To identify the area of the head where girls receive the most impacts during a game and evaluate if there is any association in cognitive changes. **METHODS:** A group of 15 youth female's soccer athletes between 9 to 11 years old (9.9 ± 0.6 years) wear a head accelerometer in a specialize headband. Each participant was encouraged to perform normally in the game. Descriptive statistics was used to assess subconcussive impacts. T-test was used for the neurocognitive pre and post-test to assess differences in rapid processing. **RESULTS:** Range of acceleration was from 17 g to 36g (Ave= 21.8 ± 6.6 g). T-Test showed differences in sequential memory for female ($p = 0.02$) A total of 13 impacts were received in three games. **CONCLUSION:** The results of this research suggest that one in two girls will receive some impact on the head during the game. There is also a high probability (62%) of receiving the impact on the frontal area of the head associated with cognitive functions as attention, memory and executive functions.

2839 Board #300 May 29 9:30 AM - 11:00 AM
Abstract Withdrawn

2840 Board #301 May 29 9:30 AM - 11:00 AM
Effects Of Maximal Exercise On Vestibular/Ocular Motor Screening And Postural Control
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Multifaceted, vestibular-related assessment tools have received increased consideration in the sideline assessment of concussion. Specifically, vestibular/ocular motor screening (VOMS) and postural control are two, vestibular-related tools that are receiving attention. Since athletes are often in a state of exertion during the immediate evaluation of a concussion, it is imperative to understand the effects of exercise on these screening tools.

PURPOSE: To examine the effects of maximal exercise testing on VOMS and postural control.

METHODS: Seventeen, healthy college-aged individuals (20.7±2.3 years) completed a baseline VOMS and modified Clinical Test for Sensory Interaction and Balance

(m-CTSIB) for postural control, followed by a graded maximal exercise treadmill test. VOMS measures consisted of symptom provocation scores per item and distance (cm) for convergence. Measures of the m-CTSIB consisted of sway index scores per task. **RESULTS:** Pre- to post-exercise symptom provocation score differences did not exist on any VOMS item, specifically, smooth pursuits (0.12 vs. 0.29, $p=0.18$), saccades (horizontal: 0.18 vs. 0.29, $p=0.70$; vertical: 0.24 vs. 0.41, $p=0.70$), convergence (2.78cm vs. 3.99 cm, $p=0.27$), vestibular ocular reflex (VOR) (horizontal: 0.59 vs. 0.94, $p=0.31$; vertical: 0.41 vs. 0.65, $p=0.27$), and visual motion sensitivity (VMS) (0.47 vs. 0.94, $p=0.13$). However, m-CTSIB sway index score differences from pre- to post-exercise only existed on the eyes open-firm surface (0.43 vs. 0.57, $p<0.001$) task. No differences existed on sway index scores during eyes closed-firm surface (0.65 vs. 0.81 ($p=0.06$), eyes open-foam surface (0.68 vs. 0.74, $p=0.15$) and eyes closed-foam surface (1.80 vs. 1.96, $p=0.11$) tasks. **CONCLUSION:** Eyes open-firm surface (using somatosensory, visual, and vestibular sensory input) task of the m-CTSIB was negatively influenced by exercise. VOMS items remained consistent from pre- to post-exercise, along with eyes closed-firm surface and both foam surface conditions, further validating their utility on sideline assessment.

2841 Board #302 May 29 9:30 AM - 11:00 AM
Heart Rate Variability Analysis: Orthostatic Challenge With Heart Rate Monitor. Pilot Study For Post-concussion Monitoring

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Heart rate variability (HRV) is viewed as a measure of autonomic nervous system (ANS) function. Various approaches are available for recording heart rate, however, few studies have compared Holter type recordings vs heart rate monitors (HRM) during orthostatic challenges. **PURPOSE:** Compare HRV measures from an electrocardiogram (ECG) Holter and HRM for further investigation on ANS response usefulness for post-concussion rehabilitation follow-up. **METHODS:** Asymptomatic subjects ($n=12$; 6 females, 6 males), age 18 to 35 yrs, non-smoking, no history of cardiac illness and physically active (3 times per week, 60 mins, moderate intensity exercise) participated in the study. ECG signals were recorded in a 12 lead configuration with a Holter (Medilog FD12plus, Schiller, Sw and proprietary HRV analysis software) and simultaneously with an HRM (H10, V800, Polar, Fi and Kubios HRV analysis software). A spacious room with controlled environment was used to assess the orthostatic challenge. A motorised tilt table was set at 180 degrees for supine and 85 degrees for standing position. Participants were instructed to remain for 7 minutes in each of the following positions: supine and standing. Analysis was performed for obtaining temporal and frequency domains measurement in both positions. ANOVA analysis was used to compare measurements obtained from both systems. Pearson correlations were used for comparing same variables measured with both systems. Significance was set at $p<0.05$. Results are presented as means \pm SD were appropriate. **RESULTS:** No significant differences were observed between measurements taken with both systems under equal conditions (supine and standing). Significant differences, however, were observed between conditions (supine and standing), except for SDNN that did not show any significant differences between systems and conditions. Same variables under similar conditions were significantly correlated ($r=0.75-0.95$, $p<0.05-0.001$). **CONCLUSION:** Both recording and analysis systems (Holter vs HRM) yielded comparable results. Thus, both systems appear valid and interchangeable for HRV analysis whilst orthostatic challenge.

2842 Board #303 May 29 9:30 AM - 11:00 AM
Utility Of A Custom Accommodation Convergence Ruler For Measuring Near Point Convergence On The Voms

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The Vestibular/Ocular Motor Screening (VOMS) tool is a common assessment that was specifically designed to evaluate vestibular and/or oculomotor control deficits following sport-related concussion. The only objective component of the VOMS is near point convergence (NPC) distance. This distance is commonly measured from the tip of the nose to the instrument (typically a 14-point font "X" on a tongue depressor) which is brought towards the patient's nose. Unfortunately, without the use of an accommodation convergence ruler, it is possible that NPC may be measured incorrectly. **PURPOSE:** The purpose of this study was to investigate the use of a custom-made accommodation convergence ruler as compared to conventional methods

for measuring NPC on the VOMS in a healthy population. **METHODS:** 12 healthy collegiate female students (average age = 22 years) all with lower than 20/20 vision (corrected and not corrected) and no diagnosed concussion history participated in this study. All participants completed 3 trials of NPC using standardized instructions and 1) traditional tongue depressor with a 14-point font "X" (TRAD) and 2) a custom made NPC accommodation convergence ruler (RULER). The custom ruler was attached to a series of supports that were connected to the ground and leveled prior to each trial. The ruler is placed at the tip of the nose and participants bring a 14-point font dot on a slide toward the bridge of their nose. Between each trial and condition, participants were given 2-mins of rest as needed to reduce ocular fatigue. Each NPC distance were measured by a highly trained rater and averaged for further analysis using a paired t-test. **RESULTS:** The results indicate no significant differences between using the TRAD (average=2.79cm \pm 2.05cm) and the RULER (average=2.12cm \pm 1.64cm; $p=0.17$; Cohen's $d=0.41$). The TRAD had two measurements that were above 5cm, while the RULER measurement had only one above 5cm. **CONCLUSIONS:** Using a more sophisticated device to measure NPC may not directly influence the measurement of NPC as compared to standard conventional methods in an all-female healthy population. Although NPC distance trended lower and had fewer false negatives using the RULER, trained clinicians using standardized instructions may not need to use an accommodation convergence ruler to obtain sufficient measurements.

2843 Board #304 May 29 9:30 AM - 11:00 AM
The Relationship Of Subjective And Objective Sleep Measures In Pediatric Concussion

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 (No relevant relationships reported)

BACKGROUND: Sleep problems after concussion may impact recovery. Early research has primarily focused on subjective sleep measures; however, actigraphy data may help objectively understand sleep patterns after pediatric concussion. **PURPOSE:** To determine association between subjective and objective sleep measures among pediatric athletes with concussion. **METHODS:** Pediatric athletes evaluated within 14 days of concussion were given a wrist-worn activity tracker, to be worn full-time, including during sleep. During initial visit and follow up evaluation at clearance for return to play (RTP), athletes completed the Pittsburgh Sleep Quality Index (PSQI). PSQI measures included self-reported sleep duration, time spent in bed, and sleep quality, while activity tracker actigraphy data was used for objective sleep duration, time spent in bed and time spent in each sleep stage. **RESULTS:** A total of 12 individuals (mean age=15.0 \pm 1.8 yrs; 42% female) completed initial concussion evaluation (mean=7.4 \pm 3.3 days post-injury), and follow-up evaluation at RTP clearance (mean=21.7 \pm 18.9 days post-injury). There was no significant difference in amount of sleep recorded using self-reported (7.9 \pm 1.2 hrs) and actigraphy (7.3 \pm 0.7 hrs) measures ($p=0.10$), or for amount of time spent in bed per night (8.8 \pm 1.6 vs. 8.2 \pm 0.7 hrs; $p=0.25$). Self-reported and actigraphy measures were highly and significantly correlated for amount of sleep per night ($r=0.73$; $p=0.04$) but not for amount of time spent in bed ($r=0.59$; $p=0.12$). Participants spent an average of 12 \pm 3% awake, 20 \pm 4% in REM sleep, 51 \pm 4% in light sleep, and 17 \pm 2% in deep sleep per night. Those who reported very good sleep quality on PSQI at RTP clearance visit had significantly more time in deep sleep (17.9 \pm 1.2% vs. 16.0 \pm 0.8% of the night; $p=0.04$) and significantly less time in light sleep (48.4 \pm 1.8% vs. 52.8 \pm 2.9% of the night; $p=0.04$) than those who reported fairly good or fairly bad sleep quality. **CONCLUSIONS:** There was no difference in subjective and objective measures for sleep duration and time spent in bed. Actigraphy data was highly correlated with self-reported measures for sleep duration following concussion. Minor differences in light and deep sleep proportions were present between pediatric athletes who reported very good sleep vs fairly good/ fairly bad sleep quality.

2844 Board #305 May 29 9:30 AM - 11:00 AM
Between Trial Reliability Of The King Devick Test In Female High School Athletes

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National high-school injury-surveillance data has demonstrated the need for continued development of concussion-related safety programs. Of note, in directly-comparable sports, concussion-incidence rates are reported to be higher for female athletes. As such, medical personnel need valid-baseline assessments in order to best serve and protect athletes suspected to have a concussion. **PURPOSE:** To determine the between-trial reliability of the King-Devick Test (KD) as part of a pre-season concussion-safety program in young-female athletes. **METHODS:** Female high-school athletes ($n = 28$, aged 16 \pm 1 years) completed electronic KD baseline assessment on hand-held tablets.

Participants were required to complete two, error-free trials - reported to the nearest 0.0 s. Descriptive data for baseline attempts were computed, mean differences were examined via paired-samples one-tailed *t*-tests, Cohn's *d* effect sizes were considered, and two-way mixed-effects intraclass correlations (ICC) were analyzed. **RESULTS:** The KD test showed strong reliability between trials (Trial 1 = 52.0 ± 7.7 s; Trial 2 = 49.8 ± 8.6 s; single-measure ICC = 0.83; 95% CI 0.66 - 0.92). Furthermore, excellent reliability was observed when KD scores were grouped by Best score and Worst score (Best = 48.7 ± 7.2 s; Worst = 53.2 ± 8.6 s; single-measure ICC = 0.94; 95% CI 0.87 - 0.97). Paired-samples *t*-test identified small or moderate differences between both pairings respectively (Trail 1 vs. Trial 2, $p = 0.01$, $d = 0.27$; Best vs. Worst, $p < 0.001$, $d = 0.57$). Most participants (75%) recorded their Best score on Trial 2. **CONCLUSIONS:** Strong-to-excellent reliability was observed among trials in this population of young-female athletes. However, these data demonstrate a need for further investigations that address the potential need for multiple baseline testing sessions in order for practitioners to best serve female, high-school athletes.

E-39 Free Communication/Poster - Musculoskeletal and Ultrasound

Friday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

2845 Board #306 May 29 9:30 AM - 11:00 AM

Case Study: Shear Wave Tensiometry Detects Asymmetry In Achilles Loading During Gait After Unilateral Rupture

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Achilles tendon ruptures are debilitating injuries that lead to long-term functional deficits in two thirds of patients. Shear wave tensiometry is a non-invasive technique for measuring tendon loading during functional activities by inducing waves traveling along the tendon and measuring their propagation speed. Tensiometers have the potential to be implemented in clinical settings to objectively track tendon loading to assist in clinical decision-making. **Purpose:** To determine whether shear wave tensiometry can detect abnormalities in tendon loading during recovery following Achilles tendon rupture and repair. **Methods:** Tensiometers were placed bilaterally on the Achilles tendons of one subject who had undergone surgical repair of a unilateral Achilles tendon rupture 14 weeks prior (M, 87.6 kg, 193 cm) and two control subjects (M, 75.0 kg, 188 cm; M, 100.0 kg, 185 cm). Each subject first performed isometric ankle plantarflexion contractions while wave speed and joint torque were measured. Tendon force was estimated from torque by assuming a normative 5 cm Achilles moment arm. Isometric data were used to calibrate a linear model for predicting tendon force from wave speed squared. The subject then walked on a treadmill (patient: 1.25 m/s; controls: 1.50 m/s) while Achilles tendon wave speed was recorded bilaterally. Plantarflexor impulse was calculated by integrating predicted tendon force over each stance phase. **Results:** We estimate that the patient produced a 40% lower plantarflexor impulse on the injured side (4.8 ± 0.4 N·s·kg⁻¹; mean ± SD) compared to the healthy side (8.0 ± 1.0 N·s·kg⁻¹), while the side-to-side differences for control subjects were 5% (8.4 ± 0.4 N·s·kg⁻¹ vs. 8.0 ± 0.2 N·s·kg⁻¹) and 2% (10.7 ± 0.7 N·s·kg⁻¹ vs. 10.5 ± 1.0 N·s·kg⁻¹), respectively. **Conclusion:** Tensiometer data show that the patient adopted a gait pattern that underloaded the healing tendon. This is important to consider given that early loading exposure may be an important determinant of long-term healing and structure of the repaired tissue. This study establishes the feasibility of using shear wave tensiometry to quantify tendon load during clinical assessments of patients with tendon injuries, which is an unmet clinical need. Supported by the Thomas B. and Jeannette E. Laws McCabe Fund and the Wisconsin Alumni Research Foundation.

2846 Board #307 May 29 9:30 AM - 11:00 AM

Feasibility Of Open Low-field MRI Measurements In Adolescent Athletes With Spondylolisthesis

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Spondylolysis and spondylolisthesis are common findings in adolescent athletes (AA), potentially leading to load-dependent pain and segmental spine instability. In diagnostics, supine MRI is frequently used to visualize the lumbar spine structures. However, upright MRI procedures have been shown to be of clinical value in the detection of load-dependent changes in parameters.

PURPOSE: To determine the feasibility of upright compared to supine MRI measurements to determine characteristics of the lumbar spine in AA with spondylolisthesis. **METHODS:** Ten AA (n=10; m/f: 4/6; 14.5 ± 1.7 ; 163 ± 7 cm; 52 ± 8 kg) from various sports, diagnosed with spondylolisthesis grade I-II Meyerding confirmed by x-ray in standing lateral view, were included. Open low-field MRI images (0.25 Tesla) in upright (82°) and supine (0°) position were evaluated by two observers. Medical imaging software was used to measure the anterior translation (AT, mm), lumbosacral joint angle (LSJA, °) and lordosis angle (LA, °). Reliability was analyzed by the intra-rater correlation coefficient (ICC) and standard error of measurements (SEM). **RESULTS:** Due to motion artifacts during upright position, measures of three participants had to be excluded. Between observers, AT ranged from 4.2 ± 2.7 mm to 5.5 ± 1.9 mm (ICC=0.94, SEM=0.6mm) in upright and from 4.9 ± 2.4 mm to 5.9 ± 3.0 mm (ICC=0.89, SEM=0.9mm) in supine position. LSJA varied from $5.1 \pm 2.2^\circ$ to $7.3 \pm 1.5^\circ$ (ICC=0.54, SEM=1.5°) in upright and from $9.8 \pm 2.5^\circ$ to $10 \pm 2.4^\circ$ (ICC=0.73, SEM=1.1°) in supine position. LA differed from $58.8 \pm 14.6^\circ$ to $61.9 \pm 6^\circ$ (ICC=0.94, SEM=1.19°) in upright and from $51.9 \pm 11.7^\circ$ to $52.6 \pm 11.1^\circ$ (ICC=0.98, SEM=1.59°) in supine position. **CONCLUSIONS:** Determination of AT and LA showed good to excellent reliability in both, upright and supine position. In contrast, reliability of LSJA had only moderate to good correlation between observers and should therefore be interpreted with caution. However, motion artifacts should be taken into consideration during upright imaging procedures.

2847 Board #308 May 29 9:30 AM - 11:00 AM

Patient Adherence Impacts The Effectiveness Of Neuromuscular Electrical Stimulation Treatment After Articular Cartilage Knee Surgery

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(No relevant relationships reported)

PURPOSE: Articular cartilage patients commonly display persistent strength deficits despite extensive rehabilitation prescriptions. The purpose was to evaluate the effectiveness of a postoperative home based neuromuscular electrical stimulation (NMES) treatment on clinical outcomes. **METHODS:** Eligible patients were consented preoperatively and randomized to a 12-week postoperative home based NMES program or the standard quadriceps exercise program, both in conjunction with formal physical therapy. Patients completed patient reported outcomes (PROs)(KOOS, VAS) and isometric quadriceps strength testing (peak torque and limb symmetry index (LSI=involved peak torque/uninvolved peak torque)) preoperatively and 3-months (3m) postoperatively. The NMES group's treatment adherence was measured via an internal monitor. An RM-ANOVA was used to compare each dependent variable between baseline and 3m postoperative.

RESULTS: 25 patients (11F, 30 ± 10yrs, BMI: 28.15 ± 5.97) were enrolled. The surgical limb peak torque strength ($p < 0.00$) and the LSI ($p < 0.00$) decreased significantly, while KOOS pain statistically improved ($p = 0.02$) (Table 1). At 3m post-operative, there were no statistical differences between groups for any dependent variable (Table 1). Patients in the NMES group completed $25.49 \pm 25.32\%$ of the prescribed treatment. Comparing the 3m strength values between two moderately adherent patients (completed 50-80% of the treatment) and the control group we see a trend favoring NMES (NMES: 1.33 Nm/kg, control: 0.92 Nm/kg).

CONCLUSIONS: Overall patients experienced a decrease in quadriceps strength but an improvement in KOOS pain. While there was a trend with 3-month quadriceps strength values being higher in patients who were moderately adherent, the overall majority of the patients were not adherent. Thus, due to the lack of adherence, an NMES home treatment program may be an ineffective treatment option for articular cartilage knee surgery patients.

Table 1: Repeated measures ANOVA results for all outcome variables

	Baseline N=25	3-Months N=25	p-value
Number of Participants			
Isometric Quadriceps Strength (Nm/kg)			
Surgical	1.72±0.70	1.09±0.58	p<0.00*
Non-Surgical	2.26±0.76	2.13±0.55	p=0.18
LSI (%)	76.44±18.78	49.56±17.05	p=0.00*
VAS Pain Scale	47.57±27.08	41.24±31.06	p=0.40
KOOS Questionnaire			
Symptoms	53.57±18.76	59.78±19.48	p=0.15
Pain	64.83±20.12	73.00±19.28	p=0.02*
Activities of Daily Living	74.05±21.96	80.41±20.59	p=0.11
Sport and Recreation	36.36±30.79	32.05±29.69	p=0.48
Knee Related Quality of Life	32.77±17.51	36.78±18.12	p=0.22
	NMES N=13	Control N=12	p-value
Number of Participants			
Isometric Quadriceps Strength (Nm/kg)			
Non-Surgical	2.14±0.51	2.13±0.61	p=0.97
Surgical	1.18±0.69	1.00±0.44	p=0.44
LSI (%)	52.84±19.38	46.01±14.07	p=0.33
VAS Pain Scale	44.25±32.66	37.22±30.23	p=0.67
KOOS Questionnaire			
Symptoms	57.67±21.31	62.09±17.99	p=0.50
Pain	72.17±21.93	73.91±16.93	p=0.73
Activities of Daily Living	79.83±22.89	81.10±18.66	p=0.83
Sport and Recreation	31.37±28.71	32.50±32.17	p=0.80
Quality of Life	33.92±17.61	39.91±18.98	p=0.41

Values presented as means and standard deviations. P values presented are for time effect; *denotes significant differences between baseline and 3 months.

2848 Board #309 May 29 9:30 AM - 11:00 AM The Relationship Between Isokinetic Hamstring To Quadriceps Strength Ratio And A Battery Of Exercise Field Tests In Healthy Women

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Knee injuries are one of the most common ball sport related injuries and cause hundreds of millions of dollars in rehabilitation costs annually. Girls and women are 4-9 times more likely to experience a knee injury compared to boys and men, and typically suffer more severe knee injuries. Strength imbalance of the hamstrings and quadriceps muscles during complex sport movements and/or as a result of fatigue may contribute to knee injury occurrence. **PURPOSE:** This study attempted to predict the ratio of isokinetic muscular strength of the hamstring and quadriceps muscles from a battery of exercise field tests both before and after fatigue. **METHODS:** Women (n = 29) were recruited from the University of Windsor and completed an exercise field testing protocol consisting of a 20m forward sprint, 20m backward sprint, 5-10-5 agility test, single leg hop for distance, side hop, vertical jump, and eccentric Nordic hamstring curl (NHC), as well as an isokinetic dynamometer protocol to obtain muscle peak torques (PT) and hamstring to quadriceps PT ratios (HQR), before and after a 45 minute simulated exercise protocol. **RESULTS:** PT ($F(1,228) = 27.678, p=0.00$) and HQR ($F(1,871,321.889) = 15.689, p=0.00$) decreased following the exercise protocol. Further, the battery of field tests were able to predict $HQR_{con/con}$ at 60° in the non-dominant limb ($F(3,24) = 4.42, R^2 = 0.622, p = 0.015$), with a combination of the speed tests (ST), jump tests (JT) and NHC in the final model, but not changes that occurred because of the exercise protocol. **CONCLUSION:** HQR may predict knee injury risk, and consequently, the field tests employed in the current study could be used by strength and conditioning specialists to assess risk without the need for more expensive equipment. However, HQR should be reassessed as a method for knee injury prediction with respect to more functional models, at specific joint angles, and in relation to fatigue. Further, future studies should employ additional field tests that may strengthen the association with risk.

2849 Board #310 May 29 9:30 AM - 11:00 AM Training Dose And Effect- Response Relationship Of Motor Control Stabilization Exercises On Pain And Disability In Chronic Non-specific Low Back Pain Patients: A Systematic Review With Meta-regression

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(No relevant relationships reported)

Motor control stabilization exercise (MCSE) is evident for the management of chronic non-specific low back pain (LBP). The optimal dose for the maximal treatment success-response relationship is, thus, still unknown.

PURPOSE: To systematically review the evidence for a dose-response relationship of MCSE on pain and disability in chronic non-specific LBP patients.

METHODS: A systematic review with meta-regression was conducted. We searched in relevant scientific databases (Pubmed (Medline), Web of Knowledge, Cochrane). The eligibility criteria for the studies were: RCTs and CTs on chronic (≥ 12 weeks) non-specific LBP patients, written either in English or German and adopting a longitudinal MCSE intervention with at least one pain intensity and/or disability

outcome assessment. Meta-regressions (dependent variable = effect sizes (Cohens d) of the interventions (once for pain and once for disability), independent variable = training characteristics (duration, frequency, time per session)) were conducted to reveal the optimal dose required for MCSE therapy success.

RESULTS: From the 3,415 studies initially selected, 46 studies on n = 2,661 LBP patients were included in the analysis. N = 1,220 patients received MCSE; the training duration was 6.4 ± 2.3 weeks and the training frequency was 3.4 ± 2.0 sessions per week with a mean training time per session of 44.2 ± 17.7 min. The meta-regressions' mean effect size was $d = 1.7$ for pain and 2.1, for disability, respectively. Total R^2 was 0.34 and 0.38. Moderate quality evidence ($R^2 = 0.136$) revealed that a training duration of 20 to 30 minutes elicited the largest effect (both in pain and disability, logarithmic association). Low quality evidence ($R^2 = 0.202$) revealed that training 3 to 5 times per week led to the largest effect of MCSE in chronic non-specific LBP patients (inverted U-shaped association). Training duration showed no systematic variance explanation on the effect sizes.

CONCLUSIONS: In non-specific chronic LBP patients, MCSE with a training frequency of 3 to 5 times per week (Grade C recommendation) and a training time per session of 20 to 30 minutes (Grade A recommendation) elicited the largest effect on pain and disability. Future work may focus on the definition of a minimum dosage for therapy success.

2850 Board #311 May 29 9:30 AM - 11:00 AM Comparison Of Quadriceps Thickness And Strength, And Knee Function Between Individuals With Acl Reconstruction And Healthy Individuals

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(No relevant relationships reported)

PURPOSE: To compare quadriceps thickness and strength, and self-reported knee function between individuals with ACL reconstruction (ACLR) and healthy individuals **METHODS:** 24 individuals who returned to sport after ACLR and 18 healthy individuals were included in this study. The ACLR group were divided into 2 groups according to time after surgery: <2 years after surgery (n=12) and >5 years after surgery (n=11). Vastus medialis obliquus (VMO), vastus medialis (VM), rectus femoris (RF) and vastus lateralis (VL) muscle thickness were measured by ultrasound. Quadriceps peak torque at 60°/s and 180°/s were measured by isokinetic system, IKDC and KOOS scores were used to evaluate self-reported knee function. One way ANOVA was performed for statistical analysis

RESULTS: VMO and VM muscle thickness were different between groups ($p=0.01, p=0.003$). ACLR group whose time after surgery <2 years had thicker VMO and VM compared to ACLR group whose time after surgery >5 years ($p=0.02$) and healthy group ($p=0.02$). There was no difference between groups in RF and VL muscle thickness ($p>0.05$). Quadriceps strength was also greater in ACLR group whose time after surgery <2 years at 60°/s ($p=0.005$) and 180°/s ($p<0.001$). IKDC and KOOS scores were greater in healthy group and ACLR group whose time after surgery <2 years compared to ACLR group >5 years after surgery ($p<0.05$).

CONCLUSIONS: Time after surgery seems to affect quadriceps size and function, and self-reported knee function in individuals with ACLR. Better outcomes in ACLR groups whose time to surgery lower than 2 years may be due to post-operative rehabilitation effect. Decrease in self-reported knee function in long term after ACLR may not related to quadriceps muscle size and strength.

2851 Board #312 May 29 9:30 AM - 11:00 AM ACL Tears Aren't Just For Girls: The Role Of Age In Predicting Pediatric ACL Injury

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(No relevant relationships reported)

Purpose: While it is well-documented that females have a higher risk of anterior cruciate ligament (ACL) injuries than males, the role of age in mediating this injury risk has not been explored. The purpose of this study was to characterize the relationship between age and sex in predicting ACL injury in the pediatric population. The primary hypothesis was that prepubescent males are more likely to sustain an ACL injury than prepubescent females.

Methods: Data were collected from The Statewide Planning and Research Cooperative System (SPARCS) database for the state of New York from 1996-2016. The database was queried for patients ≤ 19 years who had been diagnosed with an ACL tear using the ICD-9 code 844.2 or the ICD-10 codes S83.512A/ S83.511A/ S83.519A. Patient age and sex at time of diagnosis with ACL injury were recorded. Chi square analysis was used to compare the frequency of ACL injury for the categorical variables age and sex, with statistical significance set at $p<0.05$.

Results: During the study period, 20,128 patients aged ≤ 19 years old were diagnosed with an ACL tear (10,830 males, 9,298 females, male:female = 1.2:1).

129 patients <12 years sustained an ACL tear (85 males, 44 females, male:female = 1.9:1), while 19,999 patients aged 12-19 years sustained an ACL tear (10,745 males, 9,254 females, male:female = 1.2:1). Chi-square analysis demonstrated a significant relationship between sex and age group ($p < 0.006$). Additional analysis revealed that females were most at risk for ACL injury from ages 12-16 years, with 2135 males and 2994 females sustaining ACL injuries in this group, (male:female = 1:1.4, $p < 0.005$). Conclusion: The results of this study confirm the hypothesis that prepubescent males (those <12 years) are more likely to sustain an ACL injury than same-aged female peers. While a patient's sex plays an important role in determining risk for ACL injury – in addition to other factors such as sport played and previous injury history – the relative risk changes throughout the pediatric and adolescent years, with males being more likely to sustain an ACL injury in the prepubertal period while females are more likely to sustain ACL injury in the pubertal period. Understanding this allows us to better individualize screening and prevention programs for ACL injury in pediatric athletes.

2852 Board #313 May 29 9:30 AM - 11:00 AM
The Relation Between Hamstring:Quadriceps Ratio And Knee Functional Performance During Hopping Tasks

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A hamstring to quadriceps strength ratio (H:Q) $\geq 60\%$ and limb symmetry index (LSI) $\geq 90\%$ during unilateral assessments of strength and function have been used as return to play (RTP) benchmarks following anterior cruciate ligament reconstruction (ACLR). PURPOSE: Determine the relation between H:Q and single (SH), triple (TH), triple cross-over (CH), and 6 m timed (6H) hopping assessment performance (e.g. distance achieved or time to complete). METHODS: Sixty-four ACLR patients (34 males: 20.92 \pm 7.93 y, 1.83 \pm .09 m, 88.34 \pm 17.36 kg; 30 females: 17.63 \pm 2.84 y, 1.67 \pm .07 m, 63.32 \pm 7.25 kg) 26.01 \pm 9.57 wks post-surgery volunteered to participate. Participants completed maximal voluntary isokinetic knee extension and flexion strength testing on the injured leg (IL) and non-injured leg (NIL) through a range of 20° to 90° of knee flexion at 60°·s⁻¹, 180°·s⁻¹, and 300°·s⁻¹. Participants were stratified into groups based on whether they obtained $\geq 60\%$ H:Q (PASS) or $< 60\%$ H:Q (FAIL) for each speed. Three trials of each hop test were performed on IL and NIL. The mean hop performance on each leg per test was normalized to participant height. Pearson correlations were used to explore the relation between hopping performance and H:Q. T-tests were used to assess for the effect of group on hopping performance. Significance was set at $p < 0.05$ RESULTS: Males demonstrated negative correlations for IL between SH and H:Q at 300°·s⁻¹ ($r = -.49$ [-.71 -.18], $p = .003$), TH and H:Q at 60°·s⁻¹ ($r = -.80$ [-.80 to -.38], $p < .001$), and TH and H:Q at 180°·s⁻¹ ($r = -.63$ [-.76, -.27], $p < .001$). Males also demonstrated negative correlations for NIL between TH and H:Q at 60°·s⁻¹ ($r = -.41$ [-.65 to -.08], $p = .018$) and 180°·s⁻¹ ($r = -.42$ [-.64, -.05], $p = .027$). No significant correlations between H:Q and hopping performance were identified in females. At 300°·s⁻¹, FAIL males had greater normalized SH scores for both IL (.78 \pm .18 vs. .89 \pm .15; $p = .04$) and NIL (.82 \pm .15 vs. .91 \pm .14; $p = .06$). CONCLUSION: These results suggest a negative relation between H:Q and functional performance post-ACLR. H:Q $< 60\%$ may indicate superior quadriceps strength which leads to a greater internal knee extension moment capacity and improved hopping performance. However, achieving an H:Q above an acceptable threshold may be protective and aid in knee joint translation stability.

2853 Board #314 May 29 9:30 AM - 11:00 AM
Influence Of Gender, Body Mass Index, And Foot Length On Foot Strength

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PURPOSE: Foot and ankle musculature provide dynamic support during athletic activities. Impaired foot strength may impact balance, re-injury, and alter foot function. Accurate measurement of foot strength is needed to better determine if impaired strength impacts pain, function, and rehabilitation. Foot strength measurements, though, may be influenced by factors such as gender, body mass, or foot structure. Additionally, foot strength measures have been observed to be different in sitting versus standing. The purpose of this study was to determine if there is a difference in foot strength measured in sitting and standing between males and females, and if there is a relationship between foot strength and body mass index (BMI) or foot length. METHODS: Twenty four participants (Mean Age = 25 years; Mean BMI = 24.9), including 12 males and 12 females, completed the study. After consenting, participants completed a questionnaire about activity level and injury history. Participants' height, weight, and foot length were measured. In both the sitting and standing positions,

participants pulled on a towel with their toes as a dynamometer measured maximum force for each foot. Three trials were measured for each foot in each position, and the mean of the three trials used in data analysis. Order of testing was randomized. Paired t-tests and effect sizes (Cohen's d) were used to examine differences between gender and across conditions. Correlations were used to assess the influence of BMI and foot length on foot strength for both conditions.

RESULTS: In comparison to females, male foot strength was greater in both sitting and standing (both $d = .5$), but only statistically different in sitting ($p < 0.05$). Foot length was significantly correlated to strength (left: $p < 0.01$; right $p < 0.05$) in sitting, but not in standing. Body mass index was not significantly correlated to strength.

CONCLUSIONS: Gender and foot length influence strength measurements conducted in a sitting position. Body mass index does not influence foot strength measurements in sitting or standing. Further investigation about differences in foot strength measured in sitting versus standing is needed.

2854 Board #315 May 29 9:30 AM - 11:00 AM
Cross-education Effects On Rotator Cuff Strength Recovery After Bankart Repair

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Enhancing the rotator cuff (RC) strength is the primary goal of the rehabilitation after Bankart repair. Cross-education (CE) could be a promising treatment where the strengthening of the injured limb could not be possible or may be detrimental. However, there is no information about CE effect on RC strength recovery after Bankart repair.

PURPOSE: The aim of this study was to investigate effects of CE on RC muscle strength recovery in patients with Bankart repair.

METHODS: Eighteen patients with Bankart repair included to the study. Patients were randomly allocated into two groups. Patients in Group-1 (n=8, age: 21.7 \pm 3.2 years, body mass index: 25.4 \pm 2.2 kg/m²) received a standard 12-week-rehabilitation program after the surgery. Patients in Group-2 (n=10, age: 24.4 \pm 5.4 years, body mass index: 25.6 \pm 4.2 kg/m²) received the same rehabilitation program but also attended RC concentric strengthening program of the non-operated side with isokinetic dynamometer twice in a week between post-operative 2-12 weeks. The concentric isokinetic training was conducted on the scapular plane and at 45° of shoulder abduction. The training consisted of 3 sets of 10 repetitions for internal and external rotators and performed at 60°/sec angular velocity. On both groups, the concentric internal and external rotator (IR and ER) strength was measured pre-operatively and at post-operative 12 and 24 weeks. The measurements were conducted on the scapular plane using at 60°/sec and 180°/sec angular velocities on both shoulders. Repeated measures of ANOVA was used for statistical analysis.

RESULTS: The main effect of time was significant on patients with Bankart repair. Compared to pre-operative time the RC strength decreased at post-operative 12 weeks and recovered at post-operative 24 weeks ($p < 0.05$). There were no group by time interaction ($p > 0.05$).

CONCLUSIONS: The results of this study demonstrated that standard Bankart rehabilitation improved rotator cuff strength recovery but adding cross-education had no beneficial effect on recovery after Bankart repair.

2855 Board #316 May 29 9:30 AM - 11:00 AM
Impact Of Fifa 11+ Program On Acl Injury Rates In Collegian Female Rugby Players

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This is a preliminary study on the impact of a FIFA 11+ training program for collegiate female rugby players at a local college. The FIFA 11+ was developed to prevent lower extremity injuries among soccer athletes. Retrospective analysis of injured Rugby athletes suggested the non-contact (NC) ACL injuries were similar to soccer related NC ACL injuries. Given the success the FIFA 11+ program on injury reduction, it was suggested as an intervention. PURPOSE: The purpose is to investigate the effects of the FIFA 11+ program on reducing NC ACL injuries in collegiate female athletes. METHODS: Historical injury data was obtained. FIFA 11+ training program was implemented at the start of the season and continued as part of the pre-practice/game warm up. Injury data was logged throughout the rugby season of approximately 25 weeks between September and May. A comparison was made between 2016 season's injuries to the 2017 and 2018 years. RESULTS: In the 2016 season prior to intervention, 9 athletes were injured/unable to participate because of rugby related musculoskeletal injuries with 3 NC ACL injuries. In the two seasons that the FIFA 11+ program was

implemented, 2017 and 2018, NC ACL injuries were reduced to 0. In the 2017 season, 9 athletes were injured specifically, 3 concussions, 1 (Contact) ACL injury, and 5 other injuries. In 2018, ACL injuries were reduced to 0, while concussions (5) and fractures (3), and other injuries limited participation. Twice a week, 2-hour practice sessions and games were included to estimate a team NC ACL injury rate per activity hour ratio. In 2016 the ratio was 3/3000 hrs. There were no NC ACL injuries in both 2017 (0/3472 hrs) and 2018 (0/3900 hrs) together equal 0/7372 hrs. If the injury rate from 2016 were maintained, NC ACL injuries would be predicted to be >7. **Conclusions:** This preliminary study suggests the FIFA 11+ may have broader application to other field sports and that specific training programs may reduce the incident of ACL injuries in Rugby athletes.

Yr / Players	Games (estimated 2 hrs/game)	Weeks of participation	Typical Practice Hrs per week	Estimated Total Team participation hrs	NC ACL/ hrs
2016 / 25	10	25	4	3000	3/3000
2017 / 28	12	25	4	3472	0/3472
2018 / 30	13	26	4	3900	0/3900

2856 Board #317 May 29 9:30 AM - 11:00 AM

Does Immobilization Period Affects The Functional Outcomes After Bankart Repair?

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There is no consensus about the absolute immobilization time period and whether the rehabilitation should start in the first or in the third week after Bankart Repair.

PURPOSE: The aim of this study was to compare the clinical outcomes of 1 and 3 weeks of absolute immobilization time after the surgery and evaluate their effects on recurrent instability. **METHOD:** Forty-two patients with arthroscopic Bankart surgery were included to the study. Patients were randomly allocated into two groups. One week of absolute immobilization was performed to the patients in group-1 (n=21, age:24.7±7.1, BMI: 25.3±3 kg/cm²) and 3 weeks of absolute immobilization was performed to the patients in group-2 (n=21, age: 22.1±6.7 years, BMI: 24.8±2.8 kg/cm²). All of the patients come to the clinic once in a week and performed supervised exercise program and the rehabilitation program was progressed. They were also prescribed home exercise program. Shoulder ROM, pain level and shoulder function were assessed, according their groups at the first or third weeks, 4, 8 and 12 weeks of post-operative period. The pain level during resting, activity and at night was assessed with VAS. Shoulder ROM was assessed with standard goniometer and shoulder function was assessed using ASES questionnaire. At the average of 30. weeks after the surgery, it was questioned whether there was a re-dislocation. The demographics of the patients on both groups were analyzed with student t test. Two-way repeated measures ANOVA was used for the statistical analyses. **RESULTS:** There were no significant the "Group*time" interactions for pain at rest and activity and flexion, abduction, external rotation, internal rotation angles (p>0.05). The main effect of time was significant at rest and activity pain and all ROM measurements (p<0.05). There was a significant "Group*Time" interaction for pain at night (p<0.05). Pain at night was higher in the group-1 at post-operative 1 and 4. weeks compared to group-2. There were no statistically significant differences between the two groups in shoulder function at post-operative 12 weeks (p>0.05) and 30 weeks (p>0.05). One patient had re-dislocation in the group-2. **CONCLUSION:** One or three weeks of absolute post-operative immobilization period does not differ in terms of functional outcomes on patients with Bankart repair.

2857 Board #318 May 29 9:30 AM - 11:00 AM

Abstract Withdrawn

2858 Board #319 May 29 9:30 AM - 11:00 AM

Correlation Of Fms, Ybt With The Sports Injuries Of Elite Fencing Athletes

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Objective: To analyze the correlation between Functional Movement Screen(FMS), Y-Balance Test(YBT) and the Sports Injuries of different sword-type elite fencing athletes during the 2018-2019 World Cup season.

Methods: During the 2018-2019 fencing World Cup, recruited three groups of elite fencing athletes. Epee group (age:22.50±6.50years, 8males and 10 females), Foil group (age:21.00±9.20 years, 8 females) and Sabre group (age: 20.56± 5.08years, 9 males and 10 females), a total of 45 Chinese elite fencing athletes. Before the World Cup season, FMS (six movements), double upper quarter(UQ) limbs' YBT (Anterior, A; Posteromedial, PM; Posterolateral, PL) and double upper quarter(UQ) limbs' YBT(A, PM, PL) were tested to assess the movement function. After the World Cup season, athletes were classified as having sports injuries during the season in 6 levels (mild to severe trauma) according to the Abbreviated Injury Scale(AIS) Scores: Spearman's correlation analysis methods were used to analysis the relationship of FMS score, UQYBT, LQYBT with the different sword species.

Results: We found FMS score, YBT were related to the sports injuries indifferent types of fencing athletes: (1)FMS score: ①Epee group: FMS(14.89±7.0)and AIS's correlation coefficients(r=-0.223, P<0.05); ②Foil group's FMS(15.71±13.24) and AIS's correlation coefficients(r=-0.436, P<0.05); ③Sabre group's FMS(15.67±6.82) and AIS's correlation coefficients(r=-0.352, P<0.05) . the higher the FMS score, the lower the injury risk. (2) UQ-YBT: Epee group's (A=89.09±30.54) and AIS's correlation coefficients(r=-0.926, P<0.05). The higher the YBT's relative anterior distance, the lower injury risk. Epee group (P<0.05). (3)LQ-YBT: Epee group's (A=66.32±33.96) and AIS's correlation coefficients(r=-0.672, P<0.05); Sabre group's LQ-YBT(A=62.65±26.49) and AIS's correlation coefficients(r=-0.543, P<0.05); The higher the YBT's relative anterior distance, the lower of injury risk (P<0.05).

Conclusion: For elite fencing athletes, FMS score is highly related with the sports injury; YBT's was only related to of the Epee group and the Sabre group, and was not significantly related to the flower sword group; Future randomized, controlled studies are needed to confirm these findings.

2859 Board #320 May 29 9:30 AM - 11:00 AM

Knee Strength Recovery And Factors Affecting Knee Strength After Anterior Cruciate Ligament Reconstruction

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PURPOSE: To evaluate the recovery of knee extension and flexion strength after anterior cruciate ligament reconstruction (ACLR) and to identify the factors affecting knee strength at 6 months after ACLR. **METHODS:** Thirty-seven patients [31 male, 6 female; age: 22.8±8.0 years, body mass index (BMI): 22.4±4.1 kg/m²] who underwent ACLR with hamstring tendon autograft were included in this study. The patients attended a standardized rehabilitation program after surgery. Isokinetic concentric strength of the quadriceps and hamstring muscles at 60°/s were performed pre-operatively and at 3, and 6 months post-operatively. The quadriceps strength index (QSI) and hamstring strength index (HSI) were calculated by normalizing the peak torque of the involved leg with the uninvolved leg. Repeated-measures ANOVA was used to evaluate strength changes over time. The multiple linear regression analysis was used to identify independent predictors (age, BMI, preoperative knee muscle strength) of QSI and HSI at 6 months after surgery. **RESULTS:** For the QSI, significant differences were identified among the time points ($F(2,44)=9.72, p<0.001$). Quadriceps strength was greater at 6 months when compared with pre-operatively and (p<0.001) and at 3 months post-operatively (p<0.001). For the HSI, significant differences were identified among the time points ($F(2,44)=4.27, p=0.03$). Hamstring muscle strength was significantly lower at 3 months post-operatively when compared with pre-operatively (p<0.001) and it was greater at 6 months when compared with 3 months post-operatively (p<0.001). At 6 months after ACLR, 40.5% of participants demonstrated greater than 90% for QSI, 48.6% demonstrated greater than 90% for HSI. The multiple linear regression analysis showed that the age and BMI were associated with the QSI (p<0.001, $R^2=0.47$) but not associated with HSI at 6 months after surgery. **CONCLUSION:** This study showed that there was a gradual increase in quadriceps strength from preoperative to 6 months after ACLR. However, hamstring strength decreased at 3 months post-operatively and reached preoperative level at 6

months after ACLR. The most important finding of this study was that younger age and lower body mass index were related with better quadriceps strength at 6 months after surgery.

2860 Board #321 May 29 9:30 AM - 11:00 AM

Sex Differences In Patient Reported Outcomes 6 Months Following Acl Reconstruction

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(No relevant relationships reported)

Evidence indicating the important role psychological factors contribute to patient reported outcome (PROs) post anterior cruciate ligament reconstruction (ACLR) has been growing over the last decade. However, it is unclear whether sex-specific differences in psychological profile exist in ACLR recovery. Determining the potential psychological differences between sexes has important implications on the development of targeted intervention strategies post ACLR. **PURPOSE:** To determine whether sex differences in PROs exist at six months following ACLR.

METHODS: Forty-one subjects (23 F, BMI 24.0 ± 3.5 , Age 19.2 ± 5.9 , Tegner 8.8 ± 1.2) six months post ACLR completed PRO questionnaires. Subjects were administered the ACL-Return to Sport after Injury Scale (ACL-RSI), the Knee Self-Efficacy Scale (K-SES), and the Psychological Readiness to Return to Sport Scale (I-PRRS). Independent samples t-tests were used to compare PRO responses between males and females.

RESULTS: No significant differences were observed between male and female demographic information ($p > 0.05$). Significant differences were observed between male and female responses. Males reported higher scores on the ACL-RSI (M: 7.63 ± 1.43 , F: 5.46 ± 2.17 ; $p = 0.004$, Cohen's $d = 1.21$), K-SES8 (M: 8.88 ± 0.85 , F: 7.53 ± 2.11 ; $p = 0.001$, Cohen's $d = 0.88$), and I-PRRS (M: 51.58 ± 6.22 , F: 36.17 ± 13.37 ; $p < 0.001$, Cohen's $d = 1.54$) when compared to females.

CONCLUSIONS: These results show that, six months following ACLR, males have significantly higher knee-function self-efficacy, as assessed by K-SES, I-PRRS and ACL-RSI responses show that males are more psychologically ready to resume sports participation. These results show a discrepancy between male and female psychological response following ACLR, which should be a consideration for re-injury risk. While most patients are cleared to return to activity six to nine months post ACLR, there is a lack of consideration for patient's psychological readiness at the time, for both sexes. If females are returning to sports before being psychologically ready, they are likely to be hesitant and less confident in game situations, contributing to injury risk. Future work is needed to determine if psychologically-focused rehabilitation programs are needed to potentially reverse the reported sex differences.

2861 Board #322 May 29 9:30 AM - 11:00 AM

Standardized PRP Preparation And Associated Outcomes For Knee Oa

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Reported Relationships: M. baria: Other (please describe); Educational grant received from Arthrex for research.

PURPOSE: To describe a standard preparation method and clinical outcomes using the Angel concentration system (Arthrex; Naples, FL) for knee OA and develop a regression model to determine which clinical variables influence outcome.

METHODS: A review of the medical record was performed on 134 cases of patients who underwent PRP injections for knee OA. Ninety knees (65 patients) were included. All patients had blood processed at 0% hematocrit using the concentration system. International knee documentation committee (IKDC) subjective scores completed at baseline and 3 months were collected and analyzed.

RESULTS: Overall, IKDC score improved from 42.3 ± 14.1 pre-injection to 59.7 ± 17.5 at 3 months post-injection ($p < 0.001$). Of the 90 knees injected, 57% met criteria for a positive response at 3 months with an average final IKDC score of 66.5 ± 15.0 ($\Delta 24.7 \pm 10.9$). Increased patient age ($p = 0.008$) and body mass index ($p = 0.008$) were associated with lower three month IKDC scores. **CONCLUSIONS:** A single PRP injection created at the 0% hematocrit setting yielded a positive response exceeding the minimum clinically important difference in 57% patients with knee OA. Increased patient age and BMI are associated with lower patient-reported outcomes at three month post-injection.

2862 Board #323 May 29 9:30 AM - 11:00 AM

The Use Of Ultrasound Imaging In Assessing Ucl Width For Asymptomatic College Female Golfers

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Injuries of the ulnar collateral ligament (UCL) are a common pathology and have been well documented for overhead athletes. However, little research has focused on the UCL in competitive golfers, though medial elbow injuries are commonly reported. Ultrasound imaging is becoming a common diagnostic tool to diagnose UCL pathology. In addition, USI protocols have been able to reliably identify the width of the UCL at the mid substance and apex of the trochlea. **PURPOSE:** The purpose of this pilot study was to examine if differences in UCL width at the mid substance and apex of trochlea existed between the trailing and lead arm of asymptomatic golfers.

METHODS: Seven asymptomatic NCAA Division I collegiate female golfers (age 19.4 ± 1.4 yrs) participated in this study. Ultrasound images were obtained of the UCL on the participant's trailing and lead arms using a GE LOGIQ e ultrasound unit. Participants were placed supine with elbow position at 30 degrees, with a wedge placed underneath the humerus creating a gravity induced valgus force on the UCL. Ultrasound imaging measurements to evaluate the UCL at two points were performed from the apex of the trochlea to the apex of the ulna. A paired t-test was performed to evaluate differences in UCL width measurements.

RESULTS: The mean width of the UCL at mid-substance was .297cm (SD .047) in the trailing arm (mean width .297cm, SD .047) and .234cm (SD .033) in the lead arm. The mean width at the apex of the trochlea was .129cm (SD .022) and .114cm (SD .016), respectively. There was a significant difference between the UCL measurements at the mid-substance between the leading and the trailing arm (mean difference .062 cm, $t = 5.680$, $p = .036$), but the difference at the trochlea was not statistically significant.

CONCLUSIONS: The results of this pilot study indicate that the trailing arm's UCL has a larger width when comparing trailing arm with leading arm, potentially due to the increased valgus forces on the trailing elbow versus the leading elbow. These changes may be associated with structural adaptations or pathologies related to this increased load. However, it was beyond the scope of this study to identify the potential sources of the differences in width of the UCL at the mid-substance. Further research is thus recommended using larger sample size, extended study period and symptomatic populations.

2863 Board #324 May 29 9:30 AM - 11:00 AM

Musculoskeletal Injuries In Charity Team Marathoners Training For The Boston Marathon

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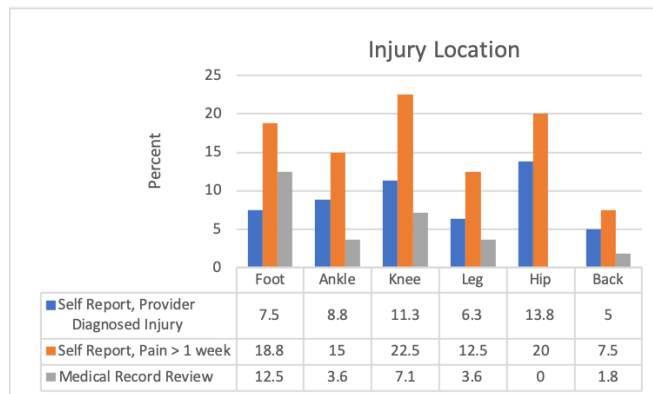
(No relevant relationships reported)

Purpose: There is a gap in the sports medicine literature about injury types and rates in runners training for a marathon with a charity team. Our objectives were to: 1. Determine the types of injuries among members of a charity marathon team, and 2. Estimate the rates of injuries in this group.

Methods: This is a survey study with a secondary medical record review of the 2019 Stepping Strong charity marathon team at Brigham and Women's Hospital, Boston, MA (140 runners). Measures were: 1. Self-report baseline questionnaire, and 2. Symptom and function inventory questionnaires completed during the training cycle and after the Boston Marathon. We generated descriptive statistics and determined injury types and rates from these measures.

Results: Participants had a mean of 10.2 (SD 8.8) years of running experience, and most commonly averaged 10 to 19.9 miles per week (41.8%). The mean number of previous marathons trained for and completed was 5 (SD 10.3), and 94.9% raised \$7,500.00 or more. 26.3% of runners reported a medical-provider diagnosed injury, 43.8% reported an injury not diagnosed by a medical provider lasting more than 1 week, 40% reported pain due to running lasting more than 1 week, and 53.8% reported pain due to running of any duration. Injury locations are displayed in **Figure 1**. More than 50% of runners reported pain that interfered with their ability to run their usual distance at their usual pace, and approximately 25% of runners reported pain that interfered with their ability to walk. 76% of respondents to the post-race questionnaire reported they developed pain at some point during the marathon training cycle, and 88% of respondents indicated they would run a marathon again.

Conclusions: Less stringent injury definitions resulted in greater percentages of participants reporting injuries. The knee, foot and hip were common injury sites. Though most participants developed pain during the marathon training cycle, almost all indicated they would run a marathon again.



2864 Board #325 May 29 9:30 AM - 11:00 AM
Sex Differences In Quadriceps Strength And Rate Of Torque Development 6 Months Post ACL Reconstruction

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(No relevant relationships reported)

Quadriceps weakness is ubiquitous post anterior cruciate ligament reconstruction (ACLR) and is strongly associated with adverse long-term patient outcomes. To date, research is equivocal in healthy subjects that males are stronger than females. However, there has been little work defining sex differences in quadriceps strength post ACLR. Identifying sex differences in quadriceps strength may allow for targeted rehabilitation strategies.

PURPOSE: To determine whether sex differences in quadriceps strength and rate of torque development (RTD) exist in subjects 6 months after ACLR.

METHODS: Seventy-five subjects (43 M, age 19.5 ± 6.0 , Tegner 8.2 ± 1.7) 6 months after an ACLR performed maximum voluntary isometric contractions (MVIC) of the quadriceps. Subjects were positioned on a Biodex System 4 per previously reported literature. The average of four MVIC trials were normalized to the subjects' body weight. Sex differences in quadriceps strength and RTD in injured and uninjured limbs were compared using analysis of covariance, controlling for age.

RESULTS: The males were older ($M = 22.6 \pm 6.7$ years, $F = 16.8 \pm 3.4$ years, $p < 0.01$) and heavier ($M = 79.1 \pm 12.5$ Kg, $F = 66.4 \pm 18.6$ Kg, $p < 0.01$) than females. Despite controlling for age and body weight, males displayed higher peak quadriceps strength in the injured limb ($M = 2.1 \pm 0.6$ Nm/Kg, $F = 1.7 \pm 0.6$ Nm/Kg, $p = 0.02$, Cohen's $d = 0.63$) and uninjured limb ($M = 3.2 \pm 0.8$ Nm/kg, $F = 2.6 \pm 0.6$ Nm/kg, $p \leq 0.01$, Cohen's $d = 0.76$). There were no significant sex differences in the injured limb's RTD ($M = 5.5 \pm 2.1$ Nm/Kg, $F = 5.0 \pm 2.4$ Nm/Kg, $p = 0.65$, Cohen's $d = 0.22$) but males displayed higher RTD in the uninjured limb ($M = 10.4 \pm 3.8$ Nm/Kg, $F = 8.1 \pm 3.5$ Nm/Kg, $p = 0.025$, Cohen's $d = 0.59$).

CONCLUSION: Six months post ACLR, males had greater peak quadriceps strength bilaterally and increased RTD in the uninjured limb compared to females with moderate to large effect sizes. However, there was no significant sex difference in RTD on the injured limb. These data suggest that females may need continued progressive resistance strength training while males may be ready to progress power-based quadriceps training strategies 6 months post ACLR. Addressing the disparity in recovery of muscle strength may reduce long-term impairments associated with osteoarthritis and subsequent ACL injury risk.

2865 Board #326 May 29 9:30 AM - 11:00 AM
Ultrasound Imaging To Assess Medial Elbow Joint Space In Female Collegiate Division I Golfers

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Medial elbow complex injuries have been reported in competitive and recreational golfers. Ultrasound imaging (USI) is a common method for assessing medial joint stability in baseball and other overhead athletes, however there is a paucity of literature in golfers. During the golf swing, there are increased valgus forces on the trailing arm elbow versus the leading elbow, potentially leading to increased medial joint laxity of the trailing arm.

PURPOSE:

The purpose of this pilot study was to examine differences in medial elbow joint space (MJS) measured by USI between the trailing and lead arm of asymptomatic female collegiate golfers.

METHODS: Seven asymptomatic NCAA Division I collegiate female golfers (age 19.4 ± 1.4 yrs) participated. Ultrasound images of the medial joint space of both arms were obtained using a GE LOGIQ E ultrasound unit. Participants were placed supine with elbow position at 30 degrees, with a wedge placed underneath the humerus creating a gravity induced valgus force on the MJS. Measurements of the MJS were performed, and differences between the trailing and leading arm were analyzed with a paired t-test.

RESULTS:

Mean elbow MJS opening on the trailing arm was .32cm (SD.079cm), and .28cm (SD .096cm) on the leading arm. There was a statistically significant difference ($t = 3.495$, $p = .01$) between MJS opening measurements of the trailing and leading arms.

CONCLUSIONS:

The results of this investigation indicate that there is increased elbow MJS opening of the trailing arm compared to the leading arm. While this study does not allow for cause and effect conclusions, this is consistent with the increased load placed on the trailing arm MJS during the golf swing. Further research is needed using larger sample sizes, more heterogeneous study populations, and examination of injury rates and MJS measurements.

2866 Board #327 May 29 9:30 AM - 11:00 AM

Loss Of Glenohumeral Range Of Motion And Its Effects On Eccentric Strength In Intercollegiate Pitchers

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Deficits in glenohumeral joint rotational range of motion (ROM) and strength in baseball pitchers' shoulders have been linked to increased risk of musculoskeletal injury. Total arc of motion deficit (TAMD) is an objective parameter that involves the comparison of bilateral shoulder internal rotation (IR) and external rotation (ER) ROM values as a measure of soft tissue changes at that joint. **PURPOSE:** To determine whether TAMD in the throwing shoulder, when compared to the non-throwing shoulder, affected the eccentric strength of IR and ER muscles of the glenohumeral (GH) joints of intercollegiate baseball pitchers. **METHODS:** 47 male pitchers (age, 19.8 ± 1.2 yrs; hgt, 183.9 ± 5.5 cm; mass, 85.7 ± 10.2 kg; pitching experience, 9.9 ± 2.8 yrs) were recruited to this study and assigned to 1 of 2 groups: 24 pitchers with $\geq 10^\circ$ side-to-side differences in total rotational motion were assigned to the TAMD group, while 23 pitchers with less than 10° side-to-side ROM differences qualified for a non-deficit group (Non-TAMD). We measured eccentric IR and ER peak torques at 300%/sec bilaterally with an isokinetic dynamometer. **RESULTS:** We observed higher ER/IR strength ratios of the dominant arms when compared to the non-dominant arms of pitchers in both the TAMD ($85.2\% \pm 24.3\%$ and $45.4\% \pm 7.3\%$) and non-TAMD groups ($87.3\% \pm 22.8\%$ and $48.5\% \pm 8.1\%$) ($p < 0.001$). There were no significant differences between the normalized TAMD and non-TAMD dominant arm eccentric IR torques (0.497 ± 0.073 Nm/kg BW vs. 0.478 ± 0.062 Nm/kg BW) or eccentric ER torques (0.407 ± 0.082 Nm/kg BW vs. 0.411 ± 0.077 Nm/kg BW) ($p > 0.05$). Dominant arm eccentric ER/IR strength ratio ($86.2\% \pm 23.3\%$ vs. $47.0\% \pm 7.8\%$) and ER eccentric peak torque (0.410 ± 0.088 Nm/kg BW vs. 0.295 ± 0.049 Nm/kg BW) were both significantly greater than in the non-dominant arm ($p < 0.05$). Internal rotation eccentric peak torque (0.488 ± 0.088 Nm/kg BW vs. 0.636 ± 0.101 Nm/kg BW) was significantly higher in the non-dominant arm ($p < 0.05$). **CONCLUSIONS:** We found ER/IR ratios that were significantly higher in the dominant arms, but no significant differences in ER or IR eccentric strength between the TAMD and Non-TAMD groups. Loss of shoulder rotation ROM did not have a significant effect on the production of IR and ER eccentric torques at the GH joint in this sample of intercollegiate pitchers.

2867 Board #328 May 29 9:30 AM - 11:00 AM

Hamstring To Quadriceps Ratio After ACL Reconstruction In Males And Females

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PURPOSE: Restoring thigh muscle strength is a universal rehabilitation goal after ACL reconstruction (ACLR). The hamstring to quadriceps (H/Q) ratio has been used both clinically and in the laboratory as an important metric to detect knee strength imbalances. Previous research has identified sex differences in H/Q ratio among young healthy male and female athletes where males exhibit H/Q ratio around 48% and females around 55% at 180°/sec. The purpose was to compare interlimb H/Q

ratio in participants with ACL reconstruction (ACLR) and to explore the influence of participants sex. **METHODS:** Participants with primary, unilateral ACLR were included in the study. Participants with reinjury or revision surgery or bilateral injury were excluded. Data from 318 (155 males, 163 females) participants was recorded (22.4±9.2yr, 1.72±9.8 m, 75.8±18.1 kg, 8.9±7.8 months post-ACLR). We measured isokinetic peak torque at 90°/sec and 180°/sec for the quadriceps and hamstring muscles bilaterally. H/Q ratio was calculated from peak torque. Repeated measures AVOVA was used to compare H/Q between limbs (within-subject) and between sexes (side*sex interaction). **RESULTS:** We observed a significant main effect for side at 90°/sec (P<0.001) and 180°/sec (P<0.001) indicating the differences among ACLR side and contralateral side (Table 1) such that ACLR side had higher H/Q ratio compared to the contralateral side with medium effect size. Statistically significant differences in H/Q ratio were found among males and females such that females had higher ratio than males at 180°. No significant side*sex effects were found at 90°/sec (P=0.226) and 180°/sec (P=0.383). **CONCLUSION:** Sex differences in H/Q ratio in the current study are similar to prior reports. We observed higher H/Q ratio on the ACLR sides compared to the contralateral sides at both velocities. Differences in the H/Q ratio persist among ACLR side and the contralateral side following ACLR and this finding is not influenced by sex.

Table 1 Within and between subject differences

Variable	Mean (Std. Deviation)	Isokinetic Speed (deg/sec)	P value	Mean difference 95% confidence intervals, Effect size
Side	H/Q Ratio ACLR side	58.27 (15.66)	<0.001	15.09 (13.41 to 16.76)
	H/Q Ratio contralateral side	43.15 (7.38)		d=0.7
	H/Q Ratio ACLR side	55.72 (14.32)	<0.001	12.48 (10.92 to 14.04)
	H/Q Ratio contralateral side	43.22 (9.40)		d=0.5
Sex	Male	49.69 (13.4)	0.06	1.98 (-4.09 to 0.12)
	Female	51.68 (15.3)		d=0.06
	Male	48.02 (12.7)	0.01	2.28 (-4.98 to 0.67)
	Female	50.85 (14.2)		d=0.10

2868 Board #329 May 29 9:30 AM - 11:00 AM
The Quantity Of Rehabilitation Is Associated With Patient Reported Outcomes Following ACL Reconstruction

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Athletes demonstrate impaired self-reported outcomes and reduced psychological readiness to return to sport (RTS) following anterior cruciate ligament reconstruction (ACLR). Formal physical therapy (PT), in conjunction with their home exercise program (HEP), ideally continues until an athlete is cleared to RTS. The quantity of total rehabilitation completed and its relationship to patient reported outcomes (PROs) remains unknown.

Purpose: Determine the relationship between the amount of rehabilitation from 4-6 months post-ACLR to PROs at 9 months.

Methods: Fifteen athletes (8 M, 16.7 ± 2.9 yrs., 171.2 ± 8.4 cm, 63.9 ± 13.3 kgs) completed a weekly four-question survey between 4-6 months following an ACLR. Questions consisted of the number of times the athlete went to PT, completed their HEP, ran, and lifted leg weights with activity ranging from 0-7 days/week. The survey was sent via a secure web-based database. At the 9-month follow-up, the athletes completed both the International Knee Documentation Committee (IKDC) and the ACL-Return to Sport after Injury (ACL-RSI). Pearson correlations were calculated between activity quantity from 4-6 months and PROs at 9 months.

Results: The average bouts of running per week (2.1 ± 1.5 bouts) 4-6 months after surgery was significantly associated with the 9-month IKDC (72 ± 6.9, r = 0.74, p < 0.01). Bouts of running per week (r = 0.54, p = 0.04) and increased adherence to the

HEP (3.5 ± 1.7 bouts, r = 0.56, p = 0.03) were significantly related to the 9-month ACL-RSI (55 ± 26). The average number of PT visits per week (0.96 ± 0.7) was not related to IKDC or ACL-RSI (p > 0.05).

Conclusion: These data suggest that increased activity, including running and HEP, during the critical 4-6-month period after surgery may result in increased self-reported outcomes and psychological readiness to RTS. Increased activity may improve athletes' comfort and confidence in their knee function. Those who were committed to running and their home exercises early after recovery may have continued to maintain this regimen through to their 9-month time point and thus felt better about their outcome. These data highlight the importance of athlete adherence to an early and consistent rehabilitation program, paired with clinician reinforcement of the HEP, for improved patient outcomes following ACLR.

2869 Board #330 May 29 9:30 AM - 11:00 AM
Ultrasonography Of Femoral Acetabular Translation In Female Athletes Undergoing Hip Arthroscopy

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BACKGROUND: Hip arthroscopy may be a risk factor for post-surgical microinstability, leading to ongoing pain. Dynamic hip ultrasonography (US) has shown to reliably measure femoral acetabular translation. Evidence regarding the effect of hip arthroscopy on femoral acetabular translation and subsequent stability is lacking, especially in female athletes. **PURPOSE 1.** To examine ultrasound measurements of femoral acetabular translation in female athletes. 2. To compare dynamic US measurements in female athletes who have undergone hip arthroscopy versus female athletes who have not. **METHODS:** Cross-sectional study design. Dynamic US examination of femoroacetabular joint translation was performed in three positions: neutral hip, neutral hip with contralateral hip in flexion, and apprehension position (extension external rotation) (d'Hemecourt et al, *CORR*, 2018). Variables include age, sex, BMI, Beighton score, acetabular coverage angles. **Main outcome measure** US measures (mm) of femoral acetabular translation. Multivariate analysis of covariance (MANCOVA) with p < 0.05 was used for statistical analysis. Independent variable hip arthroscopy vs. no hip arthroscopy. Covariates include Beighton scores and acetabular angles. **RESULTS:** 171 female athletes were included. Twenty-five female athletes underwent right hip arthroscopy, and 17 left hip arthroscopy. In the neutral position, mean femoral acetabular translation in arthroscopy patients was 2.11±2.10 mm compared to non-arthroscopy study athletes (1.76±1.99 mm; p=0.349). In the neutral with hip flexion position, translation of arthroscopy study athletes was greater when compared to translation in non-surgical study athletes (5.17±2.00 mm and 4.38±2.49 mm, respectively), with a trend toward significance (p=0.088). Arthroscopy female athletes showed greater translation in the apprehension position compared to non-surgical female athletes (6.33±2.37 mm, 5.39±2.37 mm, respectively; p=0.042). **CONCLUSION:** Female athletes undergoing hip arthroscopy demonstrated differences in femoral acetabular translation via dynamic US when compared to female non-surgical patients while accounting for acetabular coverage and ligamentous laxity. Continued investigation of hip stability using dynamic US and future clinical utility is warranted.

2870 Board #331 May 29 9:30 AM - 11:00 AM
The Effect Of Plyometric Training With Blood Flow Restriction After Anterior Cruciate Ligament Reconstruction

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Quadriceps and hamstring muscles weakness are common after anterior cruciate ligament reconstruction (ACLR). Despite rehabilitation programs, the problem persists and has negative effects on knee function. Plyometric exercises are used during rehabilitation to facilitate muscle strength, function and return to sports. However, the effects of plyometric training with blood flow restriction (BFR) have never been investigated on patients with ACLR.

PURPOSE: The aim of this study was to investigate the effects of plyometric training with BFR on muscle strength, muscle thickness and knee function after ACLR.

METHODS: Twenty-eight patients who completed a 12-week rehabilitation program after ACLR were included in the study. Patients were randomly allocated into two groups. Group-1 (n=14, age: 19.6±2.1 years) performed plyometric training with BFR 3 days a week for 8 weeks. Group-2 (n=14, age: 20.3±3.3 years) performed the same

plyometric training without BFR. Knee muscle strength, muscle thickness and knee function were evaluated before and after the interventions. Concentric knee extension and flexion muscle strength were evaluated with isokinetic dynamometer at 60°/s and 180°/s angular velocities. The thickness of the rectus femoris (RF), vastus medialis obliquus and lateralis (VMO-VL) were assessed with ultrasonography. Vertical jump (VJ) and one-leg hop (OLH) tests were used to assess the performance of the patients. The subjective knee function was evaluated with IKDC knee form and ACL-RSI score. In addition one leg hop test and ACL-RSI score were evaluated only after intervention. Mann Whitney-U test was used to analyze the change before and after the intervention between groups.

RESULTS: Group-1 had significantly higher quadriceps ($p<0.05$, $p<0.05$) hamstring muscle strength ($p<0.05$, $p<0.05$) at 60°/s and 180°/s angular velocities respectively and higher muscle thickness of RF ($p<0.05$), VL ($p<0.05$) and VMO ($p<0.05$) compared to group-2. In addition, the VJ test ($p<0.05$) and ACL-RSI score ($p<0.05$) were higher in group-1 compared to group-2.

CONCLUSIONS: The results of the study indicated that plyometric training with BFR was more effective in improving the muscle thickness, muscle strength and knee function.

E-40 Free Communication/Poster - Cardiovascular Diseases

Friday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

2871 Board #332 May 29 10:30 AM - 12:00 PM
Abstract Withdrawn

2872 Board #333 May 29 10:30 AM - 12:00 PM
Comparison Of The Prevalence Of Hypertension Using Fourth Report And The Aap Guidelines Among Nigerian Children And Adolescent

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BACKGROUND: This study compared the prevalence of hypertension based on the Fourth Report guidelines issued in 2004 (old) and the recent (new) 2017 American Academy of Pediatrics (AAP) clinical practice recommendation for describing hypertension among Nigerian children and adolescents.

METHODS: Descriptive cross-sectional study of 1758 (boys= 631; 35.9% and girls=1127; 64.1%) aged between 9 and 19 years in Ado-Ekiti, Southwest Nigeria participated in the study. Stature, body mass, abdominal obesity, systolic and diastolic blood pressure (BP) were determined using the standard protocols of ISAK, and BPs for all school-going children at each screen were classified by both fourth report guidelines (FRGs) and AAP guidelines.

RESULTS: Mean body mass, waist-to-hip ratio (WHR) ($p\leq 0.05$), body mass index (BMI) ($p<0.01$), body fat percentage and both systolic and diastolic blood pressure were significantly higher among boys compared to girls ($p < 0.001$). Based on the new guideline (AAP), the prevalence of hypertension by gender systolically, stands at 9.5% and 5.9% compared to the 4th report guidelines of 1.5% and 1.7% for boys and girls, respectively, and diastolically stands at 6.3% and 3.9% compared to the 1.6% and 0.9% for boys and girls, respectively. Based on AAP and by age, 12.1% and 12.8% of children aged 15 and 16 years were systolically and diastolically hypertensive, respectively. The result of the hypertension prevalence based on the 4th report criteria by age revealed that 5.8% and 2.8% of those aged 15 and 14 years were systolically and diastolically hypertensive, respectively.

CONCLUSIONS: A strikingly high prevalence of hypertension was found in children and adolescents following the recent AAP guidelines compared to the Fourth Report guidelines highlighting the need to scale up the intervention and prevention in children especially from low-income countries.

2873 Board #334 May 29 10:30 AM - 12:00 PM

Boxing Training Effects On Brachial And Popliteal Endothelial Function In Prehypertensive Individuals

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PURPOSE:

Endothelial dysfunction appears to have a central role in the progression to high blood pressure by reducing nitric oxide bioavailability and increasing oxidant stress. Flow mediated dilation (FMD) is the most common non-invasive test to assess endothelial function. It has been reported that traditional lower-extremity exercise modalities are associated with improvements on FMD, however, limited research has evaluated the effects of upper body exercise, such as boxing training, on endothelial function. Therefore, the purpose of this study is to determine the response of brachial and popliteal FMD within a prehypertensive population after 6 weeks of boxing training.

METHODS:

A total of 14 prehypertensive participants were randomly allocated to a boxing intervention or a control group. The boxing training intervention consisted of a 6-week program with 3 visits per week in non-consecutive days. Each session was made up of 10 rounds of 3 minutes and 1-minute rest in between rounds. The control group included a 6-week flexibility and balance training with 3 visits per week made up of 10 minutes of dynamic stretching, 5 minutes of unipedal stance, and 5 minutes of upper limb stretching. FMD of the brachial and popliteal artery were measured with a 12-MHz linear phase array ultrasound transducer before and after the intervention.

RESULTS: After the intervention, the boxing group showed a significant increment on brachial FMD by 2.4% ($p = 0.001$) and popliteal FMD by 2.8% ($p = 0.043$), while no statistical differences were found in the control group for brachial FMD ($p = 0.181$) and popliteal FMD ($p = 0.538$).

CONCLUSION: Boxing training is a suitable exercise alternative to improve endothelial function in the upper and lower extremity of individuals with prehypertension.

2874 Board #335 May 29 10:30 AM - 12:00 PM

Effects Of Boxing Training On Peripheral And Central Blood Pressure And Arterial Stiffness In Prehypertension

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PURPOSE: Early stages of high blood pressure, such as elevated blood pressure or stage 1 hypertension, have shown to increase cardiovascular mortality. Exercise is recommended for the prevention and treatment of high blood pressure; however, most clinical evidence is based on lower-body modalities of exercise. Therefore, the purpose of this study is to evaluate the effects of boxing training, a predominant upper-body exercise modality, on peripheral and central blood pressure and arterial stiffness in prehypertensive individuals. **METHODS:** A total of 14 young prehypertensive individuals were randomly allocated to a boxing training group or to a control group for 6 weeks. The boxing group underwent 42 minutes of boxing training three times per week while the control group performed flexibility and balance exercises. At the beginning and at the end of the intervention, brachial blood pressure was evaluated with an automatic cuff, central blood pressure by pulse wave analysis, and arterial stiffness by pulse wave velocity. A 2x2 repeated measures ANOVA design was employed to compare differences within and in between groups. Significance was established at $p \leq 0.05$. **RESULTS:** After the intervention, only the boxing group showed a significant reduction on systolic blood pressure ($p=0.027$), diastolic blood pressure ($p<0.001$), central systolic blood pressure ($p=0.011$), augmentation index ($p=0.021$), and augmentation index at 75 beats per minute ($p=0.008$). No difference could be observed on pulse wave velocity in the boxing group ($p=0.323$), although a significant increment was seen in the control group ($p=0.02$). **CONCLUSIONS:** Boxing training is an effective treatment alternative to reduce peripheral and central blood pressure in prehypertensive individuals. To reduce arterial stiffness in prehypertensive individuals, longer boxing training protocols might be required.

2875 Board #336 May 29 10:30 AM - 12:00 PM

Dexa Body Composition And Cardiovascular Risk Markers Are Weakly Related In Male Firefighters With Fatty Livers

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PURPOSE: To determine if obesity measures, such as fat mass and distribution (e.g. android, gynoid, and visceral fat levels), could be used to predict markers of cardiovascular disease (CVD), particularly lipoprotein-lipid levels among firefighters recently diagnosed with fatty livers (radiologist interpretation from ultrasound). **METHODS:** Thirty-three local male firefighters who had recently been diagnosed with a fatty liver and completed their annual cardiovascular health profile screenings were included in this data analysis (average age 39.5±8.6 yrs, height 70.9±3.1 in, weight 242±42.6 lbs, fat mass 76.14±24.5 lbs; lean mass 162.5±21.7 lbs; percent android fat 38±5.3; percent gynoid fat 29.4±4.7; visceral fat area (VAT) 170.5±47.3 cm², and VO_{2max} 30.0±5.0 mL/kg/min). Data taken from their annual health screening included a graded exercise test (GXT; Bruce protocol), body composition (through DEXA), and fasting bloodwork. Maximal oxygen uptake (VO_{2max}) was estimated using the Foster equation. Height, weight, resting heart rate, resting systolic blood pressure, and resting diastolic blood pressure were measured before the start of the GXT protocol. All blood samples were analyzed for total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL) cholesterol (HDL-C), low-density lipoprotein (LDL) cholesterol (LDL-C), and glucose (GLU). Relationships among the data were analyzed with Pearson's r (Significance was determined using an alpha level of 0.05). **RESULTS:** Correlations for obesity measures and other cardiovascular risk markers of interest are displayed in Table 1 (* = p < 0.05).

		Lean Tissue Mass	Fat Tissue Mass	Android Fat %	Gynoid Fat %	VAT
TC	Pearson	-.110	.059	.119	.216	-.253
	r ²	.012	.003	.014	.047	.064
HDL-C	Pearson	-.290	.155	.353*	.414*	-.312
	r ²	.084	.024	.125	.171	.097
LDL-C	Pearson	-.099	.011	.041	.140	-.393*
	r ²	.009	.000	.002	.019	.154
TG	Pearson	.058	-.019	-.020	-.079	.313
	r ²	.003	.000	.000	.006	.098
Glucose	Pearson	.127	-.038	.053	.024	-.235
	r ²	.016	.001	.003	.001	.055
VO _{2max}	Pearson	-.381*	-.637*	-.603*	-.476*	-.285
	r ²	.145	.406	.363	.226	.081

CONCLUSIONS: VO_{2max} was significantly, but weakly related to lean mass, fat mass, and the percentage of both android and gynoid fat. Factors other than fat mass and distribution may contribute to lipid profiles in our male firefighters with fatty livers, a population at high risk for CVD.

2876 Board #337 May 29 10:30 AM - 12:00 PM

Heart Rate Variability On Older Adults With Intellectual Disability: A Cross-sectional Study

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PURPOSE: There is a deficit on autonomic nervous system regulation in individuals with Down syndrome (DS). However, the cardiac autonomic modulation during exercise in older adults with intellectual disability (ID) without DS is not enough described. **AIM:** To evaluate and compare the heart rate variability (HRV) during the six-minutes walk test (6MWT) in older adults with and without ID. **METHODS:** Seventeen participants with low-moderate ID non DS and 25 participants without ID were recruited. The HRV was assessed by R-R intervals on rest (10 minutes before the test), during the 6MWT and on recovery (10 minutes after the test), in orthostatic position by a Polar RS800X heart rate monitor. The symbolic analysis was used to evaluate nonlinear HRV components, and 0V% and 2UV% variations were considered as sympathetic and vagal modulation parameters, respectively. Two-way Anova was used to compare HRV parameters between the groups on rest, 6MWT and recovery. **RESULTS:** Only the group without ID showed a significant increase of 0V% values (p=0.003), and a decreased 2UV% (p=0.003), as expected. Both groups showed a significant reduction in RRI mean (p=0.006). Distance walk on 6MWT was significant higher in the group without ID (536 m vs. 452 m (p=0.001) **CONCLUSION:** participants with ID did not present cardiac autonomic modulation responses during

the exercise, and show a worse performance in 6MWT. Thus, future studies are needed to elucidate the autonomic cardiac control during exercise in seniors with ID, and assist on prescription of appropriate intervention for this population. **Funding sources:** MINECO (DEP2017-86862-C2-1-R); Generalitat de Catalunya. Departament d'Empresa i Coneixement (2019 FI_B 00893); Ministerio de Ciencia e Tecnologia de Brasil (PDSE/CAPES 88881.189815/2018-01).

Table 1: Heart rate variability on older adults with and without ID

Variables	Adults without ID (n = 25)			Adults with ID (n = 17)			p
	Mean (SD)			Mean (SD)			
Linear Parameters	Rest	6MWT	Recovery	Rest	6MWT	Recovery	
Mean iRR (ms) *	824 (168)	755 (167)	842 (167)	849 (129)	570 (80)	790 (122)	.006
Variance (ms ²)	778 (852)	721 (890)	810 (872)	824 (849)	887 (794)	829 (737)	.052
Non-Linear Parameters							
0V% **	26 (16)	33 (16)	46 (14)	33 (11)	30 (15)	32 (11)	.003
2UV% **	22 (12)	17 (8)	8 (6)	13 (8)	20 (11)	14 (9)	.003

Note: values are means (Standard Deviation). Abbreviations: ID (intellectual disability); 6MWT (six-minutes walk test); iRR (R-R intervals). Statistically significant values are showed in bold (p ≤ .05). * Significant difference (p ≤ .05) between rest and 6MWT for all groups. ** Significant difference (p ≤ .05) between rest and 6MWT w/ID group.

2877 Board #338 May 29 10:30 AM - 12:00 PM

Aerobic Capacity And Physical Activity Level In Adults With Congenital Heart Disease

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PURPOSE: To study the Aerobic Capacity (AC) in adults with Congenital Heart Disease (CHD) and their physical activity (PA) level. **METHODS:** A cross sectional study with 93 adults (45 women 36,2±10,1 years; and 48 men 35,4±11,9 years) participated in the study. The AC was assessed by cardiopulmonary exercise test (CPET) using a modified Bruce protocol. Considering values of peak oxygen uptake (VO_{2Peak}), participants were divided into four Fitness levels (FL) quartiles (Very Low, Low, Moderate and high) for each sex. Three categories of PA level (Health-Enhancing Physical Active (HEPA), Minimally active and Inactive) were obtained by the short International Physical Activity Questionnaire (IPAQ) based on spending MET/minutes/week. Analysis of variance (ANOVA one way; post-hoc Bonferroni) to evaluate significant differences among FL and PA level were used. **RESULTS:** Significant differences appeared in VO_{2Peak} between all FL groups for both sexes. In women the VO_{2Peak} of the very low FL group was 18.5±2.8 ml/kg/min, Low FL 23.2±1.5, Moderate FL 27.6±2.2, and High FL 35.7±5.6 (P=0.001). In men the VO_{2Peak} of the very low FL group was 22.1±3.7 ml/kg/min, Low FL 30.1±3.6, Moderate FL 34.9±4.7 and High FL 47.8±6.7 (P=0.001). No significant differences were observed among FL groups in terms of PA with a mean of 2659.3±2210.0 MET/minutes/week. However, the high FL group showed an upward trend in spending MET/min/week compared with the others groups. Thirty-two participants (34.4%) reported HEPA, 49 (52.7%) reported minimally active and 12 (12.9%) reported inactivity. **CONCLUSION:** Aerobic Capacity in adults with CHD was low compared to regular values in healthy population. These findings suggesting that when the goal is to improve aerobic capacity and prognosis of disease should be recommended increase PA. Future studies with a larger sample size are needed to determine level of PA appropriate to improve aerobic capacity in adults with CHD. Supported by SUR of DEC Generalitat de Catalunya and European Union 2019FI_BI 00168.

2878 Board #339 May 29 10:30 AM - 12:00 PM
Comparison Of Oxyhemoglobin, Deoxyhemoglobin, Tissue Oxygen Saturation, And Venous Occlusion Plethysmography

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Near infrared spectroscopy (NIRS) a non-invasive technique used to measure tissue perfusion and oxygenation. Recent studies used the combination of a Venous occlusion plethysmography (VOP) with NIRS to study microvascular function. NIRS have demonstrated to monitor effectively perfusion changes in muscle microcirculation. The purpose of this study was to determine if NIRS can predict microvascular blood flow measurement via VOP.

A total of 20 young apparent healthy subjects, were recruited for this study. NIRS and VOP were performed simultaneously at the right forearm and right calf. VOP strain gauges placed around the widest part of both extremities between cuffs. Probes for NIRS were placed on forearm and calf both perpendicular to the longitudinal axis. Baseline levels were obtained for a minute for NIRS and VOP. Followed by an ischemic stress were cuffs were inflated to a suprasystolic pressure for five minutes. Post ischemic stress data was collected for one minute. Strength association was evaluated by Pearson correlation.

Lower extremity demonstrated a positive correlation with average basal oxyhemoglobin (HbO₂) versus, slope of deoxyhemoglobin (HHb) (R= 0.541; P= 0.014). HHb 30 seconds before ischemic stress is release had a positive correlation with tissue oxygen saturation (SO₂) slope (R =0.873; P <0.05). HHb post ischemic stress slope had a positive correlation with HbO₂ slope (R = 0.665; P=0.001). Upper extremity, HbO₂ post ischemic stress versus HHb post ischemic stress showed a positive correlation. (R = 0.916; P = <0.05). HbO₂ 30 seconds before ischemic stress versus HHb 30 seconds before ischemic stress slope had a positive correlation (R = .784; P = <.05). No correlation was found with VOP measurements. There were no agreements between NIRS and VOP, for the assessment of microvascular function.

2879 Board #340 May 29 10:30 AM - 12:00 PM
Effect Of Pulmonary Function On Metabolic Response To Exercise In Patients With Bicuspid Aortic Valve

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PURPOSE: To evaluate the effect of resting pulmonary function on metabolic responses to exercise in patients with a bicuspid aortic valve (BAV) compared to normal control subjects (C). **METHODS:** We evaluated 18 BAV patients and 18 C subjects, age and size matched, using a Ramp Treadmill protocol. Pulmonary function was evaluated with resting spirometry measures of Forced Vital Capacity (FVC) and Forced Expiratory Capacity in the first second (FEV1). Breathing reserve was calculated (BR). Oxygen consumption, absolute (VO₂) and indexed (VO_{2i}), percent predicted VO₂ (%PVO₂), expiratory minute volume (VE) and respiratory exchange ratio (RER) were obtained at anaerobic threshold (AT) and maximal exercise (Max). **RESULTS:** There were no significant differences between the BAV and C groups in age (14.6 ± 2.1 vs 15.8 ± 3.1(yr)), height (1.63 ± 0.1 vs 1.66 ± 0.12(m)) or weight (55.7 ± 15.1 vs 57.6 ± 13.2 (kg)). The BAV group had significantly decreased FVC (3.54 ± 0.84 vs 4.16 ± 1.03(L/min) p<0.05) and FEV1 (3.54 ± 0.84 vs 4.16 ± 1.03(L/min) p<0.02) compared to the C group. BAV group had a significant decrease in VO₂ (1524 ± 466 vs 1876 ± 540 (ml/min) p<0.04), VO_{2i} (28 ± 8 vs 33 ± 5 (ml/min/kg) p<0.04) and VE (35 ± 11 vs 42 ± 10 (L/min) p<0.02) at AT but not at Max. The %PVO₂ was significantly decreased in the BAV group at AT (67 ± 19 vs 83 ± 18 (%) p<0.01) and Max (91 ± 24 vs 109 ± 17 (%) p<0.01). BR was significantly decreased in the BAV group (46 ± 6 vs 50 ± 6 (%) p<0.05) Max RER was not significantly different in BAV and C groups (1.19 ± 0.08 vs 1.19 ± 0.06). Significance was set at p < 0.05. **CONCLUSION:** BAV and C groups reached the same intensity of exercise reflected by the RER. BAV group had decreased pulmonary function, reflected by FVC and FEV1, with a decreased BR. BAV had decreased aerobic performance at AT and Max, reflected by the VO₂, VO_{2i}, and VE at AT and %PVO₂ at AT and Max. These data suggest that a significant pulmonary function component contributes to the decreased aerobic performance in these BAV patients.

2880 Board #341 May 29 10:30 AM - 12:00 PM
High-intensity Interval Training And Resistance Training Favor Higher Improves On Cardio-metabolic Health Outcomes Compared With Combined Training Or Nutritional Guidance In Overweight Adults: Cardiometabolic Hiit-rt Study, A Randomized Controlled Trial

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PURPOSE: The 2018 Physical Activity Guidelines Advisory Committee systematically searched existing literature reviews to assess the relationship between high-intensity interval training (HIIT), moderate-intensity continuous training (MICT), or resistance training (RT) and reduction in cardiometabolic disease risk. Against this background, the aim of the present study was to investigate whether 12 weeks of HIIT, RT, combination training (CT = HIIT+RT) or a NG plan induced improvement on metabolic syndrome risk factors, vascular function and physical fitness in sedentary and overweight, and to compare the responses between the four intervention groups. **METHODS:** The study included a total of 57 sedentary subjects with abdominal obesity or excess weight. Twelve-week randomized parallel design examining the effects of different exercise regimes and/or NG on anthropometric and body composition (fat and lean mass at whole body, trunk fat, fat mass index, appendicular muscle mass, and waist circumference); metabolic syndrome risk factors and vascular parameters (blood lipids, fasting glucose, blood pressure, flow-mediated vasodilation [FMD%], aortic pulse wave velocity (PWV), and augmentation index [AIx]); and physical fitness (cardiorespiratory fitness and grip strength).

RESULTS: Adjusted mixed linear models revealed a significant improved in cardiorespiratory fitness (mL·kg⁻¹·min⁻¹): HIIT +8.3, RT +4.1, and CT +6.3 (all P < 0.001). The improvement difference between the groups was statistically significant between the HIIT and NG group (P = 0.014), [time x group interaction F_(23,564); P < 0.001; η² partial = 0.365]. In addition, RT and CT group, has a significant positive impact on PWV (m·s⁻¹) (d = 0.391 and 0.229 respectively; P < 0.001, [time x group interaction F_(5,457); P = 0.003; η² partial = 0.280]. Hereafter, RT group has a significant positive impact on the FMD (%) in comparison to HIIT, CT or NG group (time x group interaction F_(2,942); P = 0.044; η² partial = 0.174).

CONCLUSIONS: The main findings of this study are that 12 weeks of HIIT leads to significant improvements in cardiorespiratory fitness while the RT resulted in improvements in the vascular profile, supporting the positive effect of both training programs for cardiometabolic risk factors in sedentary and overweight adults.

2881 Board #342 May 29 10:30 AM - 12:00 PM
Acute Cardiopulmonary And Hemodynamic Responses To Exercise With Blood-flow Restriction In Heart Failure Patients

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Muscle training with blood flow restriction (BFR) can induce significant increases in muscle strength and mass, while BFR during low intensity aerobic training increases aerobic capacity more than the usual aerobic exercise at the same intensity. However, little is known about the safety and feasibility of BFR training in patients with chronic heart failure (CHF).

PURPOSE: This study compared hemodynamic and cardiopulmonary responses during low intensity aerobic exercise with and without BFR in CHF patients. **METHODS:** Nine CHF patients, 7 males and 2 females (age: 55.6±12.2 years, height: 175.0±10.3 cm, body mass: 89.6±29.1 kg, VO_{2peak}: 22.4±5.04 ml/kg/min, ejection fraction: 36±6%, NYHA: I-II) volunteered to participate in this crossover study. Each participant performed the same aerobic exercise protocol, i.e. a 20-minute cycling bout at 65% of VO_{2peak}, with (BFR) and without BFR (control) in random order, using a cycle ergometer. In the BFR condition, an occlusion cuff was used to regulate the occlusion pressure applied to both limbs that was proportional to thigh circumference. Mean oxygen uptake (VO₂) during the 20 minutes exercise, VO₂ recovery during the first minute of recovery (VO₂/t slope), heart rate (HR), systolic (SBP) and diastolic (DBP) blood pressure at 6 min, 12 min and 18 min of exercise, fatigue and dyspnea perception were assessed. ANOVA or paired t-test was used for statistics and data are presented as mean±SD.

RESULTS: Mean VO₂ during exercise was higher in BFR compared to control (70.6±9.8% vs 64.0±10.1%, p=0.003), while VO₂/t slope was higher in control (0.79±0.23 vs 0.53±0.11, p= 0.008). HR was higher during the BFR exercise (94±15

vs 88 ± 15 , 97 ± 20 vs 90 ± 19 , 96 ± 10 vs 84 ± 9 at 6, 12 and 18 min, respectively; $p < 0.05$), whereas SBP and DBP did not differ between the two conditions at any time point ($p > 0.05$). Fatigue (12.4 ± 2.7 vs 8.8 ± 1.7 , $p = 0.002$) and dyspnea (11.5 ± 2.5 vs 9.2 ± 1.9 , $p = 0.03$) perception were significantly higher in BFR compared to control.

CONCLUSIONS: To our knowledge, this is the first study examined BFR exercise in CHF patients, revealing specific cardiopulmonary and hemodynamic responses and suggesting that this exercise strategy is safe and feasible in those patients. More studies are needed to verify and further characterize the acute and chronic effects of BFR training in CHF patients.

2882 Board #343 May 29 10:30 AM - 12:00 PM
Comparison And Correlation Between Cardiovascular Risk Factors And Skeletal Muscle Mass In Healthy Young Adults

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(No relevant relationships reported)

It is unclear whether individuals with high skeletal muscle mass may have beneficial effects on cardiovascular health. **PURPOSE:** To ① Compare cardiovascular risk factors between individuals with Standard skeletal Muscle mass Group-Male (SMG-M) / Female (SMG-F), and High skeletal Muscle Group-Male (HMG-M) / Female (HMG-F) ② Explore the relationship skeletal muscle mass and cardiovascular risk factors.

METHODS: Fifty Healthy young male ($n=27$, 23.4 ± 0.4 years old) and female ($n=23$, 22.1 ± 0.4 years old) were recruited to participate in this study. Body composition of the subjects were measured by a Bioelectrical Impedance Analysis. Depending on the results, they were divided into 2 groups (HMG-M vs. SMG-M, HMG-F vs. SMG-F). Blood pressure, brachial-ankle pulse wave velocity (baPWV), and blood analysis [Low Density Lipoprotein Cholesterol (LDL-C), High Density Lipoprotein Cholesterol (HDL-C), Triglycerides (TRG), glucose, HbA1c] were performed.

RESULTS: There were statistically significant differences in the values of skeletal muscle mass Index (SMI) between the two groups [HMG-M vs. SMG-M, SMI(%) 130.5 ± 1.5 vs. 101.9 ± 1.3 , $p < 0.0001$; HMG-F vs. SMG-F, SMI(%) 109.0 ± 1.5 vs. 86.2 ± 2.3 , $p < 0.0001$]. Blood analysis showed that HDL-C was higher in HMG than in SMG [HMG-M vs. SMG-M, (mg/dL): 71.7 ± 4.7 vs 47.5 ± 2.3 , $p = 0.0001$; HMG-F vs. SMG-F: 79.0 ± 3.8 vs. 54 ± 2.3 , $p < 0.0001$], whereas LDL-C and TRG levels were comparable in the groups regardless of gender [HMG-M vs. SMG-M, LDL-C (mg/dL): 90.5 ± 12.1 vs 76.2 ± 12.4 , $p = 0.427$, TRG (mg/dL): 124.0 ± 22.5 vs. 104.5 ± 22.0 , $p = 0.549$; HMG-F vs. SMG-F, LDL-C: 97.2 ± 8.5 vs. 91.8 ± 6.6 , $p = 0.626$, TRG: 80.4 ± 15.0 vs. 96.0 ± 14.6 , $p = 0.477$]. In addition, baPWV did not show significant differences between groups [HMG-M vs. SMG-M, (cm/s): 1129.5 ± 18.2 vs. 1100.0 ± 49.8 , $p = 0.589$; HMG-F vs. SMG-F, 1001.7 ± 41.4 vs. 997.0 ± 73.2 , $p = 0.957$]. Interestingly, HDL cholesterol levels are associated with SMI in young adults (Male, $r = 0.640$, $p = 0.001$; Female, $r = 0.583$, $p < 0.01$).

CONCLUSIONS: In both male and female groups, HDL was significantly higher in HMG than in SMG, and a significant correlation was found between skeletal muscle mass index and HDL cholesterol. These results suggest that an increase in skeletal muscle mass may have an additive benefit on a cardiovascular risk factor, especially HDL cholesterol level.

2883 Board #344 May 29 10:30 AM - 12:00 PM
Acute Muscle Damage Is Augmented After Exercise In PAD Patients: Evidence From Diffusion Tensor Imaging

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(No relevant relationships reported)

Although the chronic myopathies associated with peripheral arterial disease (PAD) are well established, the acute muscular responses to exercise in this population are less clear. **PURPOSE:** This study used diffusion tensor imaging (DTI) to compare acute exercise related muscle damage between PAD patients and healthy controls. **METHODS:** Eight PAD patients and 7 healthy controls performed graded dynamic plantar flexion exercise in the bore of a 3T MRI scanner. In order to compare responses between the active and inactive legs, these plantar flexion trials were repeated during imaging of the exercising leg and imaging of the resting leg. Each exercise trial began at 2kg, and increased by 2kg every 2 minutes until fatigue, or until completion of 10kg. DTI images were collected from the widest portion of the calf pre and post exercise, and were analyzed for mean diffusivity (MD), fractional anisotropy (FA), and eigenvectors 1-3 ($\lambda_{1,2,3}$) of the medial gastrocnemius (MG) and tibialis anterior (TA) muscles. **RESULTS:** At baseline, there were no significant group differences in MD, FA, or any of the individual eigenvectors for the MG or TA of the exercising leg ($P \geq 0.34$). However, results did indicate significantly greater increases in MD ($+13.6$

$\pm 10.6\%$ and $+2.5 \pm 3.5\%$), λ_1 ($+13.7 \pm 14.3\%$ and $+1.4 \pm 3.1\%$), λ_2 ($+13.8 \pm 10.5\%$ and $+3.0 \pm 3.6\%$), and λ_3 ($+13.1 \pm 7.1\%$ and $+3.7 \pm 4.3\%$, all $P \leq 0.02$) in the MG of the exercising leg in PAD patients compared to controls, respectively. Results also indicated a significantly greater increase in λ_3 of the TA in the exercising leg in PAD patients compared to controls ($2.1 \pm 2.9\%$ and -1.5 ± 1.4 , respectively, $P = 0.01$). In contrast, no significant group by time interactions were observed in the resting leg (all $P \geq 0.15$). **CONCLUSIONS:** These data indicate that skeletal muscle diffusivity increases more in PAD patients compared to controls after exercise. Ultimately, this suggests that acute exercise related muscle damage is augmented in PAD patients. Supported by NIH P01-HL134609 (Sinoway) and UL1 TR002014 (Sinoway).

2884 Board #345 May 29 10:30 AM - 12:00 PM
Examining Energy Expenditure During Aerobic And Resistance Exercise In Overweight Patients With HFpEF

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PURPOSE: Previous studies have demonstrated that aerobic exercise (AE) along with caloric restriction (CR) is very beneficial in older, overweight heart failure patients with preserved ejection fraction (HFpEF). However, few studies have evaluated the impact of resistance training (RT) in these patients. Consequently, little is known about energy expenditure (EE) associated with these types of exercises in overweight HFpEF patients, as well as the reproducibility of testing energy expenditure in this population. Therefore, the purpose of this study was to examine EE between overweight HFpEF patients participating in an AE alone versus AE+RT; and to examine the reproducibility of measuring EE in these patients.

METHODS: Nine overweight HFpEF participants of the *Studies Examining Caloric Restriction and Exercise Trial II (SECRET II)* participated in this study. All SECRET II participants were following a CR diet and were randomized into either an AE ($n=5$) or AE+RT ($n=4$) group. Each participant wore the COSMED K5 system during a single exercise session (~1 hr) in order to determine the total EE (kcal) for each session. Five of the nine subjects in (AE =2, AE+RT =3) wore the COSMED K5 during two different exercise sessions (within 1 week) to examine the reproducibility of EE measurement. An independent t-test was used to compare the mean total EE, during one exercise session, between the two groups. A Pearson correlation was run to examine the reproducibility in EE.

RESULTS: Despite similar exercise duration, the mean total EE during AE+RT (276 ± 182 kcal) not statistically different ($p = 0.53$) than during AE only (263 ± 125 kcal). A Pearson correlation revealed a significant correlation ($r = 0.95$, $p = 0.014$) between EE measured on day 1 and day 2. **CONCLUSIONS:** Data from this study indicates that AE+RT and AE alone results in similar EE and that this measure is reproducible in overweight patients with HFpEF. Thus, it appears that over time, AE and AE+RT would promote similar EE and potentially weight loss in overweight HFpEF patients.

2885 Board #346 May 29 10:30 AM - 12:00 PM
CARDIORESPIRATORY FITNESS AND VASCULAR HEMODYNAMICS IN MIDDLE-AGED AND OLDER ADULTS

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 Cardiovascular disease-related (CVD) mortality with older age is in part attributable to altered vascular hemodynamics including increased central and peripheral blood pressure (BP) and augmentation index (AIx). Cardiorespiratory fitness (CRF) is inversely associated with CVD mortality independent of traditional risk factors. It is unknown, however, if CRF is inversely related to vascular hemodynamics. **PURPOSE:** To investigate the relationship between CRF and vascular hemodynamics in an apparently healthy middle-aged and older adult population. **METHODS:** Apparently healthy males and females ($N=101$; 54 M, 47 F; Age: 63.5 ± 8.5) from the Ball State Adult Fitness Longitudinal Lifestyle Study (BALL ST) were studied. All participants underwent assessment of vascular hemodynamics, which included non-invasive central and peripheral BP, central and peripheral pulse pressure (systolic minus diastolic BP), AIx (%), AIx normalized to HR 75 (AIx% HR75) and directly-measured CRF (VO_{2max} ; ml/kg/min). Age- and sex-adjusted CRF percentiles were calculated based on the Fitness Registry and Importance of Exercise National Database (FRIEND). Data were analyzed via Pearson correlations. **RESULTS:** CRF was inversely related with central systolic BP (cSBP, $r = -0.330$), central pulse pressure (cPP, $r = -0.255$), AIx % ($r = -0.366$), AIx% HR75 ($r = -0.474$), brachial systolic BP (bSBP, $r = -0.227$), and brachial pulse pressure (bPP, $r = -0.172$) (all, $p < 0.05$). cSBP ($r = -0.412$), cPP ($r =$

= -0.249), AIx % ($r = -0.202$), AIx % HR75 ($r = -0.292$), and bSBP ($r = -0.320$) were correlated with FRIEND percentiles (all, $p < 0.05$) whereas bPP ($r = -0.131$) was not ($p > 0.05$). **CONCLUSION:** Our findings demonstrate that more ideal measures of vascular hemodynamics are correlated with higher CRF in middle-age and older adults. These data support the notion that vascular hemodynamics may be a potential modulator in the inverse relationship between CRF and CVD in apparently healthy adults.

2886 Board #347 May 29 10:30 AM - 12:00 PM
Associations Of Fitness, Physical Activity, And Fatness With A New Index Of Endothelial Function

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Reported Relationships: **K.J. Stewart:** Industry contracted research; *ordex, Inc.*

Current methods for assessing endothelial function, an early marker of cardiovascular disease (CVD), are either invasive or use noninvasive methods that are highly operator dependent or require nonreusable expensive probes, thereby limiting their use for CVD risk prediction. **Purpose:** To assess the relationship of fitness, physical activity (PA), and fatness, each a CVD risk factor, with a novel measure of endothelial function. **Methods:** This was a cross-sectional data analysis in adults recruited for a study examining the clinical utility of a new device that measures endothelial vasodilator function using a standard BP cuff. The resulting EnDys score is derived from direct calibrated measurements of brachial arterial compliance throughout the entire transmural pressure curve during a staged cuff release after 5 minutes of upper arm occlusion. A higher score means better endothelial function. Fitness was assessed by a 6-minute walk test (6MWT). Self-report of PA was assessed by the Rapid Assessment of Physical Activity tool. Body mass index (BMI) was used as a marker of general fitness and waist circumference (WC) as a marker of abdominal fatness. **Results:** In all 153 subjects, 51% were female, 7% were smokers, 7% had CVD, and 10% had type 2 diabetes. The mean \pm SD for age was 49.3 ± 17.2 , EnDys was 80.8 ± 30.4 , BMI was 29.3 ± 6.9 kg/m², WC was 37.5 ± 6.7 inches, and 6MWT was 495.4 ± 113.5 meters. EnDys was higher in females, 87.6 ± 30.5 , vs males, 73.8 ± 28.9 , $p < 0.01$. EnDys did not differ by being sedentary, 80.8 ± 27.6 , or active, 81.0 ± 33.0 , $p = 0.97$. Using bivariate analysis, a lower EnDys was associated with higher BMI, $r = -0.23$, higher WC, $r = -0.33$, lower 6MWT, $r = 0.32$, and older age, $r = -0.20$, all $p < 0.02$ or less. In a multivariate model, 6MWT ($\beta = -0.06$, $p < 0.01$), WC ($\beta = -1.02$, $p < 0.02$), and sex (female, $\beta = 6.9$, $p < 0.01$) were each independently associated with EnDys. There were no interactions for sex with 6MWT and WC. **Conclusion:** Among measures of fitness, PA, and fatness, and in both sexes, a lower walking distance and a higher waist circumference were each independently associated with a lower EnDys, indicating worse endothelial function. A next logical step is to assess if EnDys improves with interventions like exercise and weight loss, thereby providing a novel and relatively simple way to track progress towards CVD risk reduction.

2887 Board #348 May 29 10:30 AM - 12:00 PM
Baroreflex Sensitivity And Autonomic Modulation In Elders With Hypertension Undergoing Lifestyle Interventions: Secondary Outcomes Of The Hael Study

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PURPOSE: Hypertension affects more than 60% of older individuals and is associated with reduced baroreflex sensitivity (BRS). Lifestyle interventions, such as exercise, are recommended to promote healthy aging. Exercise training improves autonomic modulation and BRS in varied populations but not in patients with severe autonomic dysfunction. Due to the scarcity of the literature in the context of older adults with hypertension, we aimed to evaluate BRS and autonomic modulation of elders exposed to lifestyle interventions. Our hypothesis was that the exercise intervention would be superior to a health education program in improving these variables. **METHODS:** In a secondary outcome analysis of the HAEI Study (NCT03264443), 34 older adults (mean age 67.7 ± 7.0) with hypertension (mean blood pressure $142.3 \pm 22.5/78.8 \pm 12.6$ mm Hg) and in use of anti-hypertensive drugs were randomized to one of two 12-week interventions: EXERCISE (a 3 days/week⁻¹, moderate-intensity, 1h-long, combined exercise program based on walking/running and body-weight/elastic bands resistance exercises) and EDUCATION (a weekly health education program based on hypertension management). BRS, frequency-domain indexes

of blood pressure and heart rate variability and time-domain indexes of heart rate variability were calculated pre and post interventions through a continuous beat-to-beat blood pressure signal acquired with a sampling rate of 1000Hz.

RESULTS: Baseline values for BRS were 16.7 ± 5.3 ms.mm Hg⁻¹ for EDUCATION and 16.5 ± 9.3 ms.mm Hg⁻¹ for EXERCISE. BRS change from baseline and respective 95% confidence intervals were $+0.1$ (-4.7 to $+4.9$) ms.mm Hg⁻¹ for EDUCATION and $+1.4$ (-1.5 to $+4.4$) ms.mm Hg⁻¹ for EXERCISE ($P = 0.53$). No differences were found in frequency-domain indexes of blood pressure variability and heart rate and time-domain indexes of heart rate variability.

CONCLUSIONS: In elders with hypertension, no changes in BRS or autonomic control were induced by 12 weeks of either health education or exercise training. These subjects might present some degree of blunted responsiveness to interventions with characteristics similar to what we proposed in relation to autonomic control modulation.

2888 Board #349 May 29 10:30 AM - 12:00 PM
Exercise And Spirulina Maxima Improve General Fitness And Blood Lipids In Obesity: A Randomized Trial

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ABSTRACT

Cardiovascular diseases are part of the highly preventable chronic diseases associated with changes in lifestyle. Within them, physical activity, low-fat & high-fiber diets are distinguished as the main support for prevention, even when supplementation with nutraceuticals has become a very common practice.

PURPOSE: A systematic physical exercise program and *Spirulina maxima* (*S. maxima*) intake have beneficial effects on general fitness and blood lipid profile in overweight and obese men. **METHODS:** Fifty-two young sedentary men with excess body weight (Body mass index [BMI] ≥ 25 kg·m⁻²) were enrolled in a randomized-crossover controlled trial [six weeks of a systematic physical exercise with *S. maxima* or placebo supplementation (4.5 g·day⁻¹)]. Maximal oxygen uptake (VO_{2max}), BMI, blood lipid profile (total cholesterol [TC], triglycerides [TG], low-density lipoproteins cholesterol [LDL-C], high-density lipoproteins cholesterol [HDL-C]), and their correlations were determined pre/post intervention. **RESULTS:** After the study, obese subjects showed statistical differences ($p < 0.01$, basal vs. final) in BMI (33.3 ± 3.8 vs. 30.1 ± 4.9 kg·m⁻²), VO_{2max} (30.8 ± 5.6 vs. 34.7 ± 6.2 mL·min⁻¹·kg⁻¹), and blood lipids (mg·dL⁻¹): TC (218 ± 30 vs. 184 ± 33), TG (150 ± 46 vs. 127 ± 35), LDL-C (158 ± 31 vs. 122 ± 34), and HDL-C (32.5 ± 10.9 vs. 38.6 ± 9.6). Moreover, according to the correlation analysis ($p < 0.01$), in the exercise and *S. maxima* supplementation group, BMI decrease as VO_{2max} increase ($r = -0.492$), TC and LDL-C decrease linearly ($r = -0.798$), finally, while LDL-C levels decrease, HDL-C increases ($r = -0.690$). **CONCLUSION:** These results indicate that the *S. maxima* supplementation could be acting in a synergistic way with exercise due to the enhanced effects on body composition, cardiorespiratory fitness, and blood lipid profile, this phenomenon should be considered to reduce risk of cardiovascular disorders.

The study protocol was approved by the Autonomous University of Ciudad Juarez review board (Bioethics Committee Code: CBE.ICB/062.09-15) and carried out following the declaration of Helsinki, and the trial was registered at clinicaltrials.gov (Trial ID: NCT02837666).

2889 Board #350 May 29 10:30 AM - 12:00 PM
Exercise And Detraining Change Lipid Profile In Older Women?

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Exercise in older adults results in very important benefits to health and quality of life. Low cardiorespiratory capacity, high cholesterol (HCHOL) and high triglycerides (HTRIG) are three of the mayor risk factors for cardiovascular diseases that can be improved with regular exercise.

PURPOSE: Would regular exercise (RE) and detraining (DT) promote different effects in total cholesterol, triglycerides and cardiorespiratory capacity of older women with or without lipid disorders (HCHOL and HTRIG)?

METHODS: Seventeen older women with HCHOL and HTRIG were recruited for the lipid disorder group (LDG) and twenty-three older women without HCHOL and HTRIG were recruited for the no lipid disorder group (CG) (LDG: n = 17, 68.7 ± 2.1 years; CG: n = 23, 69.4 ± 3.7 years). Booth groups followed a nine-month multicomponent exercise program before a three-month detraining period. Cardiorespiratory capacity was assessed through 6-min walk test (6MWT), and total cholesterol (TCHOL) and triglycerides (TG) blood sample were assessed in accordance with the procedures of Diabetes Atlas Committee. All assessments were conducted before and after the exercise program and after three months of detraining. Mixed-model ANOVA was used to examine differences within and between groups.

RESULTS: In booth groups RE promoted declines in TCHOL (LDG: -7.93%, $p < 0.01$; CG: -9.12%, $p < 0.01$), TG (LDG: -10.89%, $p < 0.01$; CG: -11.14%, $p < 0.01$) and 6MWT (LDG: 10.87%, $p < 0.01$; CG: 12.39%, $p < 0.01$), and DT led to negative effects on TCHOL (LDG: 5.81%, $p < 0.01$; CG: 7.8%, $p < 0.01$) and TG (LDG: 9.41%, $p < 0.01$; CG: 9.07%, $p < 0.01$), and 6MWT (LDG: -4.78%, $p < 0.01$; CG: -6.20%, $p < 0.01$).

CONCLUSIONS: Three months of DT are enough to reverse the benefits of exercise in TCHOL of non-lipid disorder older women, and regular exercise in older women with lipid disorders promotes benefits in cardiorespiratory capacity, TG and TCHOL with lower impact compared to older women without this disorders but are strong enough to be retained after three months of DT.

2890 Board #351 May 29 10:30 AM - 12:00 PM
Functional Capacity Of Patients One Year Post Cardiac Rehabilitation

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BACKGROUND: Cardiac rehabilitation (CR) improves functional capacity (FC), quality of life (QoL), psychosocial well-being, and reduces cardiovascular risk factors using lifestyle management strategies. Despite well known benefits, little is known about the long-term effects of CR on risk factor management and changes in FC following discharge. Therefore, the purpose of this retrospective cross-sectional investigation was to examine changes in 6-minute walk distance (6MWD) 11-15 months following CR. **METHODS:** Patients referred to the UAB Cardiac Rehabilitation Program from 2016-2019 who completed 24-36 sessions and 6-minute walk tests (6MWT) at intake, discharge, and post-discharge were included in this pilot investigation. Twenty-two patients were included with the following CVD diagnoses: myocardial infarction, angina, PCI, CABG, or valve replacement. Repeated measures analysis of variance (ANOVA) was used to examine differences over time for 6MWD with least significance difference (LSD) post-hoc testing (SPSS, v25). **RESULTS:** 6MWD increased by 30% from intake to discharge (388 ± 96 m to 504 ± 123 m, $P < 0.0001$). Post-discharge walking distance (519 ± 118 m) remained higher than intake ($P < 0.0001$) but was similar to discharge ($P = 0.091$). Body weight, waist circumference, systolic blood pressure (SBP), and diastolic blood pressure (DBP) all returned to baseline intake values post-discharge. **CONCLUSIONS:** The results of this study suggest that CR may produce lifestyle and behavioral changes that promote long-term maintenance of FC. While an extensive examination of other risk factors was not performed, increases in body weight and blood pressure observed 11-15 months post-discharge are discouraging. A thorough examination of the long-term consequences of these findings with preserved FC will be needed to explore the interaction between FC and other risk factors as it relates to secondary prevention of CVD.

Sponsor: UAB Departments of Human Studies and Cardiopulmonary Rehabilitation

E-41 Free Communication/Poster - Pulmonary/Respiratory Diseases

Friday, May 29, 2020, 9:30 AM - 12:00 PM

Room: CC-Exhibit Hall

2891 Board #352 May 29 10:30 AM - 12:00 PM

Comparative Effects Of Interval Warm-up Exercise And Bronchodilator On Exercise-induced Bronchoconstriction In Children With Mild Asthma

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Purpose: Bronchodilators and interval warm-up exercise are both recommended for preventing exercise-induced bronchoconstriction (EIB). Whether interval warm-up exercise can prevent EIB to the same extent as bronchodilators is unknown but clinically very important. The purpose of this study was to compare the effects of bronchodilator and interval warm-up exercise on EIB in children with mild asthma.

Methods: Eight children (6 boys, 10 ± 1 yr) completed exercise challenge tests (target ventilation 40–60% of predicted maximal voluntary ventilation) following three conditions on separate days: control; 180µg of albuterol; and interval warm-up exercise (eight 30s cycling intervals at 80–90% of HRmax with 45s recovery between intervals). Spirometry and impulse oscillometry (IOS) were completed before; 10min after condition; and after the exercise challenge test at minutes 2, 5, 10, 15, 20, 25, and 30.

Results: Baseline spirometry and IOS were not different between the three conditions. FEV₁ was higher for bronchodilator (2.4 ± 0.4L) compared with interval warm-up (2.2 ± 0.3L) and control (2.2 ± 0.4L; $P = 0.005$). Respiratory resistance at 5 Hz (R5) was lower for bronchodilator (4.78 ± 1.03 cmH₂O/L/s) compared with interval warm-up (5.86 ± 0.96 cmH₂O/L/s) and control (5.93 ± 1.06 cmH₂O/L/s; $P < 0.001$). Only one child was diagnosed with EIB (≥15% reduction in FEV₁) after the exercise challenge test (control), one child was diagnosed with a borderline response (10-14.9% reduction in FEV₁), and five children experienced bronchodilation (Range for FEV₁ %change: 5–18%).

Conclusions: EIB was not common in this limited sample. Pre-treatment with bronchodilator was associated with more favorable changes in lung function when compared with interval warm-up exercise.

2892 Board #353 May 29 10:30 AM - 12:00 PM

Effect Of Exercise Training On Calprotectin Levels In Adults With And Without Obstructive Sleep Apnea

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Obstructive sleep apnea (OSA) causes systemic inflammation which may contribute to the progression of cardiovascular pathology. Exercise training reduces chronic inflammation in obese individuals and is recommended as a behavioral treatment of OSA. Calprotectin is a useful marker of inflammation that has been associated with OSA severity. Yet, the extent to which OSA predicts a change in systemic inflammation with exercise training is not clear. **PURPOSE:** Examine the effect of 6 weeks of exercise training on plasma calprotectin in obese adults with and without OSA. **METHODS:** At baseline, participants underwent overnight polysomnography to determine the presence and severity of OSA, as defined by apnea hypopnea index (AHI). Body fat was analyzed using dual energy X-ray absorptiometry. Blood specimens were collected and plasma calprotectin levels were determined using a commercial enzyme-linked immunosorbent assay (ELISA) kit. Body fat and blood collections were repeated upon completion of a 6 week (3 sessions/wk; 1 hr/session) moderate intensity aerobic exercise training program. **RESULTS:** Seventeen (age: 52 ± 7 years; BMI: 34.0 ± 4.1 kg/m²; 9 men: 8 women) adults completed the study. By design, the AHI of adults with moderate to severe OSA (n=7) was higher compared to those without or with mild OSA (n=10) (37 ± 13 events/hour vs. 8 ± 4 events/hour; $p < 0.001$), yet no differences in BMI, total body fat percentage or calprotectin levels were observed between the groups at baseline. While no significant change in calprotectin levels (Baseline: 74 ± 16 ng/ml vs. 6 weeks: 76 ± 19 ng/ml; $p = 0.540$) were observed following the exercise intervention, total body fat percentage was significantly reduced (Baseline: 44 ± 7%, vs. 6 weeks: 43 ± 7%; $p = 0.003$). Baseline

AHI was not associated with the change in plasma calprotectin [beta coefficient = -0.11, (95% CI -0.61 - 0.39), p=0.646] or total body fat percentage [beta coefficient = 0.00017, (95% CI -0.00005 - 0.00038), p=0.120]. **CONCLUSIONS:** Contrary to previous findings, we found no association between OSA severity and levels of plasma calprotectin at baseline. Furthermore, a six week moderate intensity aerobic exercise intervention failed to alter calprotectin levels despite decreasing total body fat. Research funded by R15HL133884

2893 Board #354 May 29 10:30 AM - 12:00 PM

Aerobic Exercise Training And Ventilation-cardiac Output Ratio In Interstitial Lung Disease And Pulmonary Hypertension

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Aerobic exercise training has been shown to elicit physiological changes in cardiorespiratory capacity in people with advanced lung disease such as pulmonary hypertension (PH) and interstitial lung disease (ILD), despite impaired pulmonary ventilation (V_E) and perfusion. **PURPOSE:** To examine whether aerobic exercise training alters the V_E/Q_c ratio in subjects with PH or ILD. **METHODS:** Twelve people with ILD (5 men and 8 women; age 56.83 ± 8.26 years; BMI 28.83 ± 5.01) and 17 females with PH (age 55 ± 8.88 years; BMI 29.97 ± 7.89 kg/m²) participated in the study. All subjects were enrolled in the National Institutes of Health Exercise Therapy for Advanced Lung Disease Trial [ClinicalTrials.gov identifier NCT00678821]. All subjects underwent cardiopulmonary exercise testing (CPET) with bioelectrical impedance measure of cardiac output (Q_c) before and after 10 weeks of supervised vigorous treadmill walking, 30-45 minutes per session, 3 times per week (24-30 sessions). **RESULTS:** V_E , Q_c , and V_E/Q_c increased with CPET work stage before and after training. There was a significant increase in peak work rate after training in both groups (PH before 106 ± 48.36 watts, after 133 ± 64.12 watts p=0.002; ILD before 135 ± 57.04 watts, after 180 ± 77.35 watts p=0.001). There were no significant differences in peak V_E , peak Q_c , and peak V_E/Q_c before and after training in either group. Similarly, significant differences were not observed at rest or at the anaerobic threshold.

	Pre V_E Peak	Post V_E Peak	Pre Q_c Peak	Post Q_c Peak	Pre V_E/Q_c Peak	Post V_E/Q_c Peak
ILD	58.45±15.75 L/min	58.04±16.68 L/min	10.27±2.27 L/min	15.02±3.64 L/min	3.89±1.00	3.92±1.01
PH	43.55±10.76 L/min	44.00±11.35 L/min	13.84±3.89 L/min	13.48±3.89 L/min	3.23±0.78	3.19±0.78

CONCLUSION: Aerobic exercise training does not appear to have an effect on the ventilation-cardiac output ratio in these subjects with PH or ILD.

2894 Board #355 May 29 10:30 AM - 12:00 PM

The Impact A 6 Week Respiratory Training Program Has On Lung Function In Cystic Fibrosis

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Purpose: To evaluate the effects that a 6-week respiratory training program had on lung function and exercise capacity in an adult with cystic fibrosis (CF). **Methods:** This case study consisted of a 6-week respiratory training program for a 33-year-old female with cystic fibrosis who had a lung function of 33%. In individuals with CF, O₂ conduction and respiratory exchange are impeded due to mucus plugging that leads to chronic infections and inflammation, airway obstructions, and decreased lung function. Forced Expiratory Volume (FEV₁), Forced Vital Capacity (FVC), and Peak Expiratory Flow (PEF) are Pulmonary Function Tests (PFTs) that are used to determine lung function in CF patients. The 3-minute Step Test (3MST) is a standardized exercise test used to predict exercise capacity and is used to evaluate pulmonary deterioration in CF. PFTs, oxygen saturation tests, and a modified version of the 3MST were conducted 48 hours pre and post the 6-week program. Training consisted of two, one hour supervised respiratory training sessions and one, unsupervised respiratory training session (18 total; 3/week). A supervised respiratory training session consisted of a 10 minutes of soft tissue work, 10-minute dynamic warm up, three 10-minute respiratory training circuits that focused on respiratory-muscle strength and endurance, and a 10-minute cool down involving diaphragmatic breathing and soft tissue massage and stretching. Outcomes were measured by FEV₁/FVC ratio (decreased FEV₁/FVC ratio have been correlated to decreased lung function and exercise capacity in CF patients), PEF, O₂ saturations, and the modified 3MST. **Results:** Following completion of the 6-week

respiratory training program, the participant showed an increase in the modified 3MST (+10 steps), an increase in oxygen saturation (+5%), an increase in FEV₁/FVC ratio (+6%), and an increase for PEF (+.9L/min). In addition, the participant's lung function increased to 37%. **Conclusions:** This case study showed that a respiratory training program is feasible for an individual with CF, and can result in improved lung function and exercise endurance. Further research is necessary to validate these results using a larger cohort, nonetheless, these results suggest that individuals with CF could benefit from a respiratory training program.

2895 Board #356 May 29 10:30 AM - 12:00 PM

Work Of Breathing Changes After Aerobic Exercise Training In Pulmonary Hypertension Or Interstitial Lung Disease

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People with pulmonary hypertension (PH) or interstitial lung disease (ILD) typically display blunted ventilatory function that include gas-exchange abnormalities, restrictive lung disorders and decreased lung compliance. With the common experience of dyspnea, exercise capacity is often severely limited in people with either PH or ILD, which may lead to physical activity avoidance and progressive deconditioning. This further exacerbates their functional capacity and decreases their health-related quality of life (HRQoL). **PURPOSE:** To determine the effect of aerobic exercise training on the work of breathing (Wb) in subjects with either PH or ILD.

METHODS: Twenty-two subjects with PH (54.5±11 yrs., 22 females) and 14 subjects with ILD (57±9 yrs., 9 females and 5 males) enrolled in this study. All were participants in the National Institutes of Health Exercise Therapy for Advanced Lung Disease Trials [ClinicalTrials.gov identifier NCT00678821]. Subjects completed 10-weeks of supervised vigorous aerobic exercise training (AET) with the target intensity of 70-80% of heart rate reserve, which consisted of walking on the treadmill for 30 to 45 minutes per session, 3 times per week. All subjects also performed a cardiopulmonary exercise test (CPET) on the treadmill, before and after the AET program. Wb was calculated by established algorithms [Men: $Wb = 2.007 \times 10^2 \times V_E^2$; Women: $Wb = 2.007 \times 10^2 \times V_E + 5.355 \times 10^{-5} \times V_E^3$] using ventilatory parameters obtained during the CPET, and compared before and after AET using paired t-tests (2-tailed). Significance was determined using p<0.05.

RESULTS: After AET, peak workload and test duration (time to exhaustion) increased significantly in both groups (PH: p=0.0013, p=0.0003, respectively; ILD: p=0.0014, p<0.0001, respectively). Wb also declined after AET in both the PH (before 417.2 ± 274.5 J/min vs after 322.0 ± 179.4 J/min, p=0.016) and ILD groups (before 675.7 ± 350.9 J/min vs after 476.8 ± 266.4 J/min, p<0.001) during the last completed stage of the pre-AET CPET. A significant difference in the pre- to post-AET change in Wb was not observed between PH and ILD groups.

CONCLUSIONS: This study suggests that decrease Wb may be one of the mechanisms underlying improved exercise and physical activity tolerance following aerobic exercise training in these subjects with either PH or ILD.

2896 Board #357 May 29 10:30 AM - 12:00 PM

Exhaled-breath Temperature And Spirometer Airflow Dynamics Following Cold-water Ingestion In Healthy Subjects

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PURPOSE. Ingesting cold-water evokes decreases in spirometric indices of pulmonary function. However, given that most commercial spirometers assume an exhaled-breath temperature (EBT) of 37 °C, a cold-water-induced decrease in EBT may influence the accuracy of flow-volume measurements. Accordingly, the aims of this study were: i) to assess whether cold-water ingestion was sufficient to reduce EBT in healthy subjects; and ii) to model the influence of EBT on pneumotachograph airflow dynamics. **METHODS.** Ten healthy, recreationally-active adults (5 male, 5 female), with normal pulmonary function, volunteered to participate (age=36±7 y; mass=87.4±31.8 kg; stature=1.74±0.8 m). In a randomized crossover design, subjects consumed either 1000 mL of refrigerated water (2.1±0.64 °C) or water at room temperature (19.4±0.5 °C), with exhaled-breath temperature assessed (via the

tidal breathing method) at baseline and at 5, 10, 15, and 30 min post-ingestion. The influence of exhaled-breath temperature on the measurement characteristics of a non-heated pneumotachograph, was modelled using computational fluid dynamics (CFD). **RESULTS:** Baseline EBT was not different between the two conditions (33.8 ± 0.4 vs. 33.7 ± 0.5 °C; $p=0.269$, $d=0.25$). Following the ingestion of cold-water, EBT fell below baseline and remained so until the final measure at 30 min ($p<0.01$). When compared to water at room temperature, EBT was significantly lower following the ingestion of cold-water at 5 min (31.7 ± 1.1 vs. 33.0 ± 0.9 °C; $p<0.001$, $d=1.34$), 10 min (32.6 ± 0.6 vs. 33.2 ± 0.6 °C; $p<0.001$, $d=1.06$), and 15 min post-ingestion (32.5 ± 0.6 vs. 33.3 ± 0.5 °C; $p<0.001$, $d=1.46$). A mean decrease in EBT of 2.1 °C (as observed acutely following cold-water ingestion) was modelled to under-predict flow by 0.84% and volume by 0.78%. **CONCLUSIONS:** Cold-water reduces exhaled-breath temperature for at least 30 min post-ingestion, and to a greater extent than water at room-temperature. The mean decrease in EBT resulted in a negligible effect on calculated flow-volume variables. Accordingly, a measured change in lung function that follows cold-water ingestion likely has a physiological explanation which warrants further study. These data may also have implications for the clinical assessment of EBT in monitoring pathological processes of the airway.

E-42 Free Communication/Poster - Pediatric Exercise Oncology

Friday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

2897 Board #358 May 29 9:30 AM - 11:00 AM

Referral Patterns And Barriers To Physical Rehabilitation For Children And Adolescents With Cancer Across Canada

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Two thirds of children who have been diagnosed with cancer will develop at least one chronic or long-term adverse effect of cancer treatment, many of which are amenable to physical rehabilitation (PR). PR may help reduce the burden of cancer side effects; however, research suggests few childhood cancer survivors access PR services. **PURPOSE:** To explore PR referral patterns and barriers to service provision for children and adolescents with cancer across Canada. **METHODS:** A cross-sectional web-based survey in English and French languages was conducted. Participants identified were Canadian healthcare professionals (HCPs) who provide and/or refer children and adolescents with cancer to PR services. The survey gathered data on numbers of childhood cancers either seen or referred to PR, reasons that prompted referral to PR, and existing barriers and facilitators to PR programs. **RESULTS:** A total of 54 responses were received including physical therapists ($n=27$), nurse and nurse practitioners ($n=10$), pediatric oncologists and oncology residents ($n=9$), occupational therapists ($n=6$), a speech-language pathologist ($n=1$), and an exercise professional ($n=1$). Data indicate that approximately 25% of children with cancer are being referred to PR, suggesting less than optimal referral rates. While 70% of HCPs report referring children and adolescents to PR services; the primary reason for referral is when the child presents with, or is at risk of functional disability. Chemotherapy-induced peripheral neuropathy (CIPN) was the second most common reason for referral to PR services (63%), and was identified by survey respondents as a rehabilitation research priority. The existence of a multidisciplinary team (52%), as well as the availability of PR space and equipment (33%) were the most commonly reported facilitators by the oncology medical team; while barriers to service provision included a lack of staffing (24%) and specialized PR services (17%). **CONCLUSIONS:** The survey results demonstrate that gaps in the health system such as limited resources and specialized services exist, that impact the implementation of PR programs. Results from this survey have informed the design of upcoming research investigating the feasibility and effects of an early PR program in children at risk of developing CIPN. No funding was received.

2898 Board #359 May 29 9:30 AM - 11:00 AM

Feasibility And Validity Of Actiheart In Hospitalized Children With Cancer Coadmitted With Classmates

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The combination of cancer treatment, lack of physical activity, and subsequent reduced energy expenditure causes reduced physical fitness in children with cancer. Valid measures of children's day-to-day activity levels are therefore warranted. **PURPOSE:** We investigated the feasibility of the Actiheart-monitor to determine total daily energy expenditure (TDEE) and the validity of the Actiheart-step-test as an accurate estimate of peak oxygen uptake. **METHODS:** VO₂peak was estimated with The Actiheart-step-test and compared with a cardiopulmonary-exercise-test. TDEE was measured using the Actiheart-monitor on days with and without classmate co-admission. **RESULTS:** Of 26 eligible measurement periods (15 children), 89% participated, 91% could participate safely, however, 35% fulfilled demands for valid monitoring. The percentage of children not completing the monitoring period was 10% (attrition) and adherence to classmate-visits was 84%. Forty eight percent of the measurement periods provided data, and only 27% was calibrated data. Actiheart-step-test significantly overestimated VO₂peak (95% CI 8.2 to 19.7 mL/kg/min, $p<0.001$) compared with CPET. **CONCLUSIONS:** Measuring TDEE using Actiheart is not feasible nor implementable in children with cancer. Further, the-Actiheart-step-test is not a valid test to estimate VO₂peak in children with cancer.

2899 Board #360 May 29 9:30 AM - 11:00 AM

Exercise Is Medicine: Need To Improve Exercise Prescriptions In Pediatric Oncology To Help Female Survivors

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PURPOSE: About 65% of childhood survivors who were exposed to chemotherapeutic agents during treatment suffer from multiple late adverse effects. Even though both males and females were treated with chemotherapy during their cancer, the distinction between them is not always taken into consideration in an exercise oncology context. This study aims to assess cardiorespiratory fitness and moderate to vigorous physical activity (MVPA) of survivors in comparison to healthy participants. Genetic associations with cardiorespiratory fitness levels were reported to provide a better understanding of how physiological parameters differ in both males and females, and to find out whether gender and genetic parameters have an impact on their cardiorespiratory fitness.

METHODS: Germline variants in a selected set of genes were analyzed for an association with cardiorespiratory fitness. Whole-exome sequencing in survivors ($N=239$) was performed. Cardiorespiratory fitness and MVPA data were compared between childhood ALL survivors ($N=221$) and healthy participants ($N=825$). Additional analyses were performed to study the physiological differences between males and females.

RESULTS: We found that female survivors (27.7 ± 6.7 mL·kg⁻¹·min⁻¹) were more affected than males (36.8 ± 7.1 mL·kg⁻¹·min⁻¹) by low cardiorespiratory fitness. For a clinically equivalent level of MVPA, cardiorespiratory fitness was significantly lower in female survivors (27.7 ± 6.7 mL·kg⁻¹·min⁻¹), compared to healthy females (37.0 ± 7.6 mL·kg⁻¹·min⁻¹). Female survivors' physical deconditioning seems to increase with age. Female survivors have significant genetic associations between their cardiorespiratory fitness and their trainability genes (*LEPR*, *IGFBP1* and *ENO3* genes) that play an important role in the functioning of their skeletal and cardiac muscles. **CONCLUSIONS:** Female survivors are at higher risk than males to have an impairment in their cardiorespiratory fitness and represent at-risk patients in regard to their genetic dispositions. The promotion of physical activity needs to be encouraged through the care system with the involvement of health care professionals in pediatric oncology. An evidence-based medicine approach is essential to help females to improve their cardiorespiratory fitness through physical activity.

2900 Board #361 May 29 9:30 AM - 11:00 AM

Benefits On Cancer-related Fatigue In Children After Exercise Training: Results From The Randomized, Controlled Mucki-trial

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PURPOSE: Cancer-related fatigue (CRF) is recognized as one of the most distressing side effects in children suffering from cancer. In adult cancer patients, specific exercise training has revealed positive effects on muscular and aerobic capacity, which has been associated with benefits on CRF and health-related quality of life. However, in children with cancer, the evidence level of beneficial exercise programs is sparse. Within the “Effects of Combined Resistance and Endurance Training in Pediatric Cancer Patients During Intensive Treatment Phase (Mucki)-trial” training effects on CRF were evaluated.

METHODS: In this randomized, controlled trial, childhood cancer patients aged between 4 and 18 years were enrolled during intensive cancer treatment phase. Individuals within the exercise group (EG) participated in supervised exercise training. Training was focused on child adapted playful, moderate intense resistance and endurance exercises and took place 3 to 5 times weekly over a period of 6 to 8 weeks. Individuals of the control group (CG) received usual care. Children’s pre- and post-interventional CRF levels were evaluated by the children themselves and separately by their parents using the „PedsQLTM 3.0 Multidimensional Fatigue Scale”.

RESULTS: In total 14 patients were included in the EG (mean age 10.8 ± 4.2y) and 15 in the CG (mean age 11.5 ± 5.2y). Children in the EG reported less fatigue post- than pre-intervention ($p = 0.026$; $d = 1.11$). In the CG were no pre-post differences ($p = 0.969$). Group-time-interaction of children’s reported fatigue level was not significant ($F(1,10) = 1.061$; $p = 0.327$). Parents reported favoring effects for their children’s fatigue level in the EG in the group-time-interaction ($F(1,13) = 8.353$; $p = 0.013$; $\eta_p^2 = 0.391$).

CONCLUSIONS: The present results show benefits on CRF in the EG. It is known, that the majority of childhood cancer patients report to suffer from CRF. Mental, physical and social wellbeing might be affected by CRF. So far, there is no gold-standard treatment against CRF. Adapted exercise programs have been getting attention only since recently in pediatric cancer. The present findings support further elaboration and implementation of adapted exercise offers in pediatric oncology.

2901 Board #362 May 29 9:30 AM - 11:00 AM

Safety Of Exercise Testing In Long Term Survivors Of Pediatric Cancer Exposed To Anthracyclines

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Survivors of pediatric cancers are at risk for long-term cardiac complications, often due to a history of treatment with anthracyclines. Current recommendations for these survivors include significant exercise restriction, despite a lack of data on exercise safety. **PURPOSE:** Determine the burden of arrhythmia and/or evidence of ischemia provoked by standardized exercise stress testing in long-term survivors of pediatric cancer treated with anthracyclines. **METHODS:** Cardiopulmonary exercise testing (CPET) was performed in 20 subjects (mean age 23.0 ± 9 yrs; mean BMI 26.3 ± 7; 55% male). The 12-lead exercise EKG was evaluated for arrhythmia and ischemia at baseline, exercise, and recovery segments of the CPET. Anthracyclines mean dose was 266 ± 119 mg/m² with last dose of chemotherapy occurring 5 years ago or later. **RESULTS:** Subjects had normal left ventricular function determined by cardiac MRI (mean ejection fraction 56% ± 8). Mean VO₂ was 32.6 ± 9 mL/Kg/min. No sustained atrial or ventricular arrhythmias or ischemic changes were observed in this sample. Isolated premature atrial contractions (PACs) and premature ventricular contractions (PVCs) existed in 8 of the 20 subjects with 1 demonstrating PVCs at baseline, 6 with PVCs or PACs late in exercise, and 4 with PVCs or PACs in recovery. **CONCLUSION:** CPET revealed safe in a small sample of long-term survivors of pediatric cancer exposed to high-dose anthracyclines with normal heart function. A greater sample size with consistent results could help providers promote physical activity in this population.

2902 Board #363 May 29 9:30 AM - 11:00 AM

Associations Between Fitness And Cardiovascular Disease In Childhood Cancer Survivors: A St. Jude Lifetime Cohort Study

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Progress in biology and therapy for pediatric malignancies has resulted in dramatic improvement in survival in children with cancer. Unfortunately, childhood cancer survivors are at an increased risk for late mortality and morbidity. Physical fitness may mitigate the risk of chronic disease within childhood cancer survivors. **PURPOSE:** To evaluate the associations between baseline physical fitness and the onset of chronic cardiovascular disease in childhood cancer survivors. **METHODS:** Survivors of childhood cancer ($n=501$, mean ± SD age: 35.5 ± 8.2 years, 47.3% male) underwent a baseline, self-limited graded exercise test to assess peak maximal oxygen consumption (VO_{2peak}). Quartiles of fitness were calculated from the percentage of age and sex predicted VO_{2peak}. Moderate to severe chronic cardiovascular disease (grade 2-4) was assessed at baseline and during a follow-up period (3.6 ± 1.0 years) using the Common Terminology Criteria for Adverse Events (CTCAE) v. 4.03. A multivariable Cox-proportional hazard regression was used to examine the risk of developing cardiovascular disease. **RESULTS:** Survivors within the lowest quartile of fitness (< 60% of predicted) were at a significantly increased risk of developing cardiovascular disease compared to the survivors in the three higher quartiles of fitness (Hazard Ratio: 1.54; 95% Confidence Interval: 1.01, 2.36), adjusting for age, sex, and prevalent cardiovascular disease. Interaction between prevalent disease and VO₂ was not significant. **CONCLUSION:** Low fitness is associated with new-onset of moderate to severe cardiovascular disease regardless of previous cardiovascular disease. Importantly, survivors with the lowest fitness may benefit from increasing their cardiopulmonary fitness the most. Interventions specifically targeting cardiopulmonary fitness could help reduce future cardiovascular illness in childhood cancer survivors.

2903 Board #364 May 29 9:30 AM - 11:00 AM

Evaluation Of An Exercise Referral Programme For Young Adult Cancer Survivors In The United Kingdom

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Reported Relationships: **G. Pugh:** Consulting Fee; GP has received independent consultancy fees from Trekstock..

PURPOSE: Exercise referral programmes delivered by charity organizations have the potential to facilitate cancer survivors to be active. The purpose of this work was evaluate the uptake and effect of RENEW, a twelve-week exercise referral programme for young adult cancer survivors aged 18 to 39 delivered by Trekstock, a cancer charity based in the UK.

METHODS: The RENEW programme provides one-to-one individually tailored support from a Level 4 Cancer Rehabilitation qualified gym instructor, free gym membership and access to information resources online. Objective and self-report data on cardiorespiratory function, flexibility, fat mass, muscle mass, fatigue, sleep quality and general health-related quality of life (HRQoL) was collected from participants before the programme (week 0), immediately after (week 12) and one month later (week 16).

RESULTS: Ninety-eight RENEW referrals were made between August 2018 and May 2019, 76 young adults with cancer initiated the programme with 48 young adults (83% female; mean age 29 yrs; 73% off active treatment) consenting to participate within the evaluation. The predominant cause of programme drop-out was illness or treatment complications. Physical activity (PA) levels significantly increased following the programme and remained raised at follow-up. Improvements in physical function were significant: peak expiratory flow (mean change: 30.96, $p=0.003$), sit-and-reach test (mean change: 6.55±4.54, $p<0.0001$), and six-minute-walk-test (mean change 0.12±0.04, $p<0.0001$). Significant improvements in fatigue, sleep and HRQoL were observed across the programme and at follow-up (mean change W0-W16; 8.04±1.49; 1.05±0.49; and -0.9±0.46 respectively, $p<0.05$). Changes in self-efficacy to exercise and motivations to exercise were not observed at 12 weeks or at follow-up.

CONCLUSIONS: Results suggest that the RENEW exercise referral programme has a positive effect upon young adult cancer survivors’ physical function, PA levels, HRQoL and well-being. Health professionals and charitable bodies specialising in the care of young adults with cancer should look to address factors (including gender and treatment status) which prevent engagement and uptake of ‘real-world’ PA interventions such as the RENEW programme.

E-43 Free Communication/Poster - Symptom Research in Exercise Oncology

Friday, May 29, 2020, 9:30 AM - 12:00 PM
Room: CC-Exhibit Hall

2904 Board #365 May 29 9:30 AM - 11:00 AM Long-Term Favorable Effects Of Physical Exercise On Burdensome Symptoms In The Optitrain Breast Cancer Trial

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(No relevant relationships reported)

PURPOSE: Patients with breast cancer report multiple burdensome physical and psychological symptoms during and after adjuvant chemotherapy treatment which can be grouped into symptom clusters. Little is known about the impact of physical exercise on symptom clusters; therefore, we aimed to evaluate the effects of exercise in patients with breast cancer during chemotherapy on longitudinal changes in symptom clusters and core burdensome symptoms. **METHODS:** In the Optitrain trial, 240 patients treated with chemotherapy with stage I-IIIa breast cancer were randomized to 16 weeks of supervised resistance exercise and high-intensity aerobic interval training (RT-HIIT), moderate-intensity aerobic and high-intensity aerobic interval training (AT-HIIT), or usual care (UC). Symptom clusters were composed from self-reported symptoms using the Memorial Symptom Assessment Scale (MSAS), assessed at baseline, 16 weeks (post intervention) and at 12 months after baseline. Principal component analysis was used to form three symptom clusters. Core burdensome symptoms were defined as individual symptoms present in the respective symptom clusters at 16 weeks and 12 months in all groups. **RESULTS:** Three symptom clusters were identified: 'emotional', 'treatment-related toxicity' and 'physical', with core burdensome symptoms that remained stable over time. At 16 weeks post-baseline, the reported burdens of 'feeling sad' (RT-HIIT vs UC: Effect Size [ES] = -0.69 AT-HIIT vs UC : ES = -0.56) and 'feeling irritable' (ES = -0.41 RT-HIIT, ES = -0.31 AT-HIIT) were significantly lower in both intervention groups compared to usual care. At 12 months post-baseline, the AT-HIIT group continued to have significantly lower scores for the core burdensome symptoms 'feeling sad' (ES = -0.44), 'feeling irritable' (ES = -0.44) and 'changes in the way food tastes' (ES = -0.53) compared to UC. No between group differences were found for physical symptoms. **CONCLUSIONS:** These findings indicate a preserved and persistent beneficial effect of physical exercise on self-reported emotional well-being in patients with breast cancer treated with chemotherapy.

2905 Board #366 May 29 9:30 AM - 11:00 AM Exercise Effects On A Symptom Cluster In Breast Cancer Survivors

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(No relevant relationships reported)

Breast Cancer Survivors (BCS) have clusters of related symptoms. One proposed treatment related symptom cluster includes fatigue, cognitive changes, depression, pain, and sleep disturbances. The continuation of this cluster and effects of exercise after treatment has not been thoroughly studied. Understanding how exercise impacts this symptom cluster will expand our knowledge of BCS and may lead to improved quality of life. Team triathlon training is a unique and effective type of exercise for this population. PURPOSE: To examine the effects of triathlon training on a treatment related symptom cluster in BCS to determine the relationships in the cluster. **METHODS:** Female BCS (n = 207) participated in one of 7 seasons of a 14-week sprint triathlon training program. Training consisted of 2 supervised and 3 unsupervised sessions per week. Baseline and Post-training measures over the years included fatigue (FACIT-F), and PROMIS questionnaires for cognition (Applied Cognition-General Concerns-Short Form), depression (Emotional Distress-Depression), pain (Pain Interference-SF), and sleep (Sleep Disturbance-SF). Except FACIT-F, higher questionnaire scores represent worse function. T-tests, including Cohen's d for effect sizes, were calculated on pre- and post-training data. **RESULTS:** Data are mean (SD). Fatigue, (pre= 38.9 (10.2), post= 46.5 (5.2), p< 0.01, d=-0.79), cognition (pre= 16.6 (7.8), post= 13.7 (6.4), p< 0.01, d= 0.42), depression, (pre= 12.0 (5.4), post= 9.9 (3.7), p< 0.01, d=0.38), and pain (pre=11.2 (4.6), post= 10.0 (4.1), p< 0.05, d=0.30) presented such that is unlikely that these means are equal over time. In contrast, it is not unlikely for sleep that the mean is equal over time (pre= 14.5 (5), post= 13.8 (3.4), p=0.25, d=0.22). **CONCLUSIONS:** Triathlon training for BCS improved all symptoms in a cluster, we only failed to reject the null for the smallest effect size presented in sleep. The effect size was medium for fatigue and small for

cognition, depression and pain. The symptoms in this cluster of fatigue, cognitive changes, depression, and pain all were present and improved, except sleep disturbances which did not improve in this group of post-treatment female cancer survivors.

2906 Board #367 May 29 9:30 AM - 11:00 AM Effect Of A 12-week Supervised Exercise Program On Anxiety And Depression In Cancer Survivors

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(No relevant relationships reported)

A life-altering diagnosis, such as cancer, and its coinciding treatments, can lead to a number of adverse side-effects in patients. Along with physiological changes, cancer-related anxiety, depression, and fatigue are common side effects of patients with cancer. The cause of such psychological side-effects can be multifactorial and difficult to treat. Exercise under the supervision of an exercise professional has been shown to reduce levels of anxiety, depression, and fatigue in patients with cancer, commonly measured using The Hospital Anxiety and Depression Scale (HADS) and the Functional Assessment of Chronic Illness- Fatigue (FACIT-F). **PURPOSE:** To determine the impact of a 12-week, supervised exercise program on levels of anxiety, depression, and fatigue in a rural population of cancer survivors. **METHODS:** Seven male (4) and female (5) cancer survivors age (59.7 ± 9.50), BMI (33.13 ± 7.88), with a variety of cancer diagnosis and treatment, participated in twelve weeks of an individualized exercise program. The exercise program included balance, resistance, aerobic and flexibility on two or three days of the week. Anxiety and depression scores were analyzed using the HADS and FACIT-F. Scores and measures were assessed by running a paired-sample t test through the Statistical Package for Social Science statistical software (SPSS) version 25. **RESULTS:** A significant change was seen in anxiety, t (8) = 3.00, p = 0.017, with anxiety being lower with exercise (M = 3.00, SD = 2.91) after 12-weeks of intervention. No significant changes were seen in depression scores, t (8) = .71, p = 0.50, or levels of fatigue, t (8) = -.14, p = 0.90. **CONCLUSION:** A 12-week supervised exercise program may help the rural cancer survivor feel less anxiety during and after treatment and help them continue their activities of daily living with more normalcy. Depression scores and fatigue levels were trending toward significance suggesting that an exercise program can help maintain these scores throughout and after cancer treatment.

2907 Board #368 May 29 9:30 AM - 11:00 AM Exploring Body Image In Breast Cancer

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(No relevant relationships reported)

Treatments for breast cancer are invasive, causing visible changes such as loss of the breast, weight gain, and hair loss. These changes in conjunction with the societal pressure for women to conform to feminine beauty ideals may lead to body image disturbance in breast cancer survivors (BCS). Exercise is a positive health strategy that has shown promise in improving body image perception in both general and cancer populations. **PURPOSE:** To determine the prevalence of body image and body weight concerns in BCS participating in an exercise program and to see if a program focussing on fitness and cancer related symptoms results in improvements in self-reported body image and body weight. **METHODS:** The study took place at Wellspring Edmonton; a nonprofit centre that offers supportive programs to meet the psychological, emotional and educational needs of individuals and families living with cancer in Canada. Participants were BCS taking part in the Alberta Cancer Exercise (ACE) Program at the Wellspring site, twice weekly for 12 weeks. Patient-reported outcomes, including questions related to body appearance and weight concerns were collected before and after the intervention. Data were analyzed to compare the proportion of women reporting issues at baseline and post-intervention. Data collection began January 2017 and ended June 2019. **RESULTS:** Eighty-six BCS enrolled and completed the ACE program (100%), with an exercise attendance rate of 84%. Twenty-five (29%) BCS reported body appearance disturbance and 42 (49%) reported issues with body weight. Significant reductions were seen post-intervention in the proportion of BCS reporting issues with both body appearance (n = 14; p<0.05) and body weight (n=31; p<0.05), representing reductions of 44% and 26% respectively. Similar to findings of previous research, no significant changes (p >0.05) were observed in BMI or body weight. **CONCLUSION:** Issues with body appearance and weight are common among BCS at our Wellspring site. Although benefit was seen in some BCS from exercise alone; given that body image can affect BCS physically, psychologically and socially, research involving a multi-disciplinary approach is warranted. Wellspring provides an ideal setting for future research involving multimodal interventions. Supported by the University of Alberta

2908 Board #369 May 29 9:30 AM - 11:00 AM
Post-exertional Malaise In People With Chronic Cancer-related Fatigue

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PURPOSE: Cancer-related fatigue (CRF) is a distressing and persistent sense of tiredness or exhaustion that interferes with usual functioning. Chronic CRF continues long after the completion of curative cancer treatment. Post-exertional malaise (PEM) is the worsening of symptoms after even minor physical, mental or emotional exertion. PEM has been inadequately investigated in people with chronic CRF. The purpose of this study was to identify and describe self-reported incidences of PEM in a group of people with chronic CRF.

METHODS: Participants ($n=18$) were eligible if they scored ≤ 34 on the Functional Assessment of Chronic Illness Therapy - Fatigue scale, had a cancer-related onset of fatigue and ≥ 3 months since completion of curative cancer treatment. Participants completed a brief questionnaire to assess PEM over a 6-month time frame (the DePaul Symptom Questionnaire - Post-Exertional Malaise; DSQ-PEM). In addition, a maximal exercise test was used to investigate self-reported symptoms (via an open-ended questionnaire) after strenuous physical exertion.

RESULTS: We found preliminary evidence that a minority of people (5/18 in this sample) with chronic CRF may experience PEM. According to the DSQ-PEM, 4 participants indicated that they experienced all symptoms of a frequency (ranging from "at least half of the time" to "all the time") and severity (ranging from "moderate" to "very severe") that were indicative of PEM. Although the majority of people experienced some worsening of fatigue after maximal exercise (12/18), content analysis identified 5 people who experienced prolonged adverse consequences, including the need to reduce daily activities to account for increased fatigue, flu-like symptoms, mood disturbances and/or issues with memory/concentration.

CONCLUSION: While only a minority of people with chronic CRF may experience PEM, exercise specialists and health care professionals working with people with chronic CRF must be aware that PEM may be an issue. Symptom exacerbation after exercise should be monitored, and exercise should be prescribed to limit the potential for harm.

Supported by Canadian Cancer Society grant #704208-1.

2909 Board #370 May 29 9:30 AM - 11:00 AM
Quality Of Life Of Prostate Cancer Men Undergoing Pre-surgical Exercise Prior To Prostatectomy.

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Exercise interventions in prostatectomy patients have generally focused on the post-surgical period and enhancement of pelvic floor musculature to reduce incontinence. However, quality of life (QOL) and psychological distress are also impacted in the pre- and post-surgical period in this patient group. **PURPOSE:** To evaluate the efficacy of exercise undertaken before surgery to enhance pre- and post-surgical QOL and psychological distress in men scheduled for prostatectomy. **METHODS:** Twenty-three men with localised prostate cancer (50-73 years) scheduled for surgery were randomised to exercise (EX = 13) or usual care (UC = 10). EX underwent 6 weeks of pre-surgical exercise (resistance and aerobic) thrice weekly. Self-reported QOL was assessed using the EORTC QLQ-C30 and psychological distress using the Brief Symptom Inventory-18 (BSI-18) which includes anxiety, somatization, depression, and the global severity index (GSI). Measures were undertaken at baseline, pre-surgery, within 2 weeks post-surgery and 6 weeks post-surgery. Data were assessed for normality and analysed using two-way repeated-measures ANOVA. **RESULTS:** There were no differences between groups at baseline. Following exercise, there was a significant interaction ($p < 0.05$) for somatization with somatization increasing in EX 2 weeks post-surgery and returning to pre-training values 6 weeks post-surgery, with no change in anxiety, depression or the GSI. There was a significant time effect ($p < 0.05$) for global health, physical, role, cognitive and social function, as well as for fatigue, pain, insomnia, appetite loss and diarrhoea, with QOL generally improving over the study period. **CONCLUSION:** A pre-surgical exercise program improves components of quality of life prior to surgery, however, EX patients group had higher symptoms after surgery but then did return to pre-training level at 6 weeks post-surgery. Pre-surgery exercise may have a role in managing quality of life and psychological distress in this patient cohort.

2910 Board #371 May 29 9:30 AM - 11:00 AM
Development Of A Reference Chart For Monitoring Fatigue In Cancer Survivors In An Exercise Program

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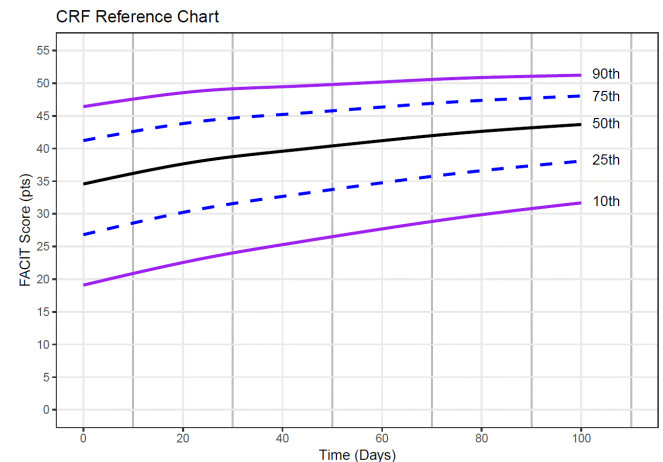
Cancer-related fatigue (CRF) is one of the most commonly reported and functionally limiting symptoms reported by cancer survivors. It is present in survivors of all cancer types, during cancer treatment, and potentially years later. Exercise is effective at reducing CRF, though currently it is not possible to predict the magnitude and time course of improvement for an individual survivor participating in an exercise program. This ability would allow providers to set meaningful, realistic goals, and track progress towards those goals, informing appropriate exercise modification.

PURPOSE: To develop a reference chart of CRF improvement for cancer survivors participating in a 3-month exercise program.

METHODS: CRF was assessed every two weeks (using the FACIT - Fatigue scale, range: 0 - 52 with lower scores indicating greater fatigue) in 173 cancer survivors participating in the BfitBwell Cancer Exercise Program, an individualized 3-month program (741 observations). No cancer types were excluded and survivors were either undergoing chemotherapy and/or radiation, or within 6 months of completing treatment. Using Generalized Additive Models for Location Scale and Shape, a reference chart for CRF was developed from the first 127 survivors and preliminarily tested for performance in the remaining 46 survivors.

RESULTS: Each survivor had an average of 4 CRF observations over the course of the program. In the test data, the reference chart demonstrated accurate coverage at each estimated centile. The 10th percentile showed steady improvement from 19 to 32 over the course of the program, while the 90th percentile improved from 46 to 51, with the majority of improvement occurring in the first month of the program.

CONCLUSIONS: This reference chart provides a novel method of monitoring CRF improvement for cancer survivors in an exercise program. Future research can investigate improvements in clinical outcomes through the implementation of the reference chart.



2911 Board #372 May 29 9:30 AM - 11:00 AM
Clinically-Measured Muscular Strength Predicts Quality Of Life And Symptom Burden In Patients With Cancer Cachexia

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Cancer cachexia is a multifaceted syndrome defined as weight loss $>5\%$ in the past six months. Weight loss is associated with decreased quality of life (QoL), increased symptom burden and a worse prognosis following a cancer diagnosis. However, evaluating muscle strength, in addition to weight loss, may help identify patients most at need for supportive care interventions in a cancer cachexia setting. **PURPOSE:** To explore the relationship between muscle strength, QoL and symptoms in patients with cancer cachexia. **METHODS:** Adults with cancer who met the criteria for cachexia and attended a cachexia clinic in Geelong, Australia were included in a retrospective analysis. Muscle strength was evaluated via maximal handgrip strength (HGS)

and 30s chair rise testing. QoL and symptoms were evaluated using the European Organization for Research and Treatment of Cancer Quality of life Questionnaire Core 15 Palliative (score: 0-100). Nutritional status was assessed using the Patient-Generated Subjective Global Assessment (PG-SGA) (score: 0-35). Data are presented as mean±SD. **RESULTS:** Overall, 187 patients (male: n=109, 58%, female: n=78, 42%) were included (BMI: 22.4±4.7 kg/m², weight loss: 12.7±7.5%). Most patients had upper gastrointestinal (n=55, 29%) or lung cancer (n=45, 24%) and metastatic disease (n=134, 72%). Weight loss did not predict overall QoL or symptoms. Chair rise repetitions and HGS predicted higher overall QoL (β : 1.36±0.32, $p<0.01$ and β : 0.45±0.19, $p=0.02$, respectively) and reduced appetite symptoms (β : -1.01±0.48, $p=0.04$ and β : -0.61±0.27, $p=0.03$, respectively). Chair rise repetitions also predicted reduced fatigue (β : -1.43±0.36, $p<0.01$), dyspnea (β : -1.53±0.42, $p<0.01$) and a lower PG-SGA score for malnutrition (β : -0.31±0.08, $p<0.01$). Further, the inability to complete a single unassisted chair rise resulted in lower overall QoL (mean difference (MD): 8.8±4.2, $p=0.04$), increased fatigue (MD: 12.0±4.7, $p=0.01$), dyspnea (MD: 11.0±5.5, $p<0.05$) and insomnia (MD: 13.7±5.8, $p=0.02$), as well as a higher PG-SGA score (MD: 3.0±1.1, $p=0.01$). **CONCLUSIONS:** Clinical measures of muscle strength may be useful screening tools in a cancer cachexia setting. Our findings support the rationale to target muscle strength, alongside weight loss, to manage QoL and symptoms in patients with cancer cachexia.

2912 Board #373 May 29 9:30 AM - 11:00 AM
Effect Of Strength Training And Antioxidant Supplementation On Perceived And Performance Fatigability In Cancer Survivors

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Oxidative stress is a well-described consequence of cancer and its treatment. Oxidative stress has also been associate with late and persistent side effects, such as metabolic impairments and cancer-related fatigue. Strength training and antioxidant supplementation attenuate oxidative stress and may improve performance fatigability. However, chronic interventions analyzing the effect of ST combined with antioxidant vitamins on perceived and performance fatigability in breast cancer survivors (BCS) are scarce.

PURPOSE: To investigate the effect of strength training combined with vitamin C and E supplementation on perceived and performance fatigability in BCS.

METHODS: Twenty-five breast cancer survivors were enrolled in this double-blinded placebo-controlled study. BCS were randomly assigned to one of two groups: Antioxidant (AG; n = 12; 51 ± 9 years; 68.08 ± 10.57kg; 1.61 ± 0.07m); or Placebo (PG; n = 13; 48 ± 8 years; 70.45 ± 9.92kg; 1.58 ± 0.05m) groups. Both groups participated in a 10-week strength training protocol, twice a week, containing six exercises. AG was supplemented with vitamins C (500mg/day) and E (400UI/day) and PG with polydextrose (1g/day). At the beginning and at the end of training period, perceived fatigue was assessed using two dimensions of MFI-20 (general fatigue - GF; and physical fatigue - PF). Also, performance fatigability was assessed using one set of 30 maximal isokinetic knee extension at 120°/s-1. A two-way mixed model ANOVA was used for the analyses.

RESULTS: After the 10-week strength training protocol, GF reduced significantly in both AG (10.58 ± 3.78 to 7.58 ± 3.63; $p = 0.004$) and PG (12.23 ± 2.52 to 9.77 ± 3.47; $p = 0.011$). Also, PF reduced significantly in both AG (9.33 ± 4.51 to 6.33 ± 2.74; $p = 0.011$) and PG (12.00 ± 2.42 to 8.15 ± 2.58; $p = 0.001$). FI reduced significantly in both AG (52.72 ± 9.32% to 48.41 ± 7.25%; $p = 0.026$) and PG (54.22 ± 9.81 to 47.11 ± 7.20; $p < 0.001$).

CONCLUSIONS: Antioxidant supplementation does not appear to add a positive synergistic effect of the strength training on decreases of cancer-related fatigue or muscle fatigability in breast cancer survivors when compared to the placebo group. Further research is need to confirm or refute the results of this initial study.

2913 Board #374 May 29 9:30 AM - 11:00 AM
Increases In Muscular Strength Do Not Correlate With Improvements In Fatigue Severity In Cancer Survivors

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 (No relevant relationships reported)

For millions of cancer survivors, cancer related fatigue (CRF) is a severe, disruptive, and lingering aftereffect of cancer treatment. Clinical practice guidelines recommend exercise training including muscle strengthening exercises as a non-pharmacologic treatment for CRF. Yet, the relationship between improved muscle strength and CRF decline is unclear.

PURPOSE: To examine the relationship between strength gains and CRF decline in cancer survivors.

METHODS: 6 cancer survivors aged 40-73 (mean 59.5) participated in three, 60-minute, guided exercise sessions each week for 12 weeks. Sessions involved 20 minutes of cardiorespiratory training, 30 minutes of resistance training, and 10 minutes of neuromotor/balance/stretching. Participants completed baseline and follow up assessments including the Facit-F fatigue scale and estimated one rep max testing (e1rm) using the brzycki equation for chest press, latissimus pull down, and leg press. **RESULTS:** Fatigue scores increased from baseline to follow up (average=7.39%, range=1.3-13.4%). Average e1rm scores also improved following the intervention (chest press average=28.9%, range=-1.7-76.2%, latissimus pulldown average=6.4%, range=-12.2-18.3%, and leg press average=6.2%, range=-13.1-43.4%). Individual comparisons showed much variation when comparing CRF to e1m improvements, and no correlation or relationship was observed. R squared values for each strength measure compared to CRF were: chest ($r^2=0.234$), latissimus pulldown ($r^2=0.120$), and leg press ($r^2=0.017$).

CONCLUSIONS: While exercise has been shown to improve outcomes in CRF and muscular strength, early evaluation did not demonstrate a correlation between these variables in this small feasibility study. We will continue to recruit participants to further explore this relationship.

2914 Board #375 May 29 9:30 AM - 11:00 AM
Impact Of One On One 12 Week Individualized Exercise Program On Cancer Related Fatigue And Functional Capacity

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 (No relevant relationships reported)

Cancer related fatigue (CRF) is the most commonly reported side effect during and after cancer treatment. This level of fatigue can have disruptive effects on individuals' daily lives, continuing on up to 5 years post treatment. CRF is defined as a persistent feeling of fatigue that is not brought on by cognitive or physical exertion, and is not relieved by sleep or rest. Aerobic exercise is suggested to alleviate symptoms of CRF.

PURPOSE: This feasibility study examined the relationship between functional capacity and CRF. **METHODS:** Six cancer survivors (59.5 ± 11.8 yrs.) enrolled in a one on one individualized 12 week exercise program. The 6 Minute Walk Test (6MWT) and the Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F) were used to assess subjects' functional capacity and self-reported fatigue before and after the exercise intervention. Exercise sessions were completed 3 times a week for an hour. Sessions included 20 minutes of cardiorespiratory training, 30 minutes of total body strength training and 10 minutes of balance and flexibility training. 6MWT and FACIT-F were assessed at baseline (week 0) and at the final assessment (week 12). **RESULTS:** Functional capacity as measured by distance walked during the 6MWT showed a significant ($p = 0.007$) increase after exercise intervention. FACIT-F Total scores also showed a significant ($p = 0.013$) increase. **CONCLUSION:** Exercise intervention has a significant impact not only of the functional capacity of cancer survivors but their self-reported CRF.

2915 Board #376 May 29 9:30 AM - 11:00 AM

Psychological Distress In Men With Prostate Cancer Undertaking ADT: Results From A 12-month RCT

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(No relevant relationships reported)

Prostate cancer patients are subject to psychological distress which may be exacerbated for those undertaking androgen deprivation therapy (ADT) due to treatment-related adverse effects. Exercise is one strategy to counter a range of treatment toxicities in men with prostate cancer and to improve overall physical function and quality of life.

PURPOSE: To assess the effect of up to 12 months of exercise on psychological distress in men with prostate cancer on ADT.

METHODS: Of 163 men (43-90 years) with prostate cancer on ADT and undertaking a 12-month RCT of various exercise modes, 135 had psychological distress assessed using the Brief Symptom Inventory-18 (BSI-18). Patients were randomized to twice weekly impact loading and resistance training (ILRT, n=49), aerobic and resistance training (ART, n=50), and usual care/delayed aerobic exercise (DEL, n=36). ILRT was supervised for 12 months, ART was supervised for 6 months and home-based for 6 months, and DEL underwent supervised aerobic exercise in the second 6 months. The BSI-18 provides three subscales for anxiety, depression, and somatisation, as well as the global severity index (GSI) where higher scores indicate higher distress. Intention-to-treat was utilised for the analyses which included group x time repeated measures ANOVA using log transformed (ln) data.

RESULTS: There were no differences among groups at baseline. Somatisation did not change over the study period, however, there were significant interactions ($p < 0.01$) for depression, anxiety, and the GSI. In ILRT, depression was reduced at 12 months compared to baseline and 6 months (0.78 ± 1.39 vs. 1.88 ± 3.24 and 1.48 ± 2.65 , respectively), as was the GSI (3.67 ± 4.34 vs. 5.94 ± 7.46 and 4.64 ± 4.73 , respectively) with anxiety reduced compared to baseline (1.08 ± 1.54 vs. 1.98 ± 2.56). Depression and the GSI decreased in ART at 6 months but increased by 12 months, while in DEL the GSI was reduced following exercise at 12 months (3.78 ± 3.94 vs. 5.25 ± 4.22 at 6 months).

CONCLUSION: Various exercise modes (when supervised) are effective in reducing psychological distress in men with prostate cancer on ADT. As a result, supervised exercise should be prescribed to not only improve physical but also psychological health in this patient group.

F-06 Thematic Poster - Cardiovascular Health in Firefighters

Friday, May 29, 2020, 1:00 PM - 3:00 PM
Room: CC-2009

2940 Chair: Denise L. Smith, FACS. *Skidmore College, Saratoga Springs, NY.*
(No relevant relationships reported)

2941 Board #1 May 29 1:00 PM - 3:00 PM
Acute Effects Of Firefighting On Vascular Health And Blood Pressure

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Firefighting is strenuous and dangerous work. Sudden cardiac death accounts for approximately 50% of firefighter line of duty deaths. **PURPOSE:** To determine the vascular and hemodynamic responses firefighting work across different positional assignments. **METHODS:** 40 experienced male firefighters completed a coordinated fire attack in a wood frame residential structure. Responding personnel were classified based upon four separate positions (assignments), including: Outside Command, Outside Vent, Inside fire suppression and search and rescue, Overhaul. Subjects were equipped with an automated blood pressure and pulse wave analysis device for measurement of cardiovascular variables (Mean Arterial Pressure, Total Vascular Resistance, Cardiac Output, Stroke Volume, Pulse-Wave Velocity). Measurements were made before, immediately after, and 30 minutes after fire suppression activities in a single-story residential structure. **RESULTS:** Increased mean arterial pressure (MAP) measured prior to the exercise indicates an anticipatory rise in sympathetic activation across all positions (Table 1). Those performing Inside suppression/search and rescue exhibited the greatest increase in MAP across all groups, with MAP remaining elevated immediately following the training exercise and a return to baseline conditions occurring 30 minutes post training (Table 1). This group also exhibited the greatest excursion in systolic blood pressure in response to training (Pre: 130.7 ± 12.7, Post: 134.6 ± 17.3). **CONCLUSIONS:** The vascular changes evidenced during acute firefighting may play a mechanistic role in the increased risk of sudden cardiac death with firefighting. Additional research is needed to better understand how these changes are related to myocardial blood flow.

Table 1, Data are expressed as Average (SD)

	Outside Command/Pump	Outside Vent	Inside	Overhaul
Age (years)	47.0 (3.9)	33.1 (6.8)	34.0 (6.8)	37.9 (8.6)
BMI (kg/m ²)	28.5 (3.2)	27.3 (3.4)	26.9 (3.7)	27.1 (2.9)
MAP (mmHg) Pre	107.6 (10.7)	103.6 (5.7)	103.8 (9.3)	103.1 (8.5)
MAP (mmHg) Post	105.3 (10.6)	102.0 (7.9)	105.9 (9.8)	98.6 (9.5)
MAP (mmHg) 30min Post	105.1 (8.2)	99.3 (3.9)	102.3 (9.2)	97.4 (7.8)

2942 Board #2 May 29 1:00 PM - 3:00 PM

Firefighters With More Service Have Smaller Blood Pressure Surge When The Pager Sounds

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(No relevant relationships reported)

Cardiac incidents cause over 50% of LODD in firefighters (FF) and may be related to their BP responses. Also, years of service may affect FF stress and depression levels and impair overall health. Using ambulatory BP (ABP) monitoring to quantify the BP surge with alarm is a novel way to assess risk, and preliminary data showed that newer FF have higher BP surge. **PURPOSE:** To compare changes in health between FF with <10yr service (FF-10) and FF with >10yr service (FF+10) after a 6-wk Mediterranean diet & circuit training program. **METHODS:** We included 21 FF who completed a 6-wk intervention. Pre- and post-intervention testing included ABP monitoring with pager activation, a fasted clinical appt, and fitness testing. Participants wore the ABP cuff for 12-hrs, during which they were paged by a pager app (OnPage) or by emergency service dispatch. When the pager sounded, they were instructed to force an ABP reading to assess the BP surge. Average BP levels and surges were determined. Fasted visit included BP, body fat, lipid panel, and vascular health measures. Fitness test included a treadmill VO_{2peak} and a battery of other fitness tests. Participants also completed a health history form and the DASS-21 questionnaire assessing stress, anxiety, and depression. **RESULTS:** FF+10 (N=12, 45.7 ± 3yrs) had worse health and lower BP surges, but larger improvements with intervention compared to FF-10 (N=9, 36.8 ± 6.2yrs), P<0.05 for differences. FF+10 had lower HDL levels (38.3 ± 2.2 vs 57.9 ± 9.7 mg/dl), were heavier (213.1 ± 8.6 vs 205.1 ± 8.6 lbs), had higher average SBP (136.6 ± 4.8 vs 126.9 ± 3.6 mmHg) and DBP (83.2 ± 2.8 vs 75.7 ± 2.8 mmHg) levels, higher pre-alarm and post-alarm BP, but had a smaller surge in SBP (11.6 ± 3.2 vs 15.0 ± 3.3 mmHg) and DBP (4.1 ± 2.7 vs 7.3 ± 1.7 mmHg) when the pager sounded. FF+10 also had worse overall psychometric scores: higher DASS-21 (11.2 ± 5.3 vs 7.6 ± 1.3; depression 3.4 ± 1.3 vs 1.4 ± 0.3; and stress 5.4 ± 1.7 vs 3.3 ± 0.5; but similar anxiety scores 2.4 ± 1.0 vs 3.0 ± 0.9. With intervention, in FF+10 we found that BP lowered, fitness improved, and psychosocial constructs improved. **CONCLUSION:** With this subset of baseline data, we show that FF+10 have smaller BP surge, worse CV health, stress, and depression levels, but larger improvements with intervention compared to FF-10. Data confirms the importance of wellness programs for FF.

2943 Board #3 May 29 1:00 PM - 3:00 PM

Perturbations In Heart Rate And Heart Rate Variability Of Volunteer Firefighters Responding To Nighttime Calls

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(No relevant relationships reported)

Firefighters (FFs) can increase their risk of cardiovascular (CV) events >100-fold during emergency response. FF research has tended to analyze career FFs or a career-volunteer blend, while neglecting to provide specific results for the volunteer population. This leaves a gap in literature that seeks to understand the magnitude and duration of call-related perturbations. Autonomic tone (AT), measured by heart rate variability (HRV) is a non-invasive measure providing insight into CV risk and resiliency, and stress response. **PURPOSE:** To identify the magnitude and duration of changes in volunteer FFs' autonomic CV control during night time emergency response. **METHODS:** Eight male FFs (36.9 ± 12.1 years) wore monitors to track heart rate (HR) and R-R intervals from 1900-0700 on nights with, and without call response for a total of 12 calls. Data filtering preceded HRV analysis in both time and frequency domain. Data was organized into 15-minute epochs, focusing on: 15-0 (PRE) pre-dispatch, 0-15 (PC1) and 75-90 (PC2) post-dispatch, and 0-15 (WAKE) when waking without a call. **RESULTS:** Compared to PRE, increases in the LF/HF ratio were observed at both PC1 (1.784 ± 1.345, p=.014), and PC2 (1.265 ± 1.238, p=.046) η²=.505 in the call condition. PRE-PC1 comparisons showed increases in HRMEAN (43 ± 13 bpm, p<.0005, η²=.837) and HRMAX (60 ± 22 bpm, p<.0005, η²=.923) at PC1, though only HRMEAN remained elevated from PRE values at PC2 (12 ± 8 bpm, p=.005). RMSSD and HF Power (HFp) decreased at PC1 (RMSSD:16.868 ± 8.100 ms, p=.001, η²=.781; HFp: 552.057 ± 311.930 ms², p=.002, η²=.758), returning within PRE ranges by PC2. Comparisons of PC1 to normal WAKE revealed decreased HFp (234.726 ± 163.721 ms², p=.002, η²=.577) and increases in both LF/HF (6.920 ± 5.044, p=.013, η²=.556) and HRMEAN (18 ± 13 bpm, p=.012, η²=.564). **CONCLUSION:** Results from the current study show sympathetic activation and parasympathetic withdrawal at PC1 and PC2 compared to

PRE. This facilitated a rapid spike in HR to 85% of age-adjusted HRMAX. Compared to waking normally, waking for call response evokes a distinctly different response where perturbations at AT tend to persist 90-minutes. This persistent ANS imbalance may indicate physiological perturbations that could explain increased atherosclerosis and CVD risk for FFs.

2944 Board #4 May 29 1:00 PM - 3:00 PM
Prevalence Of Coronary Heart Disease Risk Factors In A Large Sample Of Southern Californian Firefighters

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Firefighters (FF) are exposed to a variety of work-related stressors that can lead to increased risk of disability and premature death. Heart attack is the primary "on-duty" cause of death in these individuals. Few studies have investigated the prevalence of the various coronary heart disease (CHD) risk factors (RF) in FF and how they are affected by age in this specific group. **PURPOSE:** 1) To determine the prevalence of CHD RF and; 2) to examine the relationship between the CHD RF and age in a large group of FF. **METHODS:** Data from 1949 male (n= 1924) and female (n = 25) FF (mean age \pm s.d. = 39.8 \pm 8.8 yr.) representing 27 departments in Southern California were used for analyses in this cross-sectional study. Apart from age, the RF selected represented those that were independent of gender. Standard statistical techniques were applied to determine CHD RF frequencies and percentages. Chi-Square Analyses with Cramer's V were used to assess the relationship between age-group and RF prevalence and to estimate effect size. **RESULTS:** Overall 70.0% of FF had exceeded at least one CHD RF threshold. High blood pressure (HBP) was the most prevalent RF (26.9%) in the 20-29 yr. age-group followed by elevated body mass index (BMI) (11.2%) and low-density lipoprotein cholesterol concentrations (LDL-C) (11.2%). By contrast, 64.4% of FF in the 50+ yr. age-group had HBP with 31.9% having elevated BMI and 30.7% with elevated LDL-C. While the percentage of FF in the 20-29 yr. age-group with ≥ 2 RF was only 9.9%, it rose to 80.5% in the 50+ yr. age-group. Other than blood glucose, moderate effect sizes were observed for relationships among age-group and the individual RF.

Percentage of FF with CHD risk factor by age group.

Risk Factor	Age Group (years)				p value	Cramer's V
	20-29	30-39	40-49	50+		
HBP $S \geq 130/D \geq 80$ mm Hg	26.9%	38.7%	47.7%	64.4%	<0.001	0.219
BMI ≥ 30 kg x m ²	11.2%	18.4%	30.8%	31.9%	<0.001	0.179
Blood Glucose ≥ 126 mg x dL ⁻¹	0.0%	0.0%	0.8%	0.3%	0.05	0.063
LDL-C ≥ 130 mg x dL ⁻¹	11.2%	22.9%	36.7%	30.7%	<0.001	0.189
METs < 8	0.0%	0.7%	2.7%	8.0%	<0.001	0.172

CONCLUSION: A sizable number of FF had multiple CHD RF. Advancing age increased the percentage of FF with multiple RF. Continued efforts must be made to reduce the number of CHD RF in this specific population who serve a vital function protecting our communities.

2945 Board #5 May 29 1:00 PM - 3:00 PM
Seasonal Changes In Cardiovascular Function, Risk Factors, And Oxidative Stress Of Wildland Firefighters

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 (No relevant relationships reported)

Wildland firefighters (WLFF) experience extreme physiological strain throughout a typical season due to intense occupational demands and consistent woodsmoke exposure. There is a rationale to indicate that accumulated physiological strain, and oxidative stress, throughout a WLFF season has the potential to negatively alter cardiovascular function and risk factors. **PURPOSE:** The purpose of the study was to examine the effects of a season on cardiovascular function, risk factors, and markers of oxidative stress in WLFF. **METHODS:** Fourteen members of a Type I interagency hotshot crew participated in the study (males: n=13, females: n=1, age: 30.1 years \pm 4.8). Pre- and post-seasonal resting measurements (May, October) were obtained for heart rate variability (lnRMSSD, lnHF, lnHF, LF:HF), pulse wave velocity (PWV), blood lipid panels (TC, TG, LDL, HDL), metabolic biomarkers (blood glucose, HbA1c), blood pressure (SBP, DBP) and blood oxidative stress (3-nitrotyrosine, 8-isoprostane). Paired samples t-tests were used to identify differences among pre-

and post- seasonal values. **RESULTS:** There were no seasonal effects observed on resting heart rate variability, PWV, 3-nitrotyrosine, 8-isoprostane, TC, TG, LDL, blood glucose, SBP, or DBP ($p > 0.05$). A significant reduction occurred in HDL (Pre: 53 mg/dL \pm 14, Post: 45 mg/dL \pm 18, $p = 0.043$) and HbA1c increased (Pre: 5.2% \pm 0.2, Post: 5.3% \pm 0.2, $p = 0.034$) from pre- to post-season. **CONCLUSION:** These data suggest a WLFF season did not impact resting markers of heart rate variability, pulse wave velocity, and oxidative stress. Alterations in metabolic biomarkers of cardiovascular risk factors (HDL and HbA1c) demonstrate unfavorable seasonal changes, suggesting that the WLFF season may increase cardiovascular risk.

2946 Board #6 May 29 1:00 PM - 3:00 PM
Metabolic And Cardiovascular Alterations During Critical Training In Wildland Firefighters

Shae C. Gurney, Katie S. Christison, Cassie M. Williamson-Reisdorph, Kathryn G.S. Tiemessen, Joseph A. Sol, Tiffany S. Quindry, Matthew W. Bundle, Charles G. Palmer, John C. Quindry, FACSM, Charles L. Dumke, FACSM. *University of Montana, Missoula, MT.*
 (No relevant relationships reported)

Introduction: Wildland firefighters (WLFF) are confronted with numerous physical and mental stressors. Pre-fire season includes an intense two-week critical training period; a preparatory phase that sometimes results in injuries, illness, and rhabdomyolysis. **Purpose:** To identify physiologic changes to oxidative stress and other metabolic biomarkers that occur during 2 weeks of critical training in WLFF. **Methods:** Eighteen male (29.4 \pm 1.1 yr, 182.1 \pm 1.6 cm) and three female (26.7 \pm 2.6 yr, 169.5 \pm 4.2 cm) participants were recruited from a Type I interagency hotshot fire crew and monitored for the duration of their two-week critical training. Subjects were asked to arrive fasted and uncaffeinated for blood draws on days 1, 4, 8, and 11. Plasma was analyzed for changes in the metabolic profile and oxidative stress markers 3-Nitrotyrosine (3-NT) and 8-Isoprostane (8-ISO). A one-way repeated measures ANOVA was used to analyze 8-ISO and 3-NT. Paired samples t-tests were used to compare metabolic biomarkers. Data presented as mean \pm SEM. **Results:** Critical training elicited a decrease in total cholesterol (173.6 \pm 12.1 to 153.4 \pm 8.6 mg \cdot dL⁻¹, $p = 0.01$), hemoglobin A1c (5.2 \pm 0.1 to 5.1 \pm 0.1 %, $p = 0.003$), hemoglobin (15.5 \pm 0.4 to 14.3 \pm 0.3 g \cdot dL⁻¹, $p = 0.003$), and estimated plasma volume (53.8 \pm 0.7 to 50.7 \pm 1.4 %, $p = 0.005$) from day 1 to 11. No difference was observed in high-density lipoprotein cholesterol. A main effect for time was observed in 8-ISO ($p < 0.001$) and 3-NT ($p = 0.033$). A significant decrease was observed in 8-ISO at day 4 and 8 when compared to day 1 (day 1: 15.5 \pm 1.3, day 4: 11.8 \pm 1.0, day 8: 12.9 \pm 1.1 pg \cdot mL⁻¹). 3-NT was significantly elevated from day 4 to day 8 (day 4: 2.4 \pm 0.6, day 8: 2.9 \pm 0.6 μ g \cdot mL⁻¹). **Conclusion:** These data suggest that the exertion required of WLFF during critical training results in positive alterations to the metabolic profile. The unexpected decreases in oxidative stress markers may reflect adaptation to the stressors of critical training, although this cannot be confirmed. Additional markers should be examined across other WLFF crews to confirm and provide further information on alterations during this two-week period.

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2947 Board #7 May 29 1:00 PM - 3:00 PM
Nutrition, Physical Activity And Cardiovascular Disease Risk Of Career Firefighters In A Low-income Area

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The majority of on-duty firefighter (FF) deaths result from cardiovascular incidents, and FF wellness is related to job effectiveness and safety. Departments in low-income communities are often unable to provide wellness programming, allowing opportunities for local universities to fill the need.

PURPOSE: To determine health and cardiovascular disease (CVD) risk of local career FF in a low-income community for use in developing ongoing wellness interventions. **METHODS:** Nutrition behavior, physical activity information, anthropometric measurements [body fat percentage (%BF), mass of body fat (MBF); waist circumference (WC); height; weight], and blood lipid levels [total cholesterol (TC); low-density lipoprotein (LDL); high-density lipoprotein (HDL); and triglycerides (TG)] were collected from a cohort of FF and analyzed. **RESULTS:** Thirty-three percent (42/127) of department members participated in the study, with even representation across unit, age, and years worked. Eighty-three percent of FF were overweight/obese, as determined by bioelectrical impedance. Similarly, 83% were at-risk or at-significant-risk for CVD by waist-to-height ratio (WTHR, 0.5-0.6 and >0.6, respectively). Segmental trunk mass of body fat (SMBF_{trunk}) was correlated with waist circumference ($r = 0.915$), and also with TC ($r = 0.167$), LDL ($r = 0.189$) and TG ($r = 0.484$), while inversely correlated with HDL ($r = -0.133$). BMI and %BF were positively correlated ($r = 0.81$). Fifty percent of FF had TC, 38% had LDL, and 45%

had TG levels which placed them at-risk for CVD. Only 33% of participants reported exercising the recommended amount (3-5 times) per week, and 36% and 14% of FF reported intake of the recommended amount of fruits and vegetables, respectively, per day. **CONCLUSION:** In a cohort of career FF in a low-income area, the majority were classified as at-risk for CVD, across multiple indices, including BMI, %BF, WC, WTHR, SMBF_{trunk}, and lipid profiles. In addition, the cohort reported unhealthy levels of fruit and vegetable intake, as well as less-than-recommended levels of physical activity. These results suggest that local FF are an at-risk population for CVD, and that there is a need for nutrition and exercise interventions to help lower the risk and increase job effectiveness in our regional first responders.

2948 Board #8 May 29 1:00 PM - 3:00 PM
Changes In Obesity And Cardiovascular Disease Risk Among Older And Younger Firefighters
 Brittany S. Hollerbach¹, Kevin C. Mathias¹, Yuchen Wu¹, Donald F. Stewart², Denise L. Smith, FACSM¹. ¹Skidmore College, Saratoga Springs, NY. ²Public Safety Occupational Health Center, Fairfax, VA.
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 (No relevant relationships reported)

Over 80% of the US fire service is overweight (BMI: 25-29.9 kg/m²) or obese (BMI≥30 kg/m²), increasing the risk for cardiovascular disease (CVD). Although age is an important CVD risk factor, it is not often examined among firefighters (FFs). Risk scores are a common tool used by medical professionals. However, no investigations have examined calculated risk scores and changes over time among FFs. **PURPOSE:** To describe changes in weight, BMI and CVD risk scores among a large cohort of younger (<45 years) and older (≥45 years) FFs over a 5-year period. **METHODS:** Age, body weight, body mass index (BMI), and calculated CVD risk scores of 672 FFs (<45: n=522; 35±6 yr; ≥45: n=150; 48±3 yr) in a large northeastern fire department were assessed during an occupational medical exam in 2009-2011 and 5 years later. CVD risk scores were calculated using the Framingham Risk Score (FRS) calculation. Descriptive statistics summarized data, logistic or linear regression models compared proportions or means, and paired t-tests were used for within subject comparisons to test for significance. **RESULTS:** At baseline, younger FFs weighed 88.5 kg with a BMI 27.9 kg/m² and FRS of 3.4. Older FFs weighed 89.9 kg with a BMI of 28.5 kg/m² and FRS of 12.1. Over the 5 years, FFs <45 yr gained (+3.0 kg) significantly more weight than those ≥45 yr (+0.8 kg; p<0.001). BMI for both groups increased significantly, +0.9±0.1 and +0.4±0.2 respectively for <45 and ≥45 yr. Significantly more (55%) FFs <45 yr gained weight compared to 38% of FFs ≥45 yr (p<0.01). However, older FFs had significantly higher (p<0.001) CVD risk scores at baseline and follow up (9.3; 12.1) than younger FFs (3.4; 4.9). Although the majority of FFs ≥45 lost/maintained body weight (62%), overall their CVD risk increased (+2.8±0.4; p<0.001). **CONCLUSION:** Although FFs cannot avoid aging, they can aggressively manage other risk factors that affect their CVD risk score including preventing weight gain. Research indicates health care providers are more likely to counsel older FFs regarding weight loss. Our findings suggest younger FFs are more at risk of gaining weight and could benefit from guidance on this important risk factor. Further efforts are needed to encourage physicians and fire departments to direct FFs to establish healthy habits early in their career.
 Supported by FEMA Grant EMW-2017-FP-PP-00445

F-07 Thematic Poster - Field Measures of Running Biomechanics

Friday, May 29, 2020, 1:00 PM - 3:00 PM
 Room: CC-2007

2949 **Chair:** Allison H. Gruber, FACSM. Indiana University
 Bloomington, Bloomington, IN.
 (No relevant relationships reported)

2950 Board #1 May 29 1:00 PM - 3:00 PM
Changes In Peak Accelerations And Shock Attenuation Over The Course Of A Marathon
 Marit A. Zandbergen¹, Jaap H. Bourke¹, Peter H. Veltink², Jasper Reenalda¹. ¹Roessingh Research & Development, University of Twente, Enschede, Netherlands. ²University of Twente, Enschede, Netherlands. (Sponsor: Brian W. Noehren, FACSM)
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 (No relevant relationships reported)

Peak tibial and peak sacral accelerations have been shown to increase during a fatiguing run. Peak accelerations are often used as a surrogate for impacts on the body during running. High tibial impacts have been linked to development of tibial stress fractures. To understand how impacts are related to injury development, we need more insight in how shocks propagate through the body, especially under the influence of fatigue.

Purpose
 To investigate bilateral peak accelerations and shock attenuation over the course of a Marathon.

Methods
 5 trained athletes (2M 3F, 33.8±11.8 years, 182.3±5.8 cm, 73.9±9.1 kg years) ran a Marathon during competition. Inertial measurement units (240Hz) were placed on the sternum, pelvis, and bilaterally on the tibia and foot. Mean peak accelerations around initial contact and shock attenuation (% decrease of peak acceleration) were calculated over 25 strides during the 2nd and 42nd km of the Marathon. Paired sample t-tests were used to test for statistical differences between the 2nd and 42nd km and between the dominant and non-dominant side.

Results
 See Table 1. Mean finish time was 4:07:40±0:19:07.

Conclusion
 Impacts and shock attenuation changed asymmetrically during a Marathon. Both side dominance and fatigue significantly influenced shock attenuation. However, on sternum level, only fatigue influenced impacts and shock attenuation, implying some sort of protective mechanism to keep proximal impacts low. The non-dominant side showed larger impacts during the whole Marathon, possibly because this side is less strong and therefore less able to actively (i.e. muscle contractions) absorb shocks. Overall, impacts increased and shock attenuation decreased towards the end of the Marathon, possibly increasing the risk of overuse injuries.

Table 1. Bilateral peak accelerations and shock attenuations for the 2nd and 42nd km of a Marathon. An asterisk (*) indicates a significant difference (p<0.05) between the 2nd and 42nd km. A superscript s (!) indicates a significant difference (p<0.05) between the non-dominant and dominant side at either the 2nd or 42nd km.

m/s ²	Peak accelerations			
	Non-dominant		Dominant	
	2km	42km	2km	42km
Foot	99.4±24.0* ^s	116.2±35.4* ^s	92.7±24.5 ^s	94.4±21.2 ^s
Lower leg	92.2±21.6* ^s	124.2±68.0* ^s	84.8±18.4 ^s	87.2±26.6 ^s
Pelvis	82.8±55.9 ^s	87.5±59.1 ^s	64.2±31.1* ^s	77.3±46.2* ^s
Sternum	25.1±11.3*	35.9±16.8*	25.9±10.0*	36.7±12.6*
% reduction impacts	Shock attenuation			
	Non-dominant		Dominant	
	2km	42km	2km	42km
Foot-Lower leg	7.3±18.4*	-6.9±49.1* ^s	8.6±19.3	7.6±21.1 ^s
Lower leg-Pelvis	10.2±22.9 ^s	29.5±35.5	24.3±16.9* ^s	11.3±32.3*
Pelvis-Sternum	69.6±19.6* ^s	59.0±43.0*	59.6±20.7* ^s	52.5±35.2*

2951 Board #2 May 29 1:00 PM - 3:00 PM
Low Accelerometer Sampling Rates Attenuate Tibial Impact Acceleration Peaks During Running
 Clare E. Milner, FACSM, Kevin G. Aubol. *Drexel University, Philadelphia, PA.*
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(No relevant relationships reported)

High tibial acceleration peaks have been associated with tibial stress fracture in runners. Field-testing with wearable wireless accelerometers is now commonplace, but some devices have a lower sampling frequency than in laboratory testing. PURPOSE To determine the influence of sampling rate on peak axial tibial acceleration and peak resultant tibial acceleration magnitude during running. METHODS As part of a larger study, 19 healthy adults were recruited (10 women; 31±6 years; 1.70±0.08 m; 68.6±11.6 kg) and provided informed consent to participate. A precision accelerometer sampling at 1000Hz was attached to the distal anteromedial aspect of the right tibia. Participants ran at 3.0m/s in the laboratory for five good trials making contact with a force plate sampling at 1000Hz. Raw data were down-sampled to 500Hz and 100Hz, common sampling rates for wearable wireless accelerometers. All data were low-pass filtered at 70Hz. Stance phase was identified by foot contact on the force plate. Peak positive axial acceleration and peak resultant acceleration were determined for each trial and averaged. One factor repeated measures analysis of variance with least significant difference post-hoc tests determined whether peaks differed among sampling rates. Effect sizes were calculated to aid interpretation of the data. RESULTS Both peak axial and peak resultant acceleration were significantly reduced when tibial acceleration was sampled at 100Hz compared to 500Hz or 1000Hz (p = 0.041). Reductions were 0.7g or about 10% of the peak magnitude at 1000Hz, a small effect. Values were stable between the 500Hz and 1000Hz sampling rates. CONCLUSION We recommend that tibial acceleration data are sampled at rates of 500Hz or greater to avoid attenuation of peaks producing erroneously low values for both peak axial and peak resultant acceleration.

Table: Mean and standard deviation of peak axial and peak resultant tibial acceleration during running when sampling data at different rates

Accelerometer Sampling Rate (Hz)	Peak Axial Acceleration			Peak Resultant Acceleration		
	Mean (SD) g	p value	Effect Size	Mean (SD) g	p value	Effect Size
100	5.4 (1.8)	< 0.01	0.36	7.4 (2.9)	0.025	0.22
500	6.0 (2.1)	0.89	0.05	8.1 (3.4)	0.93	0.00
1000	6.1 (2.1)	-	-	8.1 (3.4)	-	-

2952 Board #3 May 29 1:00 PM - 3:00 PM
Changes In Running Mechanics During A Typical Interval Training On The Track Measured With IMUs
 Jasper Reenalda¹, Emily J.C. Zoetbrood¹, Marit A. Zandbergen¹, Jaap H. Buurke¹, Brian W. Noehren, FACSM². ¹*Roessingh Research and Development, University of Twente, Enschede, Netherlands.* ²*University of Kentucky, Lexington, KY.* (Sponsor: Brian W. Noehren, FACSM)
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An 8 x 400 meter interval training is often performed with the aim of improving aerobic fitness. Besides being physiological and physically challenging this type of training is also mechanically demanding. As such it could have potential negative effects on running mechanics. Inertial magnetic measurement units (IMUs) allow for continuous measurement of running mechanics during this type of training. PURPOSE: To investigate changes in running mechanics during an 8 x 400 meter interval training on the athletic track using IMUs. METHODS: 5 trained athletes (4M 1F, 25.4±7.9 years, 185.6±8.3 cm, 69.2±12.7 kg) ran 8 x 400 meters on the athletic track. They were paced to run each 400 meter at 5 km race pace with half of the time run as rest. Eight IMUs (240 Hz) were placed at the feet, tibia, upper legs, sacrum and sternum. Accelerometer data and sensor orientation were used to calculate the following parameters using custom code after calibration trials: Hip, knee and ankle angle at Initial Contact (IC), knee angle at Midstance (MST) and Midswing (MSW), peak tibial and sacral acceleration (PTA, PSA), and centre of mass (COM) displacement. Parameters were calculated for both straights of the 2nd, 4th, 6th and 8th 400 meters. Borg scale (0-10) was asked after every bout for perceived exertion. Paired sample t-tests were used to test for statistical differences between the 2nd and 8th bout. RESULTS: Table 1 CONCLUSIONS: Running mechanics (mainly ankle and knee mechanics and tibial impact) changed over the course of a typical interval training, putting runners at higher risk with increasing bouts. This indicates that this type of training is not only

physiological and physically demanding but puts increasing mechanical stress on the body. These results suggest caution should be used among athletes returning from an overuse injury.

Table 1: Results of the 8 x 400 meters interval training on the athletic track. Mean values (± SD) are presented for the selected parameters during the 2st, 4th, 6th and 8th run. P value is given for the significance between the 2nd and 8th bout.

Bout	#2	#4	#6	#8	#2 vs #8
	Mean±SD	Mean	Mean	Mean	P value
Hip angle IC	29.7±7.4	30.0±8.2	29.8±8.0	31.2±8.4	P=0.23
Knee angle IC*	24.1±7.5	26.8±8.5	27.3±9.0	27.2±7.7	P=0.00
Knee angle at MST*	42.0±7.8	42.8±7.3	43.3±8.4	43.8±7.4	P=0.00
Knee angle MSW*	112.4±8.3	114.1±7.8	113.4±11.5	116.2±7.7	P=0.00
Ankle angle IC*	-6.2±6.5	-3.1±8.1	-1.5±9.1	-1.9±8.6	P=0.02
PTA (m/s ²)*	91.9±11.5	97.8±14.2	94.0±11.0	99.3±13.0	P=0.05
PSA (m/s ²)*	37.1±4.0	41.4±4.0	40.1±3.8	43.2±4.9	P=0.28
COM (mm)	67.7±41.7	77.8±46.8	87.7±48.9	101.3±57.1	P=0.06
Borg scale*	3	5	5	6	P=0.00

2953 Board #4 May 29 1:00 PM - 3:00 PM
Automated Gait Variability Assessment In Real-World Running Using Wearable Accelerometry
 John J. Davis, IV¹, Marcin Strączkiewicz², James McDonnell¹, Jaroslaw Harezlak¹, Max R. Paquette³, John S. Raglin, FACSM¹, Allison H. Gruber¹. ¹*Indiana University, Bloomington, IN.* ²*Harvard T.H. Chan School of Public Health, Boston, MA.* ³*Memphis University, Memphis, TN.* (Sponsor: John S Raglin, FACSM)
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(No relevant relationships reported)

Using wearable sensors to assess running gait variability may be a valuable tool to identify deterioration in performance or health in competitive and recreational runners. PURPOSE: To measure associations between gait variability and training intensity, mood state, and perceived fatigue in collegiate runners (CR) and novice/recreational runners (NR). METHODS: 30 CR wore a waist-mounted ActiGraph GT3X+ accelerometer for all non-interval and non-competition training sessions for a full season. 16 NR wore a waist-mounted GT3X+ and an on-shoe activity monitor (MilestonePod) during 13 weeks of progressive training. Subjects completed written (CR) or email (NR) daily surveys. Recently developed running and step recognition algorithms were applied to isolate running gait cycles from raw sub-second level accelerometer data. Gait variability was assessed using amplitude deviation of resultant acceleration. Associations between variability and training intensity, mood state, and fatigue were assessed with generalized additive mixed models. RESULTS: 1069 runs and 7.64 million steps were analyzed. Variability was greater in CR than NR (0.301 vs 0.262g, p=0.019). Within individual runs, variability was stable from 10-60 minutes in both CR and NR (Fig. 1). In CR, mood state was not significantly associated with variability (p=0.70). In NR, variability increased nonlinearly with average running speed (p<0.001), and a 1-point increase in fatigue on a 0-10 scale was associated with a 0.003g decrease in variability (p=0.051). CONCLUSION: A runner's gait variability may be more strongly influenced by skill level and running speed than by acute changes in perceived fatigue or mood state. Unmeasured variables, such as training surface, may also affect gait variability. Figure 1. Gait variability in CR and NR across different individual runs (top left, black dots), across different levels of fatigue (top right), and within any given run (bottom left and right, thin lines).

2954 Board #5 May 29 1:00 PM - 3:00 PM
Validity Of Peak Tibial Acceleration Using Wearable Accelerometers During Running
 Adriana Miltko¹, Taylor M. Vickery¹, Richard T. Beltran¹, Clare E. Milner, FACSM², Max R. Paquette¹. ¹*University of Memphis, Memphis, TN.* ²*Drexel University, Philadelphia, PA.* (Sponsor: Clare Milner, FACSM)
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(No relevant relationships reported)

With wearable technology becoming more popular, more companies are creating sensors to assess biomechanical parameters including peak tibial acceleration (PTA) during running. However, validity of data from wearable technology relative to "gold-standard" research-grade instruments is highly important. PURPOSE: Assess the difference in PTA obtained from wearable inertial measurement units (IMU) and a research-grade accelerometer at different running speeds. METHODS: Six participants completed 1-2min treadmill running bouts at 3.0 m/s and 4.0 m/s while

wearing standardized footwear (1080, New Balance). A research-grade tri-axial accelerometer (ACC; 1200Hz, model 356A26, PCB Piezotronics) and a 9-axis IMU (1000Hz, Blue Trident, IMeasureU) were secured to the distal tibia to capture PTA during running. The testing at both speeds was completed with the ACC below and above the IMU to account for possible position effects. Data were collected for the final 15 seconds of each running bout and the average of both positions for 10-15 peaks of axial tibial acceleration were used for analyses. Paired t-tests and Cohen's *d* effect sizes were calculated to compare instrument PTA means at different speeds. **RESULTS:** At 3.0 m/s, mean PTA was not different between ACC (5.2±1.9 G) and IMU (5.9±2.2 G; *p* = 0.33; *d* = 0.34). At 4.0 m/s, mean PTA was not different between ACC (8.5±3.7 G) and IMU (9.8±4.2 G; *p* = 0.33; *d* = 0.33). Figure 1 demonstrates the individual variability in the difference in PTA obtained from the ACC and IMU at different speeds (A) and different positions (B). **CONCLUSION:** Despite the statistically similar PTA means obtained from both instruments, the difference in PTA between ACC and IMU appears to be highly variable among individuals. This variability in PTA may be due to differences between devices, device placement, attachment method, or individual running style. This highlights the difficulty in controlling sources of variability during testing.

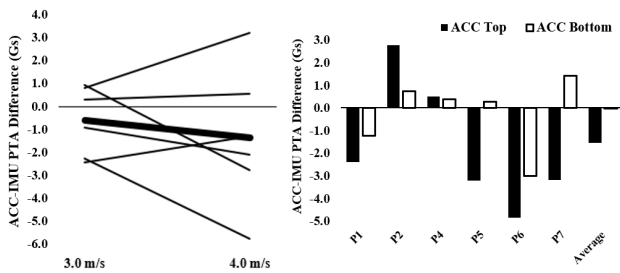


Figure 1. A) Individual and average (bold) difference of PTA between the ACC and IMU at 3.0 m/s and 4.0 m/s with sensor position pooled. B) Individual and average difference of PTA between the ACC and IMU for both positions with pooled speeds.

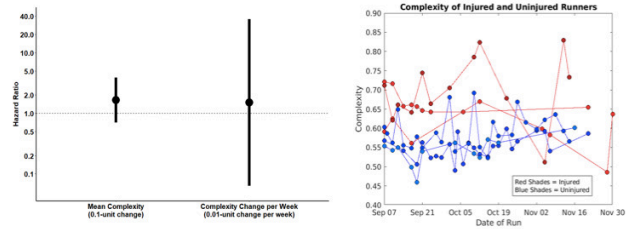


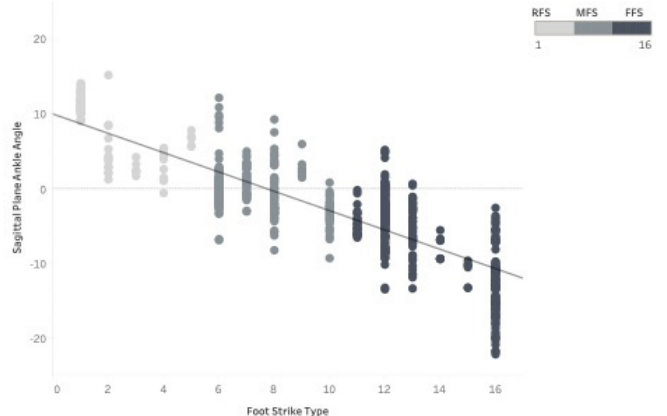
Fig. 1: (Left) Hazard ratios (error bars representing 95% CI) of the runners' average complexity across the season and the change in complexity each week across runners. (Right) Mean complexity for each week recorded during the season of exemplar injured (blue shades) and uninjured (red shades) runners.

2955 Board #6 May 29 1:00 PM - 3:00 PM
Risk Of Running-related Injury Associated With Center Of Mass Acceleration Complexity
 James McDonnell¹, John J. Davis, IV¹, Jaroslaw Harezlak¹, Max R. Paquette², Allison H. Gruber¹. ¹Indiana University, Bloomington, IN. ²University of Memphis, Memphis, TN.
 (No relevant relationships reported)

Dynamical systems theory suggests that examining the complexity of biological signals may be more sensitive in differentiating between groups of varying health status, including predicting who may develop a running-related overuse injury (RROI). This theory has yet to be tested in prospective running studies. **PURPOSE:** To evaluate if changes in complexity, quantified by mean control entropy, of center of mass (COM) resultant acceleration during running is associated with RROI development. **METHODS:** 30 collegiate runners wore an ActiGraph GTX3+ during 'easy' training runs throughout a cross-country season. Clinician-diagnosed RROI were reported via an online survey. Complexity was calculated on the resultant acceleration time series from each run. Cox proportional hazards analysis assessed injury risk as a function of the mean complexity for each runner across the season and the change in complexity per week. **RESULTS:** Seven runners sustained an injury. Across all 30 participants over the season, the mean ± 1SD complexity was 0.623 ± 0.086 units. The mean change in complexity over the course of the cross country season was -0.0014 ± 0.0043 units per week. Although not statistically significant, each 0.1-unit increase in complexity was associated with a 1.65-fold increase in injury rate (95% CI 0.70-3.89, *p*=0.30) and a 0.01-unit increase in complexity per week was associated with a 1.50-fold increase in injury rate (95% CI 0.06-35.5, *p* = 0.80). **CONCLUSION:** These preliminary findings suggest that COM complexity could at least contribute to RROI detection strategies in cross-country runners. Given these preliminary results, additional prospective studies with larger sample sizes are necessary to further assess relationships between baseline complexity and changes in complexity during running training that can be monitored with wearable technology.

2956 Board #7 May 29 1:00 PM - 3:00 PM
Relationship Between Wearable Sensor Foot Strike Outcomes And Ankle Sagittal Plane Kinematics During Treadmill Running
 Alexandra F. DeJong, Jay Hertel, FACSM. University of Virginia, Charlottesville, VA. (Sponsor: Jay Hertel, FACSM)
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 (No relevant relationships reported)

PURPOSE: Wearable sensors are capable of measuring biomechanical running outcomes. Traditional gait analyses have determined a strong relationship between ankle angle at initial contact and foot strike. However, there is currently no information available on how sensor-derived metrics of foot strike type relate to ankle sagittal motion during running as a means of validation. Therefore, the purpose of this study was to validate the sensor-derived foot strike type outcome by determining the relationship between foot strike type and ankle sagittal plane kinematics during a treadmill running analysis. We hypothesized that a rearfoot strike (RFS) would highly correlate to increased ankle dorsiflexion, while a forefoot strike (FFS) would highly correlate to increased ankle plantarflexion. **METHODS:** Twenty collegiate cross-country athletes (12 females) ran on an instrumented treadmill with 3-D motion capture at standard (2.68 m/s) and fast (3.60 m/s) speeds. Foot strike outcomes were obtained bilaterally using running wearable sensors, and sagittal plane ankle kinematics were simultaneously recorded. Pearson's *r* correlation coefficients were used to determine the relationship between sensor-derived foot strike categories (1 to 16), and ankle angles at initial contact. Dorsiflexion was defined as in the positive axis. Alpha was set a priori to .05 for all analyses. **RESULTS:** Eight hundred total steps were included for analysis. Foot strike type and ankle angles at initial contact had a strong, inverse correlation, such that a higher foot strike value was strongly related to increased ankle plantarflexion angles (*r* = -0.85, *p*<.001, Figure). **CONCLUSIONS:** Sensor-derived foot strike metrics were highly correlated to sagittal plane ankle measures, thus confirming our initial hypotheses. These outcomes support that the running wearable sensors are a valid means to assess foot strike patterns during distance running.



F-08 Thematic Poster - Methodological Advances

Friday, May 29, 2020, 1:00 PM - 3:00 PM
Room: CC-2011

2957 **Chair:** Sarah Keadle. *California Polytechnic State University, San Luis Obispo, CA.*
(No relevant relationships reported)

2958 Board #1 May 29 1:00 PM - 3:00 PM
Mixed-effects Location Scale Modeling For The Analysis Of Accelerometry Data

Whitney A. Welch¹, Donald Hedeker², Bonnie Spring¹, Juned Siddique¹. ¹*Northwestern University Feinberg School of Medicine, Chicago, IL.* ²*University of Chicago, Chicago, IL.*
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Purpose: To introduce a statistical technique, the mixed-effects location scale model, for analysis of longitudinal accelerometer-based physical activity (PA) data. This approach jointly models both the mean (location) and within-subject variability (scale) of participants' PA over time as a function of covariates, since within-person variability may be an important construct to explore in PA interventions. Random effects are included in both models to allow for subject-specific deviations beyond the effect of covariates. These random effects can be correlated. **Methods:** Participants (N=204, 77% female, age=33±11y, BMI=28.2±7.1 kg/m²) in the Make Better Choices Study were randomized to one of two activity-related intervention arms: 1) increase moderate-to-vigorous PA (MVPA) (PA group) or 2) decrease sedentary active control (SB group). Physical activity was measured by accelerometer for 5 weeks: a 2 week baseline assessment phase and a 3 week intervention follow-up phase: week 1 (rx1) and weeks 2 and 3 (rx23). The outcome MVPA min/d was analyzed using the mixed-effects location scale model in the MIXREGLS software program in STATA. **Results:** The mean model shows a significant group by time interaction (MVPA group by rx1: B=6.32 (95%CI: 3.93, 8.7) MVPA group by rx23: B=9.85 (95% CI: 7.59, 12.10)) indicating that those in the PA group had significantly greater MVPA min/d at rx1 and rx23 compared to the SB group. The PA group by rx23 interaction was significant in the within-subject variance model, suggesting that those in the PA group had significantly more variability in MVPA min/d during follow-up phase rx23 compared to the SB group. The random-location effect is positively associated with the within subject variance, participants with higher mean min/d MVPA tend to have higher min/d MVPA variability ($\tau_1=0.70$ (95% CI: 0.60, 0.80)). The scale standard deviation is significant indicating that some participant's MVPA min/d are significantly more dispersed than other participants even after adjusting for group and time effects ($\sigma_w=0.60$ (95% CI: 0.55, 0.64)). **Conclusions:** The location-scale mixed model provides a new approach for examining the mean and variability of min/d of MVPA in longitudinal data. To demonstrate, we applied this model to a randomized controlled trial to increase PA in inactive adults.

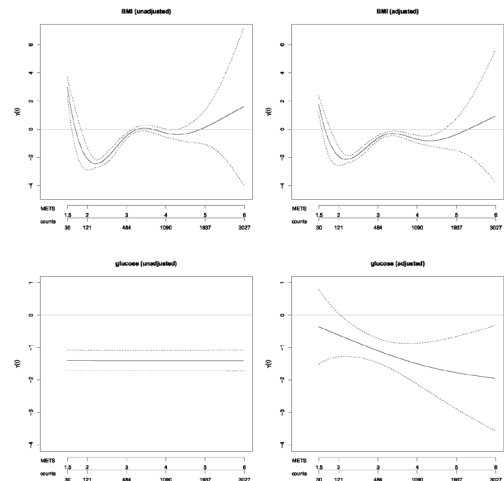
2959 Board #2 May 29 1:00 PM - 3:00 PM

A Functional Data Analysis Framework For Modeling Physical Activity Intensity Continuously Using Accelerometer Data

Chongzhi Di¹, Xu Wang², Charles Kooperberg¹, Ross Prentice¹, Andrea LaCroix³, David Buchner, FACSM⁴. ¹*Fred Hutchinson Cancer Research Center, Seattle, WA.* ²*University of Washington, Seattle, WA.* ³*University of California, San Diego, CA.* ⁴*University of Illinois at Urbana-Champaign, Champaign, IL.*
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(No relevant relationships reported)

PURPOSE: Cutpoints approaches are often used to define physical activity (PA) intensity categories for accelerometry. We proposed methods to characterize the full continuum of PA intensity, free of cutpoints, and to quantify associations between PA accumulated at varying intensity levels and health outcomes. **METHODS:** During 2012-2014, 6,379 women aged 63-99 wore accelerometers on their waist for 7 consecutive days. Accelerometer counts data were analyzed in 15-second epochs. Complementary cumulative distribution functions (CCDF) were used to characterize how each subject distributes PA across all intensity levels. Functional linear regression models were used to estimate flexible dose-response relationships between PA intensity and health outcomes, including body mass index (BMI) and fasting glucose levels. **RESULTS:** The CCDFs of PA intensity showed that age-related decline in PA occurred at all intensity levels. The dose-response relationships between PA intensity and BMI and glucose were shown in Figure 1. Neither effects were constant, indicating

that intensity mattered after controlling for volume (count-min or MET-min). The relationship between BMI and intensity was complicated, while PA accumulated at higher intensity was found to be associated with lower fasting glucose levels, after controlling for volume. **CONCLUSION:** We provided a cutpoint-free analytic framework to model PA intensity continuously. The effect of PA on BMI and fasting glucose varied across intensity levels, even when fixing PA volume. The proposed methods are applicable not only to counts data, but also to other acceleration-based metrics calculated using raw data. **Figure 1.** Association of PA intensity (counts/15-sec or equivalent METs) with BMI and fasting glucose. The adjusted analysis included age, race-ethnicity and education for BMI, and for glucose additionally adjusted for BMI. Corresponding METs were calculated based on an internal calibration study.



2960 Board #3 May 29 1:00 PM - 3:00 PM

Machine Learning Activity Classification Models For Preschool-aged Children: The Need For Free-living Training Data.

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Machine learning (ML) classification models trained on laboratory activity trials exhibit poor performance when evaluated under free-living conditions. Training models on free living data, including temporal features such as lead and lag windows, and using shorter sliding windows may improve recognition accuracy under free-living conditions.

Purpose:

To evaluate the accuracy of free-living hip and wrist Random Forest activity classifiers for pre-schoolers trained on features extracted from windows of 1s, 5s, 10s, and 15s. Performance was benchmarked against classifiers trained on laboratory-based data using a 15s window.

Methods:

31 preschool-aged children (4.0 ± 0.9 y) were video recorded during a 20-minute unstructured active play session. Participants wore an accelerometer on their right hip and non-dominant wrist. A bespoke two-stage direct observation system was used to code ground truth activity class and specific activity types occurring within each class. Data from 21 of the children were randomly selected to train the classifiers. Models were trained with and without temporal features and cross-validated in a hold sample of the remaining 10 children with overall and class-level accuracy.

Results:

Accuracy improved as window size increased from 1 sec (73.5%-77.7%) to 10 sec (82.4%-86.0%); with only minimal improvements observed for 15s windows. Inclusion of lag and lead features increased accuracy by 1.6% to 6.6%, with the largest improvements observed for shorter duration windows (≤10s). Comparatively, the accuracy of the laboratory trained model was 56.9% and 67.5% for wrist and hip, respectively. For a 10s window, training models on free-living data and including temporal features increased recognition of sedentary from 70.6% - 74.4% to 83.3% - 90.4%; light activities and games from 57.5% - 76.9% to 88.6% - 88.8%; walking from 7.5% - 17.5% to 64.1% - 75.0%; and running from 50.0% - 77.8% to 71.4% - 85.7%. There was no improvement in recognition of mod-vig activities and games (56.3% - 62.5%).

Conclusions:

Unlike models trained on laboratory activity trials, ML activity classification models for pre-schoolers trained on free-living accelerometer data perform well when evaluated under true free-living conditions.

Funding: Australian Research Council Discovery Project Grant: DP150100116

2961 Board #4 May 29 1:00 PM - 3:00 PM

Novel Application Of Accelerometry Data To Enhance Detection Of Falls Risk In Older Adults

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(No relevant relationships reported)

Purpose: The association between physical activity (PA) and falls is complex and bi-directional, with more active persons often demonstrating greater falls risk. The role of PA in preventing or aggravating falls risk may be illuminated by novel, more sensitive measures of PA. We examined the longitudinal association between accelerometer derived PA metrics and falls in control group participants of STURDY (Study to Understand Fall Reduction and Vitamin D in You), a randomized trial of vitamin D supplementation to prevent falls in older adults.

Methods: PA was assessed at baseline, 12-, and 24-months using the Actigraph Link accelerometer, worn 24-hours per day for 7 days on the non-dominant wrist. Falls were reported using a monthly calendar. Minute level activity counts were examined to derive diurnal patterns of PA and number of active minutes/day in 319 participants (mean age 77 (SD=5.4) years, 43% female). Multiple logistic regression models adjusted for age, sex, and gait speed examined the: i) risk of falls by tertiles of daily PA and ii) risk of falls by demographic and functional characteristics, comparing measures of falls per unit time (year) and falls per unit of activity (active minute).

Results: In adjusted models, those in the high and low PA tertiles had 78% and 7% greater odds of falling over the next 12 months compared to those in the moderate PA tertile, respectively (p<.05). Moreover, peak daily PA declined 12% between baseline and 24-month follow-up among fallers vs. 8% among non-fallers (p<.05). Differences in daily PA between fallers and non-fallers tended to be greatest between 8am-12pm. Models comparing risk of falls over 24 months of follow-up demonstrated stronger trends in falls risk at higher ages (80 vs >80), among men, and for those with slower gait speeds (<0.8 m/s vs 0.8m/s) when analyzed per unit of activity (falls/active minute) vs. unit of time (falls/year).

Conclusion: These results demonstrate a J-shaped association between PA and falls, with stronger differences in PA between fallers and non-fallers during the morning hours. Furthermore, the trend towards more robust results for falls/active minute vs. falls/year highlight the complex nature of the association between PA and falls and suggest that novel PA metrics may serve as more sensitive indicators for discerning falls risk.

2962 Board #5 May 29 1:00 PM - 3:00 PM

Predicting Poor Functional Status In Adults With Knee Osteoarthritis Using Real-life Accelerometry Data

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(No relevant relationships reported)

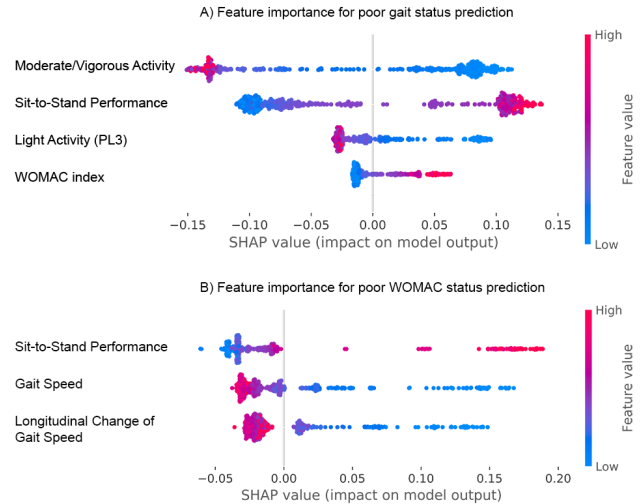
PURPOSE: Investigate the risk factors associated with longitudinal functional decline in people with knee OA using free-living accelerometry data.

METHODS: Longitudinal data from the Osteoarthritis Initiative (OAI) accelerometer study was extracted from 1229 participants tested at baseline and 2 years, including 35 features of functional capacity (gait speed, sit-to-stand time, etc), demographic characteristics, patient-reported outcome measures (WOMAC, etc.), and accelerometry-based physical activity. Poor functional status was defined as declining into or remaining in the worst function quintile compared to baseline status for two outcome measures (WOMAC score and gait speed). A Random Forest classifier was trained to predict individuals' functional status. To explore the feature importance in model prediction, the model prediction was further interpreted using a Shapley additive explanation algorithm.

RESULTS: For poor functional status in gait speed (Fig.1A), the top predictor is baseline low minutes in the performance moderate/vigorous activity range (CPM 2500+) followed by prolonged baseline sit-to-stand performance. Other significant contributing factors include high WOMAC score, low minutes in the performance light activity range (CPM 800-2499). The overall prediction accuracy is 82%. For poor WOMAC status prediction (Fig.1B), the top predictors are impaired baseline sit-to-stand and gait speed, as well as accelerated decline in gait speed. The overall prediction accuracy is 79%.

CONCLUSIONS: Accelerometry-based measures of physical activity were identified as key indicators for the decline in gait speed over time. Whereas only functional

capacity measures (gait speed and sit-to-stand performance) were identified as key indicators for the longitudinal decline in the WOMAC score. These findings may enable early detection and intervention for functional decline prevention in knee OA patients.



2963 Board #6 May 29 1:00 PM - 3:00 PM

Is A Smartphone App A Valid And Reliable Method To Measure Bicycling Behavior?

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(No relevant relationships reported)

PURPOSE: To determine the criterion validity and test-retest reliability of a smartphone app in measuring bicycling behavior.

METHODS: A GPS device was used as the gold standard for comparison to the smartphone app. Courses ~2 miles in length at two locations were tested; 1) urban college campus and 2) rural bicycle path. Adult bicyclists (N=50; 21 urban, 29 rural) carried a Global Positioning System (GPS) device and their smartphone while riding a bicycle on a course loop twice (5 minute break in between); both the GPS device and smartphone app recorded location data. Movement time was recorded for the GPS device and the smartphone app, and MET*min were calculated for bicycling assuming 6 METs/min. Using a geographic information system (GIS), a 36-foot buffer was created around the road network for each course. Location data from the GPS and smartphone devices were mapped over the course buffers in GIS, and the percent of location data within the buffers was calculated for each. Validity and reliability of the percent within buffer and validity of MET*min for each device were examined using paired sample t-tests.

RESULTS: GPS device data fell within the urban course buffer 69% of the time and within the rural course 37% of the time, while data from the smartphone app was within the urban course buffer 78% of the time and within the rural course 51% of the time. For the GPS device, maximum distance of a single GPS point away from the road buffer averaged 14 meters (range 0-290), while maximum distance of a single GPS point from the smartphone app averaged 15 meters (range 0-92). Mean difference between the GPS and smartphone devices was 9% in favor of the smartphone app on the urban course (n=40, p<0.05), and 13% in favor of the smartphone app on the rural course (n=54, p<0.01). For reliability of the GPS device, mean difference between the two repeated rides was 4% on the urban course (n=20, p>0.05), and 9% on the rural course (n=28, p<0.01). For reliability of the smartphone app, mean difference between the two repeated rides was 3% on the urban course (n=21, p>0.05), and 0.6% on the rural course (n=28, p>0.05). MET*min from the GPS device was 1.22 versus 1.21 from the smartphone app (n=94, p>0.05).

CONCLUSIONS: The smartphone app tested is a reasonable alternative to GPS devices in assessing bicycling behavior in urban and rural environments.

2964 Board #7 May 29 1:00 PM - 3:00 PM
Dynamic Segmentation Of Youth Accelerometer Data By Sojourn And Change Point Detection Methods
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(No relevant relationships reported)

Dynamic segmentation algorithms are used to find activity transitions in accelerometer data. Youth Sojourn models use a crude algorithm, which may be improved by instead using a change point detection (CPD) algorithm. Pruned exact linear time (PELT) is a CPD algorithm that finds transitions by minimizing a cost function while iterating over the data and pruning out inviable transition points. **PURPOSE:** To compare the performance of youth Sojourn and PELT. **METHODS:** Raw acceleration data (hip-worn ActiGraph GT9X) from 86 youth (age 6-18 yrs; 48% male; 16% overweight/obese) were processed using Sojourn and PELT. Participants performed two semi-structured activity routines on separate days, with each visit lasting approximately 2-2.5 h. A total of 16 activities (eight each day) were performed, twice each, and the study protocol was designed to promote variability in the ordering and duration of activities. Throughout each trial, direct observation was performed using focal sampling, which served as a criterion measure of when activity transitions occurred. Sojourn and PELT were compared to the criterion using the transition pairing method, with a maximum of 5-s lag time allowed for a prediction to be considered a true positive. Performance metrics were recall, precision, and root mean squared error (RMSE). The metrics were calculated for each participant (both visits combined), after which paired t-tests were used to compare Sojourn-vs-PELT means for each metric. **RESULTS:** Values are mean \pm SD. Recall was similar for Sojourn (49.6% \pm 9.0%) and PELT (51.5% \pm 9.2%, $p = 0.15$), and the same was true for RMSE (2.9 \pm 0.3 s for Sojourn, versus 3.1 \pm 0.4 s for PELT, $p < 0.001$). However, precision for Sojourn (21.7% \pm 4.9%) was substantially lower than for PELT (38.7% \pm 11.0%, $p < 0.001$). **CONCLUSION:** Youth Sojourn models may benefit from replacing their current segmentation algorithms with CPD algorithms like PELT. Thus, CPD warrants further investigation. Supported by NIH R01HD083431

2965 Board #8 May 29 1:00 PM - 3:00 PM
Re-examining The Energy Expenditure Of Driving
 Rachel Barnett, Karen Yagi, Sarah Keadle. *California Polytechnic State University, San Luis Obispo, CA.* (Sponsor: Todd A. Hagobian, FACSM)
Reported Relationships: R. Barnett: Industry contracted research; National Cancer Institute.

PURPOSE: Sedentary behaviors are commonly defined as having an energy expenditure < 1.5 metabolic equivalents (METs), while in a sitting, reclining or lying posture. However, the Compendium of Physical Activities (Compendium), a widely used resource, assigns a MET value of 2.5 for driving, which would not meet the consensus definition of sedentary. This MET value is based on outdated automobile and metabolic technology, thus the purpose of this study is to re-examine the MET value of driving and compare driving to other sedentary behaviors and light-intensity walking (Compendium = 2.8 METs).

METHODS: Participants ($n=17$, average age = 32 y, 11 females) wore a portable metabolic system (Cosmed K5), during five different conditions that include sitting quietly, watching TV, sitting while working on a computer, driving, and walking at 2.0 mph. We compared mean measured MET values to the corresponding value from the Compendium using one-sampled t-test. We also ran a repeated measures ANOVA to determine whether there was any significant difference in MET values across conditions.

RESULTS: The mean MET value for driving was 1.5, which is significantly lower than the Compendium value of 2.5 ($p < 0.0001$). Driving yielded significantly higher MET values than quiet sitting (1.1 METs $p < 0.0001$) and watching TV (1.1 METs $p < 0.0002$) but was similar to sitting while working. Although driving and walking at 2.0 mph have similar Compendium MET values, driving produced significantly lower measured MET values (1.46 vs 3.08 $p < 0.0001$).

CONCLUSIONS: The existing Compendium MET value may not accurately quantify the energy expenditure of driving. Measured MET values for driving more closely correspond to sedentary behaviors than light-intensity walking. Since the average American spends 46 min/day in the car, there is a need to update the Compendium to reflect these findings.

F-09 Thematic Poster - Novel Strategies to Increase Physical Activity and Fitness
 Friday, May 29, 2020, 1:00 PM - 3:00 PM
 Room: CC-2010

2966 **Chair:** Sara Wilcox, FACSM. *University of South Carolina, Columbia, SC.*
(No relevant relationships reported)

2967 Board #1 May 29 1:00 PM - 3:00 PM
Effect Of Adapting Sedentary Video Games To Facilitate Physical Activity On Exercise Intensity
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(No relevant relationships reported)

PURPOSE: To determine if adapting a sedentary video game's controls to involve total body movements can elicit an exercise intensity consistent with moderate-to-vigorous physical activity. **METHODS:** Thirty adults, 19 to 55 years of age, visited our exercise lab twice. During each visit, the participants played a sedentary video game in three randomized conditions: 1) sitting, using a hand-held controller (Controller), 2) standing, reaching and jumping in front of a motion sensor (Sensor), and 3) standing, moving and reaching for buttons with their hands and feet (Button). Oxygen consumption (VO_2), heart rate, and ratings of perceived exertion (RPE) using the Borg 6 to 20 scale were assessed throughout each condition. We hypothesized that mean relative VO_2 would be 3 to 6 metabolic equivalents (METs), mean heart rate would be 50% to 80% of age-predicted maximum heart rate (%HRmax), and RPE would be 12 (somewhat hard) to 15 (very hard) in the Sensor and Button conditions. Further, METs, %HRmax, and RPE would be lower in the Controller condition than in Sensor and Button conditions. A two-way repeated-measures analysis of variance with Bonferroni post-hoc analysis was used to compare within-participant differences in METs, %HRmax, and RPE across the two visits and three conditions. Chi-square analysis was used to determine if a significant proportion of participants achieved moderate-to-vigorous physical activity during the Sensor and Button conditions. **RESULTS:** All measures were less during the Controller condition (0.99 \pm 0.09 METs, 39 \pm 6%HRmax, 7 \pm 1 RPE) compared to the Sensor (3.52 \pm 0.58 METs, 59 \pm 10%HRmax, 13 \pm 2 RPE, $p < 0.01$) and Button (4.02 \pm 0.61 METs, 62 \pm 12%HRmax, 14 \pm 2 RPE, $p < 0.01$) conditions. There was no difference between visits ($p > 0.32$). For the 30 participants, 83% and 100%, respectively, sustained MET levels of 3 to 6 during the Sensor and Button conditions ($p < 0.01$). Similar results were found for %HRmax and RPE ($p < 0.01$). **CONCLUSION:** Sustained moderate-to-vigorous physical activity was achieved by adapting sedentary video game controls to require total body movements. Future studies should consider adapting video game controls to increase exercise enjoyment, adherence and intensity.

2968 Board #2 May 29 1:00 PM - 3:00 PM
Testing The Feasibility Of Referred At-risk Patients Participating At A Hospital-based Healthy-lifestyle Management Program
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(No relevant relationships reported)

PURPOSE: Facilitating health promotion programs within healthcare is supported by the Institute of Medicine, which is establishing a systematic implementation approach that incorporates eight social and behavioral vital signs including exercise in the electronic health record (EHR). Though limited time during clinic visits is a challenge for implementation. Using an established healthy-lifestyle management program (HLMP) to support this approach could reduce burden on clinical practitioner. The purpose was to test the feasibility of implementing fitness measures in an HLMP. **METHODS:** Healthy Me is a free HLMP offered to patients in a public, Midwest health system. Patients are enrolled through physician referral via EHR. Eligible patient have a BMI > 25 , cardiovascular disease, pre /type II diabetes, and/or depression. Low-risk patients who meet eligibility criteria can enter Healthy Me through an EHR automated bulk referral process. Healthy Me is delivered by health coaches trained in motivational interviewing, group fitness, health promotion, and chronic disease management. Patients performed chair stand, arm curl and two-minute step tests.

RESULTS: The sample included 1254 patients (80.1% women), who were 48.9 + 15.46 years of age, with a BMI of 37.4 + 10.46 and reported fair/good (74.9%), poor (16%) or very good/excellent (9.1%) health. Eighty-three patients (6.7%) completed multiple fitness tests and 654 (52.2%) completed one test. Only females completed multiple fitness tests. Chi-square test found those who completed one test had higher perceived health ratings ($\chi^2 = 15.6, p = .048$). Bivariate correlations found BMI was associated positively with waist measures ($r = .88, p < .001$), and negatively with chair the stand score ($r = -.21, p = .015$), march score ($r = -.32, p = .029$), general health rating ($r = -.53, p < .001$), general physical ($r = .11, p = .054$) and mental ($r = .33, p = .043$) health.

CONCLUSIONS: Results revealed differential characteristics between patients who only visited Healthy Me and those who completed the health/fitness tests. Future directions include using tailored approaches to encourage fitness test completion. Multiple correlations with BMI and health/fitness parameters align with previous work and emphasize the importance of promoting healthy behaviors in HLMPs, such as exercise.

2969 Board #3 May 29 1:00 PM - 3:00 PM
Determining Intervention Components For A Physical Activity Program Designed For Former Division I College Athletes

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Emerging research shows retired college athletes experience detrimental physical and mental health declines following retirement from sport. Such effects include worsening body composition, health-related quality of life, and physical function, as well as increased prevalence of depression, alcohol dependence, and eating disorders. Despite sports training, former college athletes exhibit substantial decreases in physical activity (PA) levels following retirement, which may contribute to these health declines.

PURPOSE: Explore what intervention components would be attractive, effective, and feasible for a PA program designed for former NCAA Division I (DI) college athletes.

METHODS: Semi-structured, bracketed interviews were conducted with former NCAA DI athletes retired ≤ 10 years from college sport and inactive based on the PA Guidelines for Americans (PAGA; assessed via the Paffenbarger PA Questionnaire). Qualitative analysis was conducted using the Consensual Qualitative Research Method to determine domains, categories, and core ideas from participant responses.

RESULTS: Participants (N=17, 7 men, 26±3 y, 91% Caucasian) retired 3 months to 10 years (4±3 y) and representing 9 sports across 13 athletic conferences underwent individual interviews. Based on the PAGA, 18% did not meet the muscle strengthening guidelines, 29% did not meet the aerobic guidelines, and 53% did not meet both thresholds. Emergent domains include: 1) The Recreated Team, 2) Program Needs, 3) Preventive Factors, 4) Timing. **CONCLUSIONS:** Participants highly advocated for the creation of a PA program for their population. Based on domains, effective program factors include recreating the camaraderie and accountability of a sports team, fitness testing, goal setting, and electronic communication. Potential barriers include high cost, inconvenient scheduling, lack of individual attention, and an intimidating atmosphere. Further, following a break after their last competition, participants stated they would have been ready to begin a PA program tailored for them within one year of retirement. Future directions include testing optimal combinations of intervention components to maximize their effectiveness in a future PA program. Funding provided by the Association for Applied Sport Psychology 2019 Research Grant.

2970 Board #4 May 29 1:00 PM - 3:00 PM
Commercial App Use Linked With Sustained Physical Activity In Two Canadian Provinces: A 12-month Quasi-experimental Study

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¹Western University, London, ON, Canada. ²University of British Columbia, Vancouver, BC, Canada. ³Carrot Insights Inc, Toronto, ON, Canada.
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 Reported Relationships: **M. Mitchell:** Ownership/interest/stock; Stock options, but co. went out of business June 2019.

BACKGROUND: Top tier commercial physical activity apps rarely undergo peer-reviewed evaluation. Even fewer are assessed beyond six months, the theoretical threshold for behaviour maintenance.

PURPOSE: The purpose of this study was to examine whether a commercial app rewarding users with digital incentives for walking was associated with an increase in physical activity over one year.

METHODS: This 12-month quasi-experimental study was conducted in two Canadian provinces (n=39113 participants). Following a two-week baseline period, participants

earned digital incentives (\$0.04 CAD/day) every day they reached a personalized daily step goal. Mixed-effects models estimated changes in weekly mean daily step count between the baseline period and the last two recorded weeks. Models were fit for several engagement groups and separately by baseline physical activity status within engagement groups.

RESULTS: Nearly half of participants (43%) were categorized as physically inactive at baseline (fewer than 5000 daily steps), and 60% engaged with the app for at least six months [‘Regular’ (24-51 weeks of step data) or ‘Committed’ sub-groups (52 weeks)]. Weekly mean daily step count increased for physically inactive users regardless of engagement status ($P < .0001$). The increase was largest for ‘Regular’ and ‘Committed’ participants—1215 and 1821 steps/day, respectively. For physically active participants, step count increases were only observed in the ‘Committed’ sub-group ($P < .0001$). Effect sizes were modest-to-medium depending on the sub-group analyzed.

CONCLUSIONS: A commercial app providing small but immediate digital incentives for individualized goals was associated with an increased weekly mean daily step count on a population-scale over one year. This effect was more evident for physically inactive and more engaged participants.

2971 Board #5 May 29 1:00 PM - 3:00 PM
Enjoyability And Acceptability Of Bone Targeted Exercise For Young Adult Women: The OPTIMA-Ex Trial

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 (No relevant relationships reported)

PURPOSE: While physical activity participation is recognized as an effective modifiable risk factor for osteoporosis, adherence and compliance present significant challenges. We aimed to explore the experiences related to a bone-targeted exercise intervention, determine enjoyment and acceptability of each exercise mode, and identify barriers and facilitators to osteogenic exercise for young adult women with low bone mass. **METHODS:** A mixed-methods study was conducted within the OPTIMA-Ex trial, a three-arm RCT comparing musculoskeletal outcomes from high-intensity impact training (IT), high-intensity resistance training (RT), and a home-based low-intensity exercise control (CON). All 32 participants (IT=10, RT=12, CON=10) who finished the trial completed questionnaires on physical activity enjoyment (PACES-8, Kruskal-Wallis and Friedman’s test), quality of life (AQoL-6D, repeated measures ANOVA), and semi-structured interviews to facilitate qualitative analysis (Leximancer v4.50) of participant experiences. **RESULTS:** At follow-up, RT had the highest total score for PACES-8 (48.6±4.7), while only the IT group experienced an increase in total score over the 10 months (34.8±4.1 to 41.4±6.9, $p < .05$). Only CON experienced an improvement in total AQoL-6D score. For the sub-domains, all groups experienced clinically significant improvements (> 0.06 points) for ‘mental health’, while IT improved for ‘senses’ and CON improved for ‘coping’ ($p < .05$). The qualitative analysis revealed that overall trial exercises were viewed positively by all groups, yet the two high-intensity groups had the ‘richest’ exercise experiences, developing a more positive attitude to exercise. Barriers to exercise related to time, convenience, accessibility, and cost. Both IT and CON groups experienced a 41% drop out compared to 29% in the RT group. Compliance did not differ between CON (78.8±4.1%), IT (61.4±15.1%), or RT (66.4±11.2%) ($p = 0.085$). **CONCLUSIONS:** While IT and RT provide enjoyable bone-targeted exercise experiences for young adult women, on balance RT appears most favorable. It seems prudent, that bone-targeted exercise interventions for this demographic address perceptions of time demands and environmental barriers to participation in order to maximize compliance and adherence.

2972 Board #6 May 29 1:00 PM - 3:00 PM
Positive Lifestyle Enhancement In At-risk Youth After A 16-wk Mountain Bike Program

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Weekly, physical activity should be a primary component in long term, healthy lifestyles to enhance aerobic capacity and potentially decrease risk of cardiovascular disease (CVD). Start The Cycle (STC) is a non-profit, community-based program dedicated to building confidence and self-esteem in at-risk youth (e.g., helping them achieve healthy, life goals) through weekly mountain bike rides and adult mentorship.

PURPOSE: To quantify physiological change and probability of CVD in at-risk youth during a 16-wk, mentored mountain biking program. **METHODS:** Participants included (mean ± SD) new members (NM, n = 15, age = 13.6 ± 1.8 yrs), returning members (RM, n = 15, age = 15.9 ± 2.3 yrs), and combined (NM + RM) members (CM, n = 30, age = 14.7 ± 2.4 yrs). Free mountain bikes were provided to participants

by STC with a promise of ownership if the full program was completed. The program met 16-wks, 1 x week, and 2-hrs·day⁻¹ starting late spring and into late summer. Indoor physical conditioning and bike maintenance + skills classes were implemented the initial 4-wks with mentored, group rides occurring the last 12-wks. Maximal oxygen uptake (i.e., via the progressive aerobic cardiovascular endurance run or PACER test) and CVD risk (via a prediction equation from prior, unpublished research) were assessed pre- and post-intervention following the indoor training sessions (i.e., after 4-wks) and immediately prior to a final, 28-mile organized bike race. Data were analyzed using paired t-tests between pre- and post-intervention within NM, RM and CM groups with significance set at $p < 0.05$. Effect size is reported as Cohn's d with $d = .2, .5, \text{ and } .8 = \text{small, medium, and large effect sizes, respectively. RESULTS:}$ Significance from pre- to post-test (mean \pm SD), respectively, is as follows for $\text{VO}_{2\text{max}}$ in $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ (NM, 37.1 ± 2.5 vs 41.8 ± 5.4 , $p = 0.004$, $d = 0.98$; RM, 40.7 ± 6.9 vs 46.2 ± 10.9 , $p = 0.037$, $d = 0.19$; and CM, 38.7 ± 5.1 vs 43.8 ± 8.3 , $p = 0.000$, $d = -0.04$) and CVD risk with lower score = decreased risk (NM, 5.2 ± 2.8 vs 3.8 ± 2.8 , $p = 0.018$, $d = -0.38$; RM, 6.2 ± 6.2 vs 3.9 ± 8.0 , $p = 0.027$, $d = 0.19$; and CM, 5.7 ± 4.7 vs 3.8 ± 5.8 , $p = 0.001$, $d = -0.07$). Body mass index (BMI) did not change across any group. **CONCLUSION:** A community-based, adult-mentored, youth mountain bike program is a practical means to improve aerobic capacity and reduce CVD risk in at-risk minors.

2973 Board #7 May 29 1:00 PM - 3:00 PM
A Randomized Controlled Trial Comparing Two Different Approaches To Prescribe Exercise

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The Physical Activity Guidelines for Americans (PAG) recommend 150min/wk of moderate intensity aerobic physical activity (PA) plus 2days of muscle strengthening PA for health. Yet, 26% of Americans and 36% of college students perform no leisure time PA, stressing the need to increase PA in these populations. **PURPOSE:** We conducted a randomized controlled trial (RCT) comparing two different exercise prescription (ExR_x) approaches to increase PA among college students. The purpose of this interim analysis was to assess differences in the Transtheoretical Model stage of change (SOC) and drop-out (DO) rates at the 6wk mid-point (6W) of the RCT compared to baseline (BL) between the two ExR_x approaches. **METHODS:** 60 sedentary, healthy college students >18yr were randomized to two groups: ExR_x #1 emphasized meeting the PAG via the Frequency, Intensity, Time, and Type or FITT principle of ExR_x ; and ExR_x #2 emphasized that all PA counts. Both ExR_x approaches progressed students from being sedentary to meeting weekly PA goals over the 12wk PA intervention. The primary RCT outcome was the change in PA volume at 12wk, assessed via accelerometer and the Paffenbarger PA Questionnaire. At BL and 6W students completed the SOC to measure PA action transitions over time. Height (cm) and weight (kg) were measured to calculate the body mass index (BMI) at BL. DO was calculated as those who ceased participation at 6W divided by the total randomized sample $\times 100$. RMANOVA tested if SOC differed over time by group and Chi-Square tested if DO differed between groups. **RESULTS:** Subjects ($n=32$) were sedentary, overweight ($\text{BMI}=26.0\pm 4.2 \text{ m}^2/\text{kg}$), healthy college students ($24.7\pm 5.2\text{yo}$) with no differences in BL characteristics between ExR_x groups or DO and completers (>0.05). At 6W DO was 28.1% for the total sample with no differences between ExR_x groups ($p>0.05$). At 6W SOC increased from BL in both ExR_x groups ($p<0.001$), but to a greater level in ExR_x #1 of 3.6 ± 1.2 indicating progression from the contemplation to action stage than ExR_x #2 of 2.7 ± 1.0 indicating progression from the contemplation to preparation stage ($p=.045$). **DISCUSSION:** Improvements in SOC suggest PA increased with both ExR_x approaches at 6W. Whether these SOC improvements persist at 12wk and translate into greater increases in PA and lower DO remains to be determined.

F-10 Thematic Poster - Resistance Training

Friday, May 29, 2020, 1:00 PM - 3:00 PM
 Room: CC-2000

2974 Chair: J. G. Mouser. *Troy University, Troy, AL.*
 (No relevant relationships reported)

2975 Board #1 May 29 1:00 PM - 3:00 PM
Is There A Cross Over Effect In Post Activation Potentiation?

Vickie Wong, Yujiro Yamada, Zachary W. Bell, Robert W. Spitz, Ricardo B. Viana, Raksha N. Chatakondi, Takashi Abe, Jeremy P. Loenneke, FACSM. *The University of Mississippi, University, MS.* (Sponsor: Jeremy P. Loenneke, FACSM)
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Post activation potentiation (PAP) is a phenomenon whereby strength is acutely increased following a conditioning contraction. This effect is purported to be small and specific to the contraction history of the muscle (local), however, a potential cross-over effect in PAP has not been ruled out. **PURPOSE:** To determine if PAP is specific to the muscle being conditioned or if it is also observed within the homologous muscles of the contralateral limb. **METHODS:** 56 men and women participated in a four-visit study. Visit 1 included baseline measurements and familiarization of the unilateral biceps contractions (isometric and isokinetic for each arm). Visits 2-4 included the completion of one of the three experimental conditions: 1) control, 2) same side PAP, and 3) cross over PAP in a randomized order. Each visit included a warm up followed by three maximal isokinetic contractions at 210°/second (baseline). The control condition then rested eight minutes prior to completing three more maximal isokinetic contractions (post). The other two conditions completed the pretest followed five minutes later by a six-second maximal isometric contraction on the same side as the baseline isokinetic test (same side PAP) or on the opposite side (cross over PAP) followed by three additional maximal isokinetic contractions (post) three minutes after conditioning stimulus. The variable of interest was the change from baseline in isokinetic strength. Three hypotheses were compared using Bayesian Informative Hypothesis Evaluation (BAIN). The hypotheses were as follows: H1) same > cross = control; H2) same > cross > control; H3) same = cross = control. **RESULTS:** Torque produced during the potentiating stimulus was similar between PAP conditions (same: 47 Nm vs. cross: 45 Nm). The change [mean (95% credible interval)] in isokinetic strength for each condition was: control = -0.41 (-0.91, 0.07) Nm; same side PAP = 0.48 (-0.20, 1.16) Nm, and cross PAP = -0.03 (-0.67, 0.60) Nm. The posterior probabilities were 0.45, 0.28, 0.19, and 0.06 for H1, H2, H3, and the unconstrained model, respectively. H1 was 1.5 and 2.2 times more likely than H2 and H3, respectively. **CONCLUSIONS:** The current evidence indicates that if a PAP effect exists, it is small and may be specific to the muscle being conditioned. There does not seem to be a substantial cross over effect in PAP.

2976 Board #2 May 29 1:00 PM - 3:00 PM
Muscle Thickness Changes Do Not Mediate Changes In Muscle Strength

Matthew B. Jessee¹, Scott J. Dankel², John P. Bentley¹, Jeremy P. Loenneke, FACSM¹. ¹*The University of Mississippi, University, MS.* ²*Rowan University, Glassboro, NJ.* (Sponsor: Jeremy P. Loenneke, FACSM)
 (No relevant relationships reported)

The position that hypertrophy mechanically increases muscle strength is currently debated among scientists.

Purpose: To determine indirect (via hypertrophy) and direct (not hypertrophy) effects of training on muscle strength.

Methods: 151 participants were randomized into control, one-repetition maximum training, or traditional training. For 6 weeks control avoided resistance exercise; training groups performed elbow flexion 3x/week (dominant arm). One-repetition maximum participants had 5 attempts to lift the greatest load possible. Traditional participants performed 4 sets to task failure (load adjusted for ~8-12 repetitions). Attempts/sets were separated by 90 s. Anterior muscle thickness (B-mode ultrasound) at 50, 60, and 70% upper arm length, and strength (one-repetition maximum) were assessed pre- and post-training. Change-score mediation models (adjusted for sex, pre-muscle thickness, and pre-strength) were constructed for each muscle thickness site. Effects of each training were evaluated relative to control. Data presented as coefficient (95% CI).

Results: Relative direct effects on strength were greater for one-repetition maximum [50% = 1.89 (1.20, 2.58); 60% = 1.88 (1.19, 2.58); 70% = 1.81 (1.12, 2.50) kg] and

traditional training [50% = 2.04 (1.28, 2.79); 60% = 1.98 (1.21, 2.74); 70% = 1.79 (1.04, 2.53) kg]. The relative effect of one-repetition maximum on muscle thickness was different in 60% [0.09 (0.01, 0.17) cm] and 70% [0.09 (0.00, 0.17) cm] models [50% = 0.67 (-0.01, 0.14) cm] while traditional was greater in all three: [50% = 0.24 (0.15, 0.32); 60% = 0.24 (0.16, 0.33); 70% = 0.22 (0.14, 0.31) cm]. The effect of muscle thickness on strength was not significant for 50% [-0.44 (-1.72, 0.84) kg], 60% [-0.15 (-1.48, 1.17) kg], or 70% [0.73 (-0.48, 1.96) kg] models. The relative indirect effect on strength was not significant for one-repetition maximum [50% = -0.02 (-0.16, 0.09); 60% = -0.01 (-0.17, 0.16); 70% = 0.06 (-0.09, 0.27), or traditional training [50% = -0.10 (-0.48, 0.29); 60% = -0.03 (-0.42, 0.40); 70% = 0.16 (-0.22, 0.58)].

Conclusions: One-repetition maximum and traditional training increase strength, however, there was no evidence that the increase in strength was mediated by hypertrophy, providing experimental and analytical evidence for the disconnect between variables.

2977 Board #3 May 29 1:00 PM - 3:00 PM
Effects Of Six Weeks Of Unilateral High-volume Versus High-intensity Resistance Training On Vastus Lateralis Muscle Morphology In Previously Trained, College-aged Males.

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 (No relevant relationships reported)

Purpose: To compare the effects of high-volume (HV) versus high-intensity (HI) resistance training on vastus lateralis muscle morphology. **Methods:** Resistance trained, college-aged males (n=15) participated in 6 weeks of resistance training in which their legs were randomized to undertake HV and in the contralateral leg HI. Resistance training was undertaken 3 days per week. All participants went through 10 days of deload following the 6 weeks of training. Muscle ultrasound of both vastus lateralis muscles was conducted prior to week 1 of training (T1), 72 hours following the last training bout of week 6 (T2), and 10 days following the last training bout (T3) for muscle thickness, pennation angle, and fascicle length assessments. **Results:** There was a significant condition by time effect ($p=0.039$) for muscle thickness. Post hoc analysis revealed that muscle thickness significantly increased from T1 to T2 (2.7±0.4 cm to 2.9±0.4 cm, $p=0.023$) in the HV leg, but not in the HI leg. However, there was no difference between conditions at any time point. Furthermore, there were no significant interactions or main effects for pennation angle or fascicle length. **Conclusion:** HI versus HV training elicits differential effects in vastus lateralis muscle thickness over a 6-week period, albeit neither training modality altered pennation angle or fascicle length.

2978 Board #4 May 29 1:00 PM - 3:00 PM
Effects Of High-Load Versus High-Volume Resistance Training On Muscle Sarcoplasmic, Actin, And Myosin Protein Concentrations

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 (No relevant relationships reported)

PURPOSE: Our laboratory has recently shown high-volume resistance training (RT) can elicit increases in skeletal muscle sarcoplasmic protein concentrations, while also causing a dilution of contractile protein concentrations (i.e., sarcoplasmic hypertrophy). The purpose of this study was to evaluate effects of 6 weeks of high-load (HL) and high-volume (HV) training on skeletal muscle sarcoplasmic and contractile protein concentrations. **METHODS:** Trained college-aged males (n = 15; training age = 7 ± 3 yrs; mean 1RM squat relative to bodyweight = 1.9 ± 0.4 kg) performed 6 weeks of unilateral lower-body RT, with one leg performing HV training and the contralateral leg performing HL training using leg press and leg extension. Participants underwent a period of passive recovery lasting 10 days following the training intervention. Vastus lateralis biopsies were obtained from both legs prior to the start of training (PRE), 72 hours following the last training day (POST), and 1 week following POST testing (POSTPR). Sarcoplasmic protein content was determined following differential centrifugation using bichononic assays, and actin and myosin

concentrations were quantified using SDS-PAGE and Coomassie staining. **RESULTS:** Significant main effects of time ($p = 0.022$) and condition ($p=0.002$) were observed and condition by time approached significance for sarcoplasmic protein concentrations ($p = 0.088$). There were no significant interactions or main effects for actin or myosin concentrations. **CONCLUSIONS:** Contrary to our prior data, sarcoplasmic, actin and myosin concentrations remained unaffected with HV training. However, interesting trends were observed for sarcoplasmic protein concentrations and these will be further interrogated.

2979 Board #5 May 29 1:00 PM - 3:00 PM
Acute Signaling Responses To Resistance Exercise In Previously Trained And Untrained Skeletal Muscle

Sebastian Edman, Marcus Moberg, Niklas Psilander. Åstrand Laboratory, Swedish School of Sport and Health Sciences, Stockholm, Sweden.
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 (No relevant relationships reported)

It has been indicated that human skeletal muscle has a heightened sensitivity to exercise stimulus when it has been previously trained i.e. possess a "muscle memory". While previous studies have been directed to the aspects of myonuclear content and epigenetic modifications, no previous study have explored the potential of a muscle memory concerning signaling responses related to acute resistance exercise.

PURPOSE: The aim here was to study whether basal and acute resistance exercise induced cell signaling is influenced by previous strength training history in human skeletal muscle.

METHODS: 19 training naïve women and men completed 10 weeks of hypertrophy inducing unilateral strength training followed by 20 weeks of detraining. Subsequently, an acute resistance exercise session involving leg press and knee extensions was performed alternated with both legs. *Vastus lateralis* biopsies taken at rest and 1 h post exercise in both the Control- and Memory-leg. Immunoblotting was used to assess total content and phosphorylation status of proteins in the mTORC1- and related pathways.

RESULTS: Following detraining leg muscle hypertrophy had been reversed, but the Memory-leg was on average 19% stronger than the Control-leg. There were no differences between legs with regard to total protein content of all the signaling proteins analyzed. The phosphorylation of AMPK^{Thr172} and eEF2^{Thr56} was 16%, respectively 21%, higher in the Memory-leg compared to the Control-leg at both time points. The effect on AMPK^{Thr172} was attributed to changes in the women only, whereas the effect on eEF2^{Thr56} was present in both sexes. Exercise induced an increased phosphorylation of mTOR^{Ser2448} (26-36%), S6K1^{Thr389} (6- to 7-fold) and S6^{Ser235/236} (13- to 18-fold), that did not differ between the Control- and Memory-leg. In contrast, post exercise phosphorylation of 4E-BP1^{Thr46} and 4E-BP1^{Ser65} was 18%, respectively 31%, higher in the Memory-leg compared to the Control-leg. For 4E-BP1^{Ser65} the effects were attributed to changes in the male subjects only.

CONCLUSION: In summary, we illustrate that both basal- and exercise induced cell signaling important for muscle adaptations to strength training can be altered by previous training history, and that some of the changes seem to be sex dependent.

2980 Board #6 May 29 1:00 PM - 3:00 PM
Effect Of Muscle Contraction Number On Muscle Protein Synthesis And Hypertrophy In Rat

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 (No relevant relationships reported)

PURPOSE: When a high number of lifts are performed in resistance exercise (RE), the power (load × lifting speed) gradually decreases. In particular, the physiological meaning of repeated lifting at low power in the latter half of the session is unclear. In this study, we investigated the effect of different numbers of REs on the anabolic response of skeletal muscle using the RE model of Sprague Dawley (SD) rats.

METHODS: Eleven weeks old male SD rats (n=17) were randomly assigned into low repetitions group (n=8, 5 repetitions x 5 sets) and the high repetitions group (n=9, 10 repetitions x 5 sets). Unilateral electrical stimulation of rat right gastrocnemius as a resistance exercise (isometric contraction, 100V, 100 Hz, 3 sec stimulation-7 sec rest). Left hindlimb was served as the internal control. Six hours after exercise session, we injected puromycin 15 minutes prior to dissection. Medial gastrocnemius muscles were used for biochemical analysis. Puromycin-labeled newly synthesized proteins and a mammalian target of rapamycin complex 1 signal proteins were measured by western blot. In addition, 4-weeks training (3 sessions per week) was conducted. 48 hours after training, the medial gastrocnemius muscles were excised to perform further analysis. **RESULTS:** We found significant elevations muscle of protein synthesis rate and phosphorylated ribosomal protein small 6 (rpS6) at ser240/244 in both groups. However, there was no difference between groups. Both of chronic training similarly increased muscle wet weights. Muscle protein synthesis increased

at 30% in the high contraction frequency group and 50% in the low contraction frequency group. Phosphorylated rpS6 (Ser240/244) significantly increased 70% in both groups ($P < 0.05$). After the chronic training sessions, muscle wet weight increased significantly on the exercise side by 10.7% in the high contraction group and 6.8% in the low contraction group ($P < 0.05$) without significant difference between the two groups. **CONCLUSIONS:** Even though exercise volume was different (5 repetitions \times 5 sets vs 10 repetitions \times 5 sets), anabolic responses and muscle hypertrophy rate were equivalent. We speculate that repetitions with high power output are enough for inducing muscle protein synthesis and muscle hypertrophy.

2981 Board #7 May 29 1:00 PM - 3:00 PM
Does Muscle Glycogen Content Account For The Contralateral Force Deficit During Unilateral Fatigue?
 JoCarol E. Shields, Jesus A. Hernandez-Sarabia, Alejandra Barrera-Curiel, Micheal J. Luera, Jason M. DeFreitas. *Oklahoma State University, Stillwater, OK.*
(No relevant relationships reported)

Performing unilateral contractions to exhaustion has been shown to lead to force deficits of both the exercised and unexercised limbs. It has been proposed that the contralateral force deficits are of neural origin, and not due to peripheral mechanisms of fatigue (e.g. glycogen depletion). While this proposed model appears likely, it remains speculative as the absence of peripheral factors to contralateral force deficits have not been verified. **PURPOSE:** Therefore, the purpose of the study was to quantify the changes in muscle glycogen content and maximal force of both limbs in response to unilateral fatigue. **METHODS:** Nineteen healthy subjects performed two maximal voluntary isometric (MVC) knee extensions of each leg before (PRE) and after (POST) a fatiguing protocol of the right leg. The fatiguing protocol consisted of repeated 56 second long ramp contractions of the right leg at 30% MVC until failure. During the plateau phase of each contraction, ultrasound images were taken at the midpoint of the rectus femoris (RF). The echo intensity, which has been shown to be sensitive to acute changes in muscle glycogen content, was analyzed from each image of the RF muscle. **RESULTS:** A two way repeated measures ANOVA showed a significant time \times limb interaction ($p < 0.001$) for MVCs. Follow-up paired sample t-tests indicated that both limbs showed significant force loss. However, the right leg (-33%, from 773.36 \pm 191.79 to 517.13 \pm 136.72, $p < 0.001$) demonstrated a much larger force deficit than the left leg (-9.7%, from 803.07 \pm 215.32 to 725.04 \pm 198.44, $p = 0.002$). For echo intensity, the right leg demonstrated a significant change (8.8%, from 48.64 \pm 7.70 to 52.58 \pm 8.68, $p = 0.009$) from PRE to POST. However, the left leg did not change (1.34%, from 53.93 \pm 7.65 to 54.65 \pm 7.72, $p = 0.621$). It is worth noting the increase in echo intensity, such as seen with the right leg, represents a decrease in tissue density (e.g. decreased muscle glycogen content). **CONCLUSION:** Our findings suggest peripheral fatigue mechanisms, such as muscle glycogen content, were not responsible for the decreased force in the contralateral limb. This absence of peripheral, intracellular changes supports the original proposal that the contralateral force deficit is of a central, neural origin.

2982 Board #8 May 29 1:00 PM - 3:00 PM
Does Skeletal Muscle Growth Contribute To Strength Adaptation In Resistance Trained Individuals?
 Ryo Kataoka, Ecaterina Vasenina, Noam Yitzchaki, Wenyuan G. Zhu, Tayla E. Kuehne, Samuel L. Buckner. *University of South Florida, Tampa, FL.*
(No relevant relationships reported)

Performing a one-repetition maximum (1RM) strength test twice a week has been shown to produce similar strength adaptations as traditional resistance exercise. Of note, the increase in muscle size with traditional training has no additive effect on strength adaptation in non-resistance trained individuals. The training status is often pointed out as a limitation to understanding the "potential" of muscle growth to contribute to strength. Specifically, it is thought that growth would be of increased importance for resistance trained individuals. **PURPOSE:** To examine the changes in biceps muscle thickness (MT), and 1RM strength following 8 weeks of 1RM practice or traditional training. **METHODS:** 19 individuals completed the study. Participants visited the lab for 18 visits. During visit 1, MT and strength were measured. MT was measured at 50, 60 and 70% the distance between the acromion process and lateral epicondyle. Participants then performed biceps curls twice a week for 8 weeks. One arm performed 4 sets of as many repetitions as possible with approximately 70% of their 1RM, and the other arm performed a single maximal repetition. Post measurements of MT and strength were taken. Results are displayed as means (SD). **RESULTS:** For MT at the 50% site there was an interaction ($p = 0.004$). MT increased from pre [2.60 (.6) cm] to post [2.71(.5) cm, $p = 0.02$] intervention in the hypertrophy condition, with no change in the strength condition ($p = 0.57$). For MT at the 60% site there was an interaction ($p = 0.03$). MT increased from pre [2.86 (.6) cm] to post [3.02 (.5) cm, $p = 0.004$] intervention in the hypertrophy condition, with no change in the strength condition ($p = 0.52$). For MT at the 70% site there was an interaction ($p < 0.001$). MT increased from pre [3.26 (.5) cm] to post [3.48 (.5) cm, $p < 0.001$]

intervention in the hypertrophy condition, with no change in the strength condition ($p = 0.26$). For 1RM strength there was no condition \times time interaction ($p = 0.29$). However, there was a main effect for time ($p < 0.001$). 1RM strength increased from pre [16.7 (4.2) kg] to post [18.9 (4.2) kg] intervention, with no difference observed between conditions. **CONCLUSIONS:** In resistance trained individuals, bi-weekly 1RM training produces similar increases in 1RM strength as a more traditional resistance training approach without inducing muscle growth.

F-11 Free Communication/Slide - Cardiorespiratory Physiology
 Friday, May 29, 2020, 1:00 PM - 2:45 PM
 Room: CC-3014

2983 Chair: JJ Duke. *Northern Arizona University, Flagstaff, AZ.*
(No relevant relationships reported)

2984 May 29 1:00 PM - 1:15 PM
Relationship Between Lung Diffusion And Exercise Capacity In Heart Failure With Preserved Ejection Fraction
 Caitlin C. Fermoye, Glenn M. Stewart, Barry A. Borlaug, Bruce D. Johnson. *Mayo Clinic, Rochester, MN.*
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(No relevant relationships reported)

Purpose: Patients with heart failure with preserved ejection fraction (HFpEF) have impaired lung diffusion (DL) at rest and during exercise which may contribute to a reduced exercise capacity. However, it is unclear whether these impairments are solely due to alterations in pulmonary hemodynamics or related to other cardiopulmonary factors which may impair oxygen uptake such as the inability to recruit lung surface area. Therefore this study examined simultaneous measurements of DL for carbon monoxide (DLCO) and nitric oxide (DLNO), which allows for partitioning of DL into its alveolar-capillary membrane (Dm) and pulmonary capillary blood volume (Vc) components, to better understand the relationship between exertional changes in lung diffusion and exercise capacity.

Methods: HFpEF patients (N=17, age=62 \pm 9y, BMI=36 \pm 8kg/m²) undergoing exercise right heart catheterization performed simultaneous rebreath DLCO/NO tests at rest and during each stage of incremental supine cycling exercise, and membrane conductance (Dm) and pulmonary capillary blood volume (Vc) were calculated. Breath-by-breath pulmonary gas exchange was recorded throughout rest and exercise. **Results:** All patients were hemodynamically diagnosed with HFpEF (pulmonary capillary wedge pressure >15 at rest and/or >25 mmHg during exercise). Overall lung and alveolar-capillary membrane diffusion increased from rest to peak exercise (DLCO: 11.8 \pm 4.0 to 16.2 \pm 7.4 ml/min/mmHg, DLNO: 33.1 \pm 11.5 to 48.4 \pm 21.9 ml/min/mmHg, Dm: 18.9 \pm 7.2 to 28.3 \pm 13.1 ml/min/mmHg; p 's <0.01). The change in DL was related to exercise capacity (change in DLCO vs. peak $\dot{V}O_2$: R=0.69, $p < 0.01$, change in DLNO vs. peak $\dot{V}O_2$: R=0.65, $p < 0.01$) and this was primarily driven by changes in Dm (change in Dm vs. peak $\dot{V}O_2$: R=0.63, $p < 0.01$) but not Vc (change in Vc vs. peak $\dot{V}O_2$: R=0.15, $p = 0.582$).

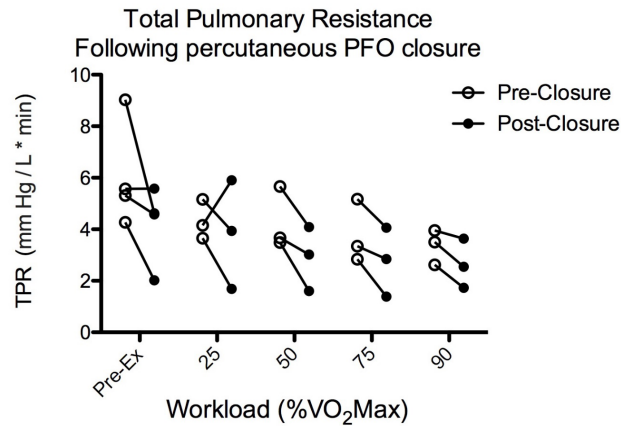
Conclusions: These data highlight that a limited increase in lung diffusion and alveolar-capillary membrane conductance during exercise are associated with a lower $\dot{V}O_2$ peak in HFpEF patients. In addition to hemodynamic constraints previously reported in HFpEF, an inability to recruit lung surface area during exercise may also contribute to the reduced exercise capacity in these patients.

2985 May 29 1:15 PM - 1:30 PM
The Effect Of Exercise Intensity On The Development Of Diaphragm And Expiratory Abdominal Muscle Fatigue

Tim A. Hardy, Matt R. Chadwick, Carrie Ferguson, Bryan J. Taylor. *University of Leeds, Leeds, United Kingdom.* (Sponsor: Dr Thomas P Olson, FACSM)
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(No relevant relationships reported)

Exhaustive high-intensity exercise (85-95% of $\dot{V}O_{2peak}$) elicits respiratory muscle fatigue, likely due to a high work of breathing (WoB) combined with a competition for available cardiac output (Q). However, the WoB associated with submaximal heavy-intensity exercise ($\leq 75\% \dot{V}O_{2peak}$) makes insufficient demands for $\dot{V}O_2$ and Q to engender a substantial competition for available blood flow. Whether the respiratory muscles fatigue in response to exhaustive heavy-intensity exercise remains unclear.

PURPOSE: To investigate the effect of exercise intensity on the presence and severity of exercise-induced diaphragm and expiratory muscle fatigue in healthy humans. **METHODS:** Ten healthy adults (25 ± 3 y, 3 females) performed a 'ramp sprint' test to determine critical power (CP), peak ramp power (P_{peak}) and $\dot{V}O_{2peak}$ (54 ± 9 ml/kg/min). The subjects then performed two constant-power cycling tests to exhaustion: 1) 5% < CP (173 ± 50 W, *heavy intensity*); 2) ~25% of the difference between CP and P_{peak} (215 ± 53 W, *severe intensity*). Diaphragm and expiratory muscle fatigue were quantified as the pre- to post-exercise reduction in the transdiaphragmatic (Pdi_{tw}) and gastric (Pga_{tw}) twitch pressure response to magnetic stimulation of the cervical and thoracic nerves, respectively. **RESULTS:** Exercise time was longer for heavy vs. severe exercise (36 ± 6 vs. 10 ± 3 min, $P < 0.05$). Final min $\dot{V}O_2$ was lower during heavy (3.12 ± 0.74 L/min; $82 \pm 5\%$ of $\dot{V}O_{2peak}$) vs. severe exercise (3.60 ± 0.83 L/min; $95 \pm 4\%$ of $\dot{V}O_{2peak}$) ($P < 0.05$). Both heavy and severe exercise elicited a significant reduction in Pdi_{tw} ($-13 \pm 11\%$ and $-19 \pm 13\%$) and Pga_{tw} ($-23 \pm 20\%$ vs. $-24 \pm 17\%$) (both $P < 0.05$); however, the magnitude of exercise-induced respiratory muscle fatigue was not different between trials ($P > 0.05$). The cumulative diaphragm and gastric pressure-time products were greater for heavy vs. severe exercise (PTP_{di} : 16790 ± 6727 vs. 5945 ± 1956 cmH₂O/s; PTP_{ga} : 7818 ± 3368 vs. 2595 ± 1233 cmH₂O/s; both $P < 0.05$). **CONCLUSION:** The diaphragm and expiratory muscles fatigue in response to exhaustive heavy- and severe-intensity exercise in healthy humans. The magnitude of exercise-induced respiratory muscle fatigue between trials was not different despite a substantially greater cumulative PTP_{di} and PTP_{ga} for heavy- vs. severe-intensity exercise.



2986 May 29 1:30 PM - 1:45 PM
Reduction In Pulmonary Arterial Pressure At Rest And During Exercise Following Percutaneous Closure Of Patent Foramen Ovale
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 (No relevant relationships reported)

Purpose: The PFO is a source of intracardiac right-to-left shunt and is present in ~1/3rd of the adult population. Deficits in pulmonary gas exchange efficiency associated with PFO have been well-documented (Lovering *et al*, J Appl Physiol 2016). However, changes in pulmonary artery pressure and total pulmonary resistance (TPR) following closure have not previously been reported. **Methods:** Four candidates (3F, 1M) for closure of PFO were identified by local cardiologists and referred to our laboratory as subjects. 3 subjects (3F) received physician clearance to participate in the exercise trials. 1 subject (1M) was not cleared for exercise so only resting measures were taken. Presence and size of PFO was confirmed utilizing transthoracic saline contrast echocardiography (TTSCE). Subjects exercised at 4 sub-maximal workloads (25%, 50%, 75% and 90% of pre-closure VO_{2Max}). Transthoracic ultrasound measures of cardiac output (QT) and pulmonary arterial systolic pressure (PASP) were taken prior to exercise and during the final minute of each workload. TPR was calculated as $PASP / QT$. All measures were repeated in the laboratory 3-6 months after closure of PFO following confirmation of endothelialization of the closure device with TTSCE. **Results:** Data were analyzed by a 2-way (Closure x Workload) RMANOVA. There was a main effect of closure on PASP $F(1, 11) = 21.05$, $p = 0.0008$, and a main effect of closure on TPR $F(1, 11) = 9.899$, $p = 0.0093$, with reductions in both following closure. There was a main effect of workload, but not closure, on cardiac output $F(4, 11) = 60.18$, $p < 0.0001$. **Conclusion:** Improvements in pulmonary gas exchange efficiency are expected with removal of the intracardiac right-to-left shunt. However, our results demonstrating a significantly reduced pulmonary artery pressure, due to a significantly reduced TPR, are intriguing and deserve more attention to better understand the contributing factors of a PFO to exercise-induced pulmonary hypertension.

2987 May 29 1:45 PM - 2:00 PM
Effect Of Active Muscle Mass On Work Of Breathing And Oxygen Cost Of Ventilation
 Saad A. Alhammad¹, Monira I. Aldhahi², Andrew A. Guccione¹, Randall E. Keyser, FACSM¹. ¹George Mason University, Fairfax, VA. ²Princess Nourah Bint Abdulrhaman University, Riyadh, Saudi Arabia. (Sponsor: Randall E. Keyser, FACSM)
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PURPOSE: To compare estimates of work of breathing (Wb) and O₂ cost of ventilation in the respiratory muscles (V_{RMO2}) among three types of exercise, representing smaller and large active muscle masses. **METHODS:** Twenty healthy adults (25±4.9 yrs, BMI: 23.9 ±2.6 kg/m²) completed three randomized peak cardiopulmonary exercise tests (CPET) on separate days: 2-leg (large muscle mass) and 1-leg (medium mass) tests and 1-arm (small mass). Estimates of Wb and V_{RMO2} were compared at power outputs corresponding to 25%, 50%, 75%, and 100% of the peak power output on the tests and at Isomax, defined as the power output identical to peak exercise on the 1-arm CPET. Wb was estimated using an established algorithm: $Wb = V_{RMO2} \times P_{aw}$ and $V_{RMO2} = \frac{Wb}{P_{aw}}$. **RESULTS:** Peak power output was 32 ± 11.96 watts for the 1-arm, 97.8 ± 30.48 watts for the 1-leg, and 186.25 ± 44.03 watts for the 2-leg CPETs. At 50% of peak WR, significant differences in Wb and V_{RMO2} between 1-arm and 2-leg (Wb $p=0.001$; V_{RMO2} $p=0.001$). At 100%, there were differences in Wb and V_{RMO2} between 1-arm and 2-leg (Wb $p<0.01$; V_{RMO2} $p<0.01$) and between 1-leg and 2-leg CPETs (Wb $p=0.02$; V_{RMO2} $p=0.02$)

	1-arm		1-leg			2-leg		
	50%	100%	50%	100%	Isomax	50%	100%	Isomax
Wb kg.m.min ⁻¹	1.3±0.9	5.91±4.7	2.2±1.2	9.5±6.5	1.2±0.8	2.8±1.3	15.8±9.7	0.3±0.3
VRMO ₂ mL.min ⁻¹	44.9±7.4	79±35.4	51.2±9.2	105.9±48.2	43.8±5.9	55.5±9.7	152.7±72.1	37.4±2.4

At Isomax, significant increases were found in Wb and V_{RMO2} between the 1-arm and 1-leg ($p<0.001$) CPETs and between the 1-arm and 2-leg ($p<0.001$) CPETs. **CONCLUSION:** The findings suggest that breathing economy is diminished with respect to exercising that requires progressively smaller active muscle masses. This study suggests that CPETs requiring smaller active muscle masses may not be sufficient for examining maximal Wb or V_{RMO2} capacity

2988 May 29 2:00 PM - 2:15 PM

External Dead Space Explains Sex-differences In The Exercise Ventilatory Response In Obese And Nonobese Children

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PURPOSE: Increases in external dead space augment the exercise ventilatory response independent of the potential respiratory effects of sex and obesity. Therefore, the dead space imposed by the mouthpiece and breathing valve (V_{DM}) should be accounted for when comparing the exercise ventilatory response, particularly in prepubescent children who have smaller lungs. We evaluated the impact of V_{DM} on the exercise ventilatory response, defined as the slope of the relation between minute ventilation (\dot{V}_E) and carbon dioxide ($\dot{V}CO_2$), in obese and nonobese prepubescent boys and girls. **METHODS:** 27 nonobese (age: 10 ± 1 y; height: 146 ± 8 cm; weight: 39 ± 7 kg; BMI percentile: 57.2 ± 21.3) and 46 obese (age: 10 ± 1 y; height: 147 ± 8 cm; weight: 62 ± 16 kg; BMI percentile: 98.0 ± 1.3) children were studied. Subjects were divided into groups by sex (nonobese: 13 girls and 14 boys; obese: 17 girls and 29 boys). All subjects performed a 6-minute constant load cycling test at a fixed intensity (40W). To correct the $\dot{V}_E/\dot{V}CO_2$ slope for the effects of V_{DM} , we subtracted V_{DM} (0.225 L) from \dot{V}_E to derive a slope that was absent from the effects of V_{DM} . A two-way group (obese vs nonobese) by sex (girls vs boys) analysis of variance was conducted. **RESULTS:** When \dot{V}_E was not corrected for V_{DM} , there was no group by sex interaction in the $\dot{V}_E/\dot{V}CO_2$ slope ($p = 0.76$). $\dot{V}_E/\dot{V}CO_2$ slope was not different ($p = 0.48$) between obese (32.7 ± 4.3) and nonobese children (32.2 ± 6.1) however, there was a main effect for sex ($p = 0.03$) where the $\dot{V}_E/\dot{V}CO_2$ slope was higher in girls (35.4 ± 5.6) compared with boys (32.6 ± 4.9). When \dot{V}_E was corrected for V_{DM} , the $\dot{V}_E/\dot{V}CO_2$ slope remained similar ($p = 0.31$) between obese and nonobese children; however, the main effect for sex was eliminated ($p = 0.12$). There was no main effect for group (obese vs nonobese) or sex (girls vs boys) in the end-tidal partial pressure of carbon dioxide at rest ($p > 0.05$) or during exercise ($p > 0.05$). **CONCLUSIONS:** Accounting for the external dead space imposed by the valve and mouthpiece eliminates the difference in the exercise ventilatory response detected between pre-pubescent boys and girls. Considering that the breathing apparatus comprises a large portion of both resting and exercise tidal volume in children, it should be accounted for before evaluating the $\dot{V}_E/\dot{V}CO_2$ slope, especially in prepubescent children.

2989 May 29 2:15 PM - 2:30 PM

Bronchodilation Increases Estimated Ventilatory Capacity In Children With Mild Asthma

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(No relevant relationships reported)

Purpose: Children with asthma experience reduced maximal expiratory flows, which can decrease ventilatory capacity and increase ventilatory limitations during exercise; however, the effects of mid-flow bronchodilation on these variables are underappreciated. The purpose of this study was to examine the effect of bronchodilation on ventilatory capacity and ventilatory limitations during a maximal exercise test.

Methods: Nine children with mild asthma (7 boys, 10 ± 1 yr, BMI percentile: 66 ± 30 , forced expiratory volume in 1s, FEV₁; 106 ± 24 %predicted, Range 78-144) completed spirometry before and after 360µg of albuterol. On a separate visit, they completed an incremental exercise test to exhaustion. Estimated ventilatory capacity was calculated using the volume time curve from estimated maximal tidal volume (FVC/2) and estimated maximal total respiratory cycle time ($2 \times FET_{25-75\%}$) both before and after bronchodilator. Ventilatory limitation was defined as $<10\%$ of breathing reserve (Estimated ventilatory capacity - maximum minute ventilation).

Results: Estimated ventilatory capacity increased by 16% after bronchodilator (60 ± 23 vs. 69 ± 27 L/min; $p = 0.013$). Measured maximal tidal volume was lower than estimated (1.12 ± 0.32 vs. 1.33 ± 0.25 , $p = 0.002$) but measured maximal total respiratory cycle time (T_{tot}) was not different from estimated (1.41 ± 0.36 vs. 1.47 ± 0.46 , $p = 0.792$). In a subset of seven children who received 180µg albuterol before the incremental test, five would have been ventilatory limited (i.e., $<10\%$ breathing reserve) at maximal exercise using "before bronchodilator" estimated ventilatory capacity (breathing reserve range: -61 to +9%). However, only one child was ventilatory limited at maximal exercise using "after bronchodilator" estimated ventilatory capacity.

Conclusions: Bronchodilator administration prior to maximal exercise testing may be necessary to increase estimated ventilatory capacity and reduce ventilatory limitations even in children with mild asthma.

2990 May 29 2:30 PM - 2:45 PM

Exercise Training In Chronic Obstructive Pulmonary Disease: Examining The Plasticity Of Oxygen Transport Limitations To $\dot{V}O_{2peak}$

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In patients with chronic obstructive pulmonary disease (COPD), exercise training-induced improvements in peak O₂ uptake ($\dot{V}O_{2peak}$) are reliant on adaptations beyond the lungs, particularly in skeletal muscle. Muscle $\dot{V}O_{2peak}$ is determined by the integration of convective and diffusive O₂ transport, which are markedly diminished in COPD. It remains to be determined how these components of O₂ transport respond to exercise training and if their adaptation is compromised in COPD. **PURPOSE:** To test the hypothesis that exercise training improvements in muscle convective and diffusive O₂ transport, and therefore $\dot{V}O_{2peak}$, would not be attenuated in patients with COPD compared to matched controls. **METHODS:** Metabolic and vascular adaptations to single leg knee extensor exercise (KE) training (1 h, 3 times a week for 8 weeks) were compared between 8 patients with severe COPD (FEV₁±SE=0.9±0.1 L, 30% of predicted) and 8 controls matched for age and physical activity. Femoral arterial and venous blood samples, in conjunction with thermodilution, were used to determine muscle O₂ transport and utilization at peak KE. **RESULTS:** Training increased muscle convective O₂ transport in the controls (0.69 ± 0.07 vs. 0.80 ± 0.10 l/min, $p < 0.05$), but not in the patients with COPD (0.44 ± 0.06 vs. 0.49 ± 0.08 l/min, $p > 0.05$). Muscle diffusive O₂ transport was increased with training in both the patients (6.6 ± 0.8 vs. 9.1 ± 0.12 ml/min/mmHg) and controls (10.4 ± 0.9 vs. 13.3 ± 0.9 ml/min/mmHg) (each $p < 0.05$), which equated to an 86% training response in the patients relative to the controls. Training increased $\dot{V}O_{2peak}$ in the patients with COPD (0.27 ± 0.04 vs. 0.34 ± 0.05 l/min) and controls (0.42 ± 0.05 vs. 0.58 ± 0.07 l/min) and peak work rate in the patients (12 ± 2 vs. 16 ± 2 W) and controls (24 ± 4 vs. 36 ± 4 W) (each $p < 0.05$), which equated to a 44% ($\dot{V}O_{2peak}$) and 33% (peak work rate) training response in the patients relative to the controls. **CONCLUSION:** These findings document limited plasticity in convective O₂ transport to the muscle, but relatively conserved plasticity in muscle diffusive O₂ transport with exercise training in COPD. Thus, despite a near restoration of muscle diffusive O₂ transport, the improvements in muscle $\dot{V}O_{2peak}$ and peak work rate in patients with COPD were constrained by the limited plasticity in convective O₂ transport.

F-12 Free Communication/Slide - Endurance and Interval Training

Friday, May 29, 2020, 1:00 PM - 2:45 PM
Room: CC-3020

2991 **Chair:** Matthew D. Barberio. George Washington University, Washington D.C., DC.

(No relevant relationships reported)

2992 May 29 1:00 PM - 1:15 PM

DOES TRAINING ALTER BIOMARKERS OF IRON HOMEOSTASIS IN FEMALE COLLEGIATE ATHLETES RESIDING AT MODERATE ALTITUDE?

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Iron deficiency is reported to be more prevalent in female athletes compared to the general population, which can negatively affect athletic performance. Hepcidin (HEP) and erythropoietin (ERY) play a significant role in the homeostatic control of iron, but erythropoietic activity, inflammation, and red cell turnover also influence iron homeostasis. It is unknown whether these factors are altered in female athletes while

training at altitude. **Purpose:** To determine how markers of iron homeostasis, including ferritin (fer), hemoglobin concentration (Hb), reticulocytes, HEP, ERY, interleukin 6 (IL6), and tumor necrosis factor alpha (TNFa), lactate dehydrogenase (LDH) and creatine phosphokinase (CPK) change during training in female endurance and team sport athletes residing at moderate altitude. **Methods:** We recruited 94 female athletes from the University of Colorado DI cross country (XC; n = 28), nordic (n = 6) and alpine (n = 8) skiing, lacrosse (LAX; n = 35) and soccer teams (n = 17). In addition, 12 full time female college students were recruited as controls. Between 2 to 7 fasted blood samples were collected over a minimum of 3 months. All athletes were provided with oral iron supplements from a certified nutritionist during this period. **Results:** Average fer and Hb were higher in endurance athletes (fer: 53 ± 30 ng/dL; Hg: 14.6 ± 0.8) compared to team sport athletes (31 ± 19 ; 13.8 ± 0.8) and controls (18 ± 9 ; 13.9 ± 1.1). Fer remained stable over time for all groups except LAX, who decreased by 20 ng/dL post season. HEP was higher in endurance (36.6 ± 60.3 ng/dL) compared to team sport athletes (18.0 ± 12.0), but there were no differences between groups for ERY (overall average: 10.1 ± 50.8 ng/dL); neither HEP or ERY changed significantly over time. In LAX, soccer, and nordic, IL6 and TNFa were lower than XC and remained stable over time; however, IL6 and TNFa started higher in XC and decreased over time. All teams except nordic showed fluctuations in LDH and CPK over the training cycle, but there were no differences between groups for these parameters or percent reticulocytes for any groups. **Conclusion:** Endurance athletes had higher Hb, fer, and HEP. While IL6 and TNFa were higher in XC athletes, other biomarkers of iron homeostasis tended to not be different between groups, although some parameters fluctuated over time.

2993 May 29 1:15 PM - 1:30 PM

Markers Of Training Stress Associated With Functional Overreaching In Middle Distance Runners

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PURPOSE: The present study aimed to identify markers of training stress that were related to the incidence of overreaching in response to overload training in middle distance runners. **METHODS:** Twenty-four middle distance runners ($n=16$ M, $\dot{V}O_{2peak}$: 73.3 ± 4.3 mL·kg⁻¹·min⁻¹; $n=8$ F, $\dot{V}O_{2peak}$: 63.2 ± 3.4 mL·kg⁻¹·min⁻¹) completed 3 wk of normal training, followed by 3 wk of high-volume training (HVTr; 10% increase in volume each successive week), and a 1-wk taper (TapTr; 55% exponential reduction in training volume from HVTr wk 3). Before, and immediately after each training phase, an incremental treadmill test was performed to measure time to exhaustion (TTE), peak heart rate (HR_{peak}), HR recovery, peak blood lactate concentration ([La]_{bpeak}) and $\dot{V}O_{2peak}$. In addition, resting metabolic rate (RMR), body composition, energy intake and resting blood biomarkers of training stress were measured. Runners who had a decreased TTE (>CV) after HVTr were classified as being functionally overreached (FOR), others as acutely fatigued (AF; no decrease performance). Differences between AF and FOR were analysed using mixed-model ANOVAs with pairwise comparisons. **RESULTS:** Following HVTr, there were significant between group differences in the responses to exhaustive running, whereby FOR ($n=12$) had a decrease in TTE (-49 ± 14 s), HR_{peak} (-4 ± 3 BPM; $p = 0.02$), [La]_{bpeak} (-4.30 ± 1.80 mmol·L⁻¹; $p = 0.01$) and $\dot{V}O_{2peak}$ (-2.33 ± 2.0 mL·kg⁻¹·min⁻¹) and a faster HR recovery (-5 ± 4 BPM; $p = 0.03$) compared to AF ($n=12$). There were no between group differences in these variables during submaximal running, nor were there changes in absolute or relative RMR, while only the FOR group increased energy intake during the HVTr. There was no statistically significant change in body composition in either group throughout the study nor were there changes in resting blood biomarkers that reflected inflammation (IL-6, GDF-15 and CRP), metabolism (thyroid hormones), catabolism and anabolism (DHEA, urea, total protein, testosterone, cortisol and GH) or iron regulation (iron, ferritin, and UIBC). **CONCLUSIONS:** Middle distance runners who were classified as FOR following an overload training period did not have alterations in RMR, resting blood biomarkers or submaximal exercise responses compared to runners who did not have impaired performance.

2994 May 29 1:30 PM - 1:45 PM

Molecular Mechanisms Underpinning The Regulation Of Peak Fat Oxidation Rates During Exercise

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(No relevant relationships reported)

PURPOSE: The molecular regulation of peak fat oxidation (PFO) during exercise remains poorly characterized. The aim of this study was to examine the relationship between the content of key proteins involved in adipose tissue and skeletal muscle fat metabolism with PFO.

METHODS: Thirty-six healthy men and women adults [15 females; mean (SD) age 40 (11) years; $\dot{V}O_{2peak}$ 42.5 (9.5) mL·kg⁻¹·min⁻¹; body fat %: 21.8 (8.2) %] completed two incremental exercise tests (separated by 7-28 days) to determine PFO via indirect calorimetry. A DEXA scan and adipose tissue and/or skeletal muscle biopsies were obtained 2-7 days after the second exercise test to determine the protein content of PLIN1, CGI-58, ATGL, HSL, ACSL1, and oestrogen receptor α (ER α) in adipose tissue, and FABPpm, ATGL, ACSL1, CTP1b and ER α in skeletal muscle. Sex comparisons were performed on sub-groups of males and females matched for aerobic capacity relative to fat free mass and classifications of the physical activity level index and fat mass index ($n = 14$ and 12 for adipose tissue and skeletal muscle comparison sub-groups, respectively).

RESULTS: Moderate strength correlations were found between PFO (mg·kg⁻¹·min⁻¹) and the protein content of ATGL [$r = 0.41$ (0.05 - 0.68), $p < 0.05$] and CPT1b [$r = 0.41$ (0.05 - 0.68), $p < 0.05$] in skeletal muscle. No other statistically significant bivariate correlations were found between PFO and the content of proteins in adipose tissue or skeletal muscle. Females had a greater PFO compared to males when expressed relative to fat-free mass [mean (SD): 7.1 (1.9) and 7.3 (1.7) vs 4.5 (1.3) and 4.8 (1.2) mg·kg⁻¹·min⁻¹ in the adipose tissue and skeletal muscle-sub-groups, respectively, $p < 0.05$]. No statistically significant sex differences were found in the content of any of the measured proteins involved in lipid metabolism in adipose tissue or skeletal muscle.

CONCLUSIONS: The molecular regulation of PFO may primarily lie within skeletal muscle rather than adipose tissue, involving processes relating to intramyocellular triglyceride hydrolysis (ATGL) and mitochondrial fatty acid transport (CPT1b). Future studies should explore alternative molecular mechanisms that may account for sexual dimorphism in exercise fuel metabolism.

2995 May 29 1:45 PM - 2:00 PM

The Effect Of Ischemic Preconditioning And Hypoxia On Neuromuscular Function During Intense Exercise

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(No relevant relationships reported)

Ischemic preconditioning (IPC) has been proposed to preserve neural drive during fatiguing exercise, however the underlying mechanism of this response remains unclear. Previous research has shown exercises impairing local tissue oxygenation to be more favourable in eliciting the humoral effects of IPC. **PURPOSE:** To determine whether IPC mediated effects on neuromuscular function are dependent on tissue oxygenation. **METHODS:** Eleven resistance-trained males completed four exercise trials (6 sets of 11 repetitions of maximal effort dynamic single-leg extensions) in either normoxic (fraction of inspired oxygen (FiO₂): 21%) or hypoxic (FiO₂: 14%) conditions, preceded by treatments of either IPC (3 x 5 min bilateral leg occlusions at 220 mmHg) or sham (3 x 5 min at 20 mmHg). Femoral nerve stimulation was utilized to assess voluntary activation and potentiated twitch characteristics during maximal voluntary contractions (MVCs) performed at baseline, prior to the exercise task and after each set of the exercise task. Tissue oxygenation (via near-infrared spectroscopy), blood oxygenation (via pulse oximetry) and surface electromyography activity was measured throughout the exercise task. **RESULTS:** MVC and twitch torque declined 62% and 54%, respectively (MVC: 96 ± 24 Nm, 95% CI = 73 to 119 Nm, Cohen's $d = 2.9$, $p < 0.001$; twitch torque: 37 ± 11 Nm, 95% CI = 26 to 48 Nm, $d = 1.6$, $p < 0.001$), between pre- and post-exercise measurements without reductions in voluntary activation (mean decrease $0.2 \pm 6.2\%$, 95% CI = -5.7 to 6.1%, $d = 0.05$, $p > 0.21$); there were no differences between conditions. Hypoxia reduced both blood and tissue oxygenation by 5% and 6%, respectively, compared to normoxic conditions (blood oxygenation: $4.8 \pm 0.3\%$, 95% CI = 4.7 to 5.0%, $d = 1.9$, $p < 0.001$; tissue oxygenation: $3.5 \pm 1.5\%$, 95% CI 2.6 to 4.4%, $d = 2.4$, $p < 0.001$), with a further 3% reduction in tissue saturation evident in the hypoxic IPC compared to hypoxic sham trial (mean decrease $1.8 \pm 0.7\%$, 95% CI = 0.5 to 3.5%, $d = 1.0$, $p < 0.05$).

CONCLUSION: IPC did not affect any measure of neuromuscular function regardless of tissue oxygenation. A reduction in FiO_2 did invoke a humoral response and improved muscle O_2 extraction during exercise, however it did not manifest into any performance benefit.

2996 May 29 2:00 PM - 2:15 PM

Blood Lactate Steady State Is Maintained During Moderate Intensity Interval Training Depending Rest Time Duration

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Interval training (IT) is a method commonly used by coaches. The rest between stimuli is a variable that can be manipulated in IT. Rest time influences the specificity of workload. Considering that Blood Lactate (BLA) represents the balance of metabolic intracellular production-removal-oxidation, is very important to determine different levels of Lactate Steady-State (La SS) with variation in rest time, which are able to sustain La SS for longer periods, using IT workouts. **PURPOSE:** To analyze BLA during 90s of passive rest (pr) in steady-state moderate intensity IT (mIT). In previous work, we have shown that La SS was maintained for 60s of pr (Mazza et al., 2018), without significant differences (SD). **METHODS:** Eleven trained swimmers (19.4±3.8 y) performed a mIT (BLA 4 to 6 mMol/l). The bout was 10x100m freestyle with 90s pr. BLA and heart rate (HR) were measured at 10s, 50s and 80s at same time, during pr, every 2 reps. We applied Shapiro-Wilk test to analyze distribution's data. We compared BLA-10s vs. BLA-50s vs. BLA-80s applying One-way ANOVA ($p < 0.05$) in reps 2-4-6-8 and 10; also, we determine Pearson correlation coefficient (r) between BLA-10s, BLA-50s, BLA-80s vs. HR-10s, HR-50s, HR-80s, respectively. **RESULTS:** BLA data show normal distribution ($p > 0.05$). The mean BLA max./min. values were 6.25/5.08 mMol/l, respectively, at 1.49±0.07 m/s. Statistical analyses are shown in the following table: & SD BLA-10s vs. BLA-50s; * SD BLA-50s vs. BLA-80s; # SD BLA-10s vs. BLA-80s. We found a low r between BLA and HR ($r = 0.25-0.30$). **CONCLUSION:** This work shows that La SS in mIT depends of pr duration to generate sustained metabolic stress during whole exercise - rest workout. BLA-10s vs. BLA-50s does not register SD (except rep. 6). However, BLA-50s vs. BLA-80s are SD, showing a tendency to lower BLA level. La SS is maintained within BLA 4 to 6 mMol/l range with only 1.17 mMol/l differences between max./min. mean values. Also, we found that HR is not valid variable to control metabolic stress in mIT.

2997 May 29 2:15 PM - 2:30 PM

Training Alterations In Total Hemoglobin Mass And Plasma Volume In Collegiate Athletes Residing At Altitude

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Total hemoglobin mass (THM) is directly related to maximal oxygen consumption and can be used to determine blood volume, red cell volume and plasma volume (PV). The effect of training on THM and PV for male and female intercollegiate athletes across sports residing at altitude has received limited attention. **Purpose:** To examine if training alters THM and PV in NCAA DI athletes residing at altitude. In addition, the effects of sex and/or sport were investigated. **Methods:** We recruited 88 NCAA DI athletes from the University of Colorado Boulder alpine ski, (8M & 7F), nordic ski (NSKI; 6M & 6F), football (FB; 9M), lacrosse (LAX; 35F) and soccer (17F) teams. THM and PV were measured over 3 or more months at selected time points where coaches indicated a change in training stimulus. Recreationally active students (14M & 12F) served as baseline controls. The optimized carbon monoxide rebreathing procedure was used to measure THM and determine PV. Values were reported as means and standard errors while significance was set at $p < 0.05$. **Results:** **Females:** Initial THM for controls, alpine, LAX, NSKI and soccer (577 ± 27, 622 ± 39, 614 ± 11.2, 658 ± 29, 628 ± 23 g, respectively) were not different between groups and did not change with training for any teams. Initial PV for controls, alpine, LAX, NSKI and soccer (2981 ± 190, 3079 ± 128, 3118 ± 56, 3160 ± 194, 3341 ± 107 mL, respectively) were not different between groups. PV decreased with training for alpine, LAX and soccer by 304 ± 116, 112 ± 51 and 268 ± 84 mL, respectively. **Males:** Initial THM

for alpine, FB and NSKI (996 ± 43, 1169 ± 35 & 1089 ± 64 g, respectively) were not different and did not change with training. Initial THM for controls (894 ± 38.1) was lower than FB and NSKI. Initial PV values for controls, alpine, FB and NSKI were 3763 ± 158, 3901 ± 268, 4855 ± 121 and 4597 ± 260 mL, respectively. Initial PV for controls were lower than FB and NSKI, while alpine was lower than FB. NSKI had a decrease in PV (-477 ± 157 mL), which then returned to initial values. **Conclusion:** THM remained constant during training, regardless of sport or sex, indicating that the training stimuli experienced by the athletes may not alter THM. During the course of training certain teams exhibited a decrease in PV, which could be a result of the nature of training stimuli and/or hydration status.

2998 May 29 2:30 PM - 2:45 PM

Abstract Withdrawn

F-13 Free Communication/Slide - Neuroscience

Friday, May 29, 2020, 1:00 PM - 3:00 PM

Room: CC-2005

2999 Chair: Ali Boolani. Clarkson University, Potsdam, NY.

(No relevant relationships reported)

3000 May 29 1:00 PM - 1:15 PM

Brain-Heart Dynamics Are Associated With Cardiorespiratory Fitness & Cognitive Control

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(No relevant relationships reported)

An association between cardiovagal activity and cognitive control may represent overlapping roles of the prefrontal cortex for autonomic and cognitive functions. Greater vagal tone is associated with greater cardiorespiratory fitness and may partially explain the well-established benefits of exercise for cognitive control.

PURPOSE: The aim of this study was to relate cardiorespiratory fitness ($\text{VO}_{2\text{max}}$) and cognitive control to dynamic brain-heart connectivity.

METHODS: Twenty-three, recreationally active young adults (14 women; 18-35 years old) completed a treadmill $\text{VO}_{2\text{max}}$ test, assessment of cognitive control, and resting measures of electroencephalography (EEG) and electrocardiography (EKG). Cognitive control was defined by performance on the Flanker Test ('inhibitory control') and Dimensional Change Card Sort Test ('cognitive flexibility'). A multi-taper method (1-50 Hz; 1 Hz steps) was used to compute dynamic power from from six frontal electrodes and six posterior electrodes as controls. A point-process model, based on an inverse Gaussian distribution fit between R-peaks, was used to produce an instantaneous estimate of heart rate. The maximal information coefficient (MIC), a non-parametric statistic capable of identifying linear and non-linear associations, was computed between the heart rate model and time-varying power at each electrode and frequency to represent dynamic brain-heart connectivity. A partial least squares analysis characterized the brain-heart connections that significantly and reliably contributed to a relationship between MIC and $\text{VO}_{2\text{max}}$ and cognitive control.

RESULTS: One latent variable ($p = .036$) represented independent, negative correlations between MIC and $\text{VO}_{2\text{max}}$, inhibitory control, and cognitive flexibility. High $\text{VO}_{2\text{max}}$ and cognitive control were positively associated with right-lateralized MICs (boot-strap ratios ≤ 1.96) in the delta band (1-3 Hz) and negatively associated with left-lateralized MICs (boot-strap ratios ≥ 1.96) in the delta and theta bands (1-7 Hz). There was no relationship between MIC measured with control (posterior) electrodes and the dependent variables ($p > .236$).

CONCLUSION: The benefits of exercise for cognitive control may be associated with right-lateralized communication between the prefrontal cortex and heart.

3001 May 29 1:15 PM - 1:30 PM

Aerobic Exercise Regulates Synaptic Homeostasis In The Hippocampal CA1 Region Of APP/PS1/tau Mice

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(No relevant relationships reported)

PURPOSE: Physical exercise is an important lifestyle behavior that may reduce the risk of Alzheimer's disease (AD) and delay the onset and progression of AD. Most of the mechanisms underlying these effects are based on molecular biology and little reports are involved in cellular function. In this study, we were to explore the changes

of synaptic homeostasis in the early pathology (6 months) of APP/PS1/Tau transgenic (3xTg) mice, and the possible mechanism of aerobic exercise improving synaptic plasticity.

METHODS: 3xTg mice (2 months old) were randomly divided into exercise groups and sedentary groups (AS, AE), and C57BL/6J mice as cohort control (CS, CE). The exercise groups would run on the treadmill for 16 weeks. Brain slice patch clamp were used to detect the changes of I-O curve, PPF, LTP, LTD, miniature EPSCs (mEPSCs), miniature IPSCs (mIPSCs) and E/I ratio of pyramidal neurons in hippocampal area CA1.

RESULTS: In hippocampal area CA1 of AS, the I-O curve (0.31 ± 0.02) was reduced compared with the CS (0.60 ± 0.02 , $p<0.01$), also in LTP (151.29 ± 7.63 vs $183.55\pm 13.71\%$, $p<0.01$), the mEPSCs frequency (0.25 ± 0.02 vs 0.39 ± 0.03 Hz, $p<0.01$), the amplitude of mIPSCs (23.48 ± 0.44 vs 26.11 ± 0.55 pA, $p<0.05$) and E/I ratio (0.51 ± 0.02 vs 0.81 ± 0.02 , $p<0.01$) of pyramidal neurons. At the interval time of 20 ms, the PPF (1.78 ± 0.08 vs 1.55 ± 0.04 , $p<0.01$) was increased, as were LTD (62.61 ± 3.25 vs $76.14\pm 2.88\%$, $p<0.01$), the amplitude of mEPSCs (14.51 ± 0.34 vs 12.83 ± 0.35 pA, $p<0.01$) and the frequency of mIPSCs (2.46 ± 0.19 vs 1.99 ± 0.10 Hz, $p<0.05$) of pyramidal neurons. Aerobic exercise apparently reversed the changes above of AS in I-O curve (0.74 ± 0.03), LTP ($170.97\pm 5.42\%$), the frequency of mEPSCs (0.51 ± 0.04 Hz), the amplitude of mIPSCs (41.20 ± 1.13 pA) and E/I ratio (0.71 ± 0.03), and decreased PPF (1.42 ± 0.07), LTD ($79.01\pm 4.99\%$), the amplitude of mEPSCs (11.52 ± 0.29 pA) and the frequency of mIPSCs (1.72 ± 0.12 Hz). Meanwhile, those electrophysiology signals were also increased in the CE group.

CONCLUSIONS: Aerobic exercise could regulate synaptic homeostasis plasticity by increasing mEPSCs frequency and mIPSCs amplitude, and decreasing mEPSCs amplitude and mIPSCs frequency. Then it would improve basic synaptic transmission and LTP, weaken LTD in hippocampal area CA1 of the early pathology in 3xTg mice to enhance synaptic plasticity.

3002 May 29 1:30 PM - 1:45 PM

Is Aerobic Fitness Associated With The Dopaminergic System? Evidence From Spontaneous Eye Blink Rate

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(No relevant relationships reported)

Many studies, including ours, have revealed that aerobic fitness, as a physiological indicator of physical activity, is associated with cognitive performance based on the prefrontal cortex and the hippocampus (Hyodo, Soya *et al.*, *NeuroImage*, 2016; Suwabe, Soya *et al.*, *Sci Rep*, 2017). As a potential neurobiological basis for this, the brain dopaminergic system is postulated by animal and a few human studies. Current studies hypothesize that higher physical activity levels may prevent elderly people from declining cognitive function probably via a protective effect against reduced dopamine D2/3-receptor availability (Köhnecke *et al.*, *NeuroImage*, 2018; Jonasson *et al.*, *NeuroImage*, 2019). It remains uncertain, however, whether this association could generally be observed in a healthy population without cognitive decline. To this end, we measured spontaneous eye blink rate (EBR), a potential non-invasive marker for activity in the dopaminergic system related to D2/3-receptors (Groman *et al.*, *J Neurosci*, 2014). **PURPOSE:** We examined the association between aerobic fitness, physical activity and EBR as an indicator of the dopaminergic system in healthy young adults. **METHODS:** Thirty-six 18- to 24-yr-old healthy young men completed an aerobic fitness assessment ($V\cdot O_{2peak}$) using a graded exercise test with a recumbent ergometer, self-reported on their leisure-time physical activity (the Japanese language version of the International Physical Activities Questionnaire), and had their EBR measured while staring at a fixation cross while at rest. **RESULTS:** Greater aerobic fitness ($V\cdot O_{2peak}$) was correlated with both higher leisure-time physical activity ($r=0.51$, $p<0.01$) and higher EBR ($r=0.40$, $p<0.05$) after controlling for age. In addition, Leisure-time physical activity was also positively correlated with EBR ($r=0.37$, $p<0.05$). **CONCLUSION:** These results show that aerobic fitness is associated with EBR in healthy young adults, supporting the hypothesis above that aerobic fitness is an indicator of physical activity associated with cognitive function via the dopaminergic system related to D2/3-receptors.

3003 May 29 1:45 PM - 2:00 PM

Forced Running Exercise Modulates Amyloid-beta Protein Clearance Anddegradation Pathways In Prevention Of Alzheimer'S Disease

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PURPOSE: Most of studies demonstrate positive effects of exercise on A β levels in Alzheimer's Disease (AD) model, while a small subset of investigations reports no change. Nearly all studies using the APP/PS1 mouse showed reduced A β levels after

a forced exercise, but studies using the 3xTg-AD mouse did not after a voluntary exercise. Discrepancies in the data may be due to the wide range of transgenic animal strains, starting age, intervention type, and length of intervention used in these studies. Here, we used 12-week protocol starting with different age of 3xTg mouse to investigate forced running effect on A β levels.

METHODS: 6, 9 and 12 months 3xTg mice were randomly divided into exercise and sedentary groups, 2-month 3xTg mice as the control group. The exercise groups would run on the treadmill for 12 wks. Immunofluorescence and Dot blot were used to detect A β plaque and soluble A β respectively. Western blot was used to detect β -site APP cleaving enzyme (BACE1) and A β degradation or clearance enzyme Neprilysin (NEP) in the cerebral cortex and hippocampus and Insulin-degrading enzyme (IDE) in liver.

RESULTS: The hippocampal and cortical tissue showed soluble A β increased with age. Obvious A β plaque accumulation was showed at 9 and 12-month-old. With AD-pathology the BACE1 levels were increased ($p<0.05$) while NEP expression decreased ($p<0.05$) in hippocampus and cortex, and IDE content decreased ($p<0.05$) in liver. Disturbances went more severe with aging. Exercise treatment ameliorated soluble A β aggregation and A β plaque, BACE1 (0.70 ± 0.13 , 0.78 ± 0.13 , $0.81\pm 0.08/1.06\pm 0.12$, 0.78 ± 0.08 , 0.69 ± 0.10 , $p<0.05$), NEP (1.50 ± 0.24 , 1.19 ± 0.12 , $1.20\pm 0.12/1.16\pm 0.04$, 1.22 ± 0.26 , 1.31 ± 0.12 , $p<0.05$) and IDE (1.07 ± 0.13 , 1.19 ± 0.20 , 1.24 ± 0.12 , $p<0.05$) changes were partially protected by exercise.

CONCLUSIONS: In the 3xTg-AD mice at different age of 6, 9 and 12 months, 12 wks forcing treadmill exercise can obviously reduce the levels of A β with lower BACE1, higher NEP expression in the brain and IDE of the liver. Although it is not definite that forced exercise interventions are better for reducing A β levels, the benefits of exercise interventions still support the value of this healthy life-style against neurodegeneration.

3004 May 29 2:00 PM - 2:15 PM

Effects Of Aerobic Exercise On The Nicotine Addiction Induced Inhibitory Synaptic Plasticity In The Vta

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(No relevant relationships reported)

PURPOSE: Disinhibition of the ventral tegmental area (VTA) dopamine neurons has been implicated in nicotine addiction. This study aimed to investigate the effect of aerobic exercise on the nicotine addiction behavior in mice, and the effect on GABAergic transmission and dopaminergic activity in the VTA.

METHODS: 2 months old male C57BL/6J mice were randomly divided into sedentary + saline group (SS), sedentary + nicotine group (SN), exercise + saline group (ES) and exercise + nicotine group (EN) respectively. The ES and EN groups were made to run on the treadmill for 1 hour per one day, five times a week, for 12 weeks. The exercise workload consisted of running at a speed of 12 m/min for the first 10 min, 15 m/min for the last 50 min, with 0% grade of inclination. The conditioned place preference (CPP) assay was used to evaluate nicotine addiction related behavior. In the CPP assay, SN and EN mice were given an intraperitoneal (i.p.) injection of nicotine (0.5 mg/kg) while SS and ES mice were given an injection of saline. Patch clamp was used to investigate the dopamine neuron excitability and GABAergic transmission in the VTA. Immunofluorescence was used to detect the expression of tyrosine hydroxylase (TH) in the VTA.

RESULTS: 8 weeks of treadmill exercise decreased nicotine exposure induced CPP expression (CPP score, SS, -33.69 ± 16.57 ; SN, 121.51 ± 14.53 ; ES, -21.72 ± 15.12 ; EN, 66.34 ± 15.12 ; SS vs. SN, $p<0.001$; EN vs. SN, $p<0.05$, two-way ANOVA). Exercise decreased nicotine CPP induced dopamine neuron hyperexcitability (SS, 3.36 ± 0.45 ; SN, 6.63 ± 0.56 ; ES, 3.22 ± 0.48 ; EN, 4.60 ± 0.18 ; SS vs. SN, $p<0.001$; EN vs. SN, $p<0.01$, two-way ANOVA). Exercise decreased nicotine CPP induced increase of TH expression in the VTA (relative fluorescence intensity, SS 1.00; SN, 2.03 ± 0.15 ; ES, 1.38 ± 0.06 ; EN, 1.04 ± 0.07 ; SS vs. SN, $p<0.001$; EN vs. SN, $p<0.001$, two-way ANOVA). Exercise restored nicotine CPP induced impairment of GABA transmission in the VTA (sIPSCs frequency, % as baseline, SS, $154.62\pm 6.86\%$; SN, 102.19 ± 6.20 ; ES, 141.36 ± 5.84 ; EN, 121.82 ± 4.41 ; SS vs. SN, $p<0.001$; EN vs. SN, $p<0.05$, two-way ANOVA).

CONCLUSIONS: Aerobic exercise restores nicotine addiction induced VTA dopamine neuron hyperexcitability by enhancing the inhibitory transmission. Supported by the China Postdoctoral Science Foundation (2018M641260, 2019T120067).

3005 May 29 2:15 PM - 2:30 PM

Pupillary Responses Indicate Working Memory Processing Differences: Implications For Healthy And Clinical Populations

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Task-evoked pupillary responses (PR) are established psychophysiological measures for neural resource allocation. During working memory tasks, pupils dilate proportional to increasing cognitive demands and constrict when demands exceed resource availability. PRs have demonstrated greater sensitivity to load-dependent processing differences in clinical populations, beyond performance accuracy, under high cognitive demands. Few studies have examined concussion history, sex, and performance accuracy effects on PRs across varying cognitive load levels.

PURPOSE: To examine effects of concussion history, sex, and performance accuracy on PR in healthy individuals during a digit-span task. **METHODS:** Participants self-reported sex (female vs. male) and concussion history (yes vs. no), and completed a backwards digit-span task in a single testing session. A virtual reality headset with 60Hz infrared eye tracking displayed the task and recorded pupil size fluctuations. Pupil size (diameter in mm) was recorded before each trial (baseline=3sec) and following randomly presented digit sequences between 4 and 14 digits long (retention=2sec). PR was calculated as the mean size during retention, normalized to mean baseline. Accuracy was calculated as the proportion of correctly recalled digits by serial position. A mixed effects model examined concussion history, sex, and accuracy effects on PR across sequence-lengths (*a priori* $\alpha=0.05$). **RESULTS:** 40 participants were included [age=21.9±2.1years; males=50%; 17 (43%) with concussion history]. There were significant effects of sex ($F_{1,36}=15.66, p<0.001$) and accuracy ($F_{1,2588}=4.70, p<0.03$) on overall relative PR controlling for all other model predictors and interactions. Specifically, females exhibited smaller mean PRs compared to males. Smaller mean PRs were also associated with higher average task accuracy. **CONCLUSION:** In our study, females exhibited smaller overall pupillary responses during a digit-span working memory task compared to males, indicating potential sex-dependent processing differences. The association between better task accuracy and smaller PRs may further support PR measure to better inform neurocognitive processing differences in healthy and clinical populations, when demands exceed cognitive resource availability.

3006 May 29 2:30 PM - 2:45 PM

Behavioral-induced Prefrontal Cortex Activation And Episodic Memory Function

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(No relevant relationships reported)

PURPOSE Here we evaluated the effects of several behaviors (e.g., acute exercise, fist clenching, and saccades) on episodic memory, and whether prefrontal cortex oxygenation mediated these relationships. Six experiments were conducted to evaluate these direct and indirect effects. **METHODS & RESULTS** Experiment 1 was a four-visit, within-subject, counterbalanced randomized controlled experiment. The visits included 1) exercise and saccadic eye movements, 2) exercise only, 3) saccadic eye movements only, and 4) no exercise and no saccadic eye movements (control). A word-list based episodic memory assessment was employed, including a long-term memory evaluation. The RM ANOVA was statistically significant ($P=0.01, \eta_p^2=0.15$), as the number of words recalled at the delay period were, respectively, 7.8 (2.7), 8.1 (2.7), 8.1 (2.3), and 6.6 (2.8). In our second experiment, we evaluated the effects of saccadic eye movements on prefrontal cortex oxygenation (PFC O_2Hb), a proxy for neuronal activity. We found a main effect for time over a three-minute period, ($P<0.001, \eta_p^2=0.31$), representing higher oxygenation levels during saccadic eye movement. In our third experiment, we evaluated the effects of acute exercise on PFC O_2Hb , which also demonstrated an increase in PFC O_2Hb across time, ($P=0.04, \eta_p^2=0.09$). Experiment 4 replicated Experiment 1, but instead of saccadic eye movements, used a fist clenching protocol. The RM ANOVA was statistically significant ($P<0.001, \eta_p^2=0.46$), with memory being significantly better for the exercise only, fist only, and exercise + exercise visit compared to control. Experiment 5 evaluated the effects of fist clenching on PFC O_2Hb . Results demonstrated a significant main effect for time, with oxygenation increasing during fist clenching, ($P<0.001, \eta_p^2=0.35$). Experiment 6 demonstrated that PFC oxygenation was statistically significantly positively associated with episodic memory function, in that, for every 1 μM increase in oxygenation during memory encoding, there was a 0.27 increase in the number of words (out of 8) recalled ($b=0.27; 95\% CI: 0.02, 0.52; p = .03$). **CONCLUSION** These six experiments suggest that several behaviors may improve memory function and may, potentially, do so via increases in PFC O_2Hb .

3007 May 29 2:45 PM - 3:00 PM

Relationships Between Muscular Strength, Cognitive Control, And Hippocampal Dependent Relational Memory Function

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PURPOSE: An increasing number of studies have shown a positive correlation between aerobic fitness and cognitive control, and hippocampal memory performance. However, the relationship between muscular strength and specific domains of cognitive function has not yet been well elucidated. The aim of this study was to examine cross-sectional relationships between muscular strength and cognitive control (i.e., attention and inhibitory control), as well as hippocampal-dependent relational memory. **METHODS:** Adults (N=35) between 45 and 64 years underwent strength assessments measured by leg extension one-repetition maximum (1RM), maximal voluntary isometric contraction (MVC), and isokinetic knee extension. Selective attention, inhibitory control, and hippocampal-dependent relational memory was assessed using the Flanker, Go/NoGo, and a Spatial Reconstruction task, respectively. Lean mass was measured via dual X-ray absorptiometry (DXA). **RESULTS:** Following adjustment for covariates (i.e., age, sex, and lean mass), greater MVC ($r=-0.37, P=0.04$) and isokinetic peak knee extension torques measured at $60^\circ \cdot s^{-1}$ ($r=-0.47, P=0.008$), $120^\circ \cdot s^{-1}$ ($r=-0.37, P=0.04$), and $180^\circ \cdot s^{-1}$ ($r=-0.39, P=0.03$) were related to faster incongruent reaction time during the Flanker task. Misplacement error during spatial reconstruction task was inversely related to peak knee extension torques measured at $120^\circ \cdot s^{-1}$ at the trend level ($r=-0.36, P=0.05$). No significant associations were observed for Go/NoGo accuracy (all $r's \leq -0.34$, all $P's \geq 0.6$). **CONCLUSION:** Individuals with greater muscular strength exhibit greater cognitive function. These findings provide insights into the potential for domain-specific interrelationships between muscular strength attentional abilities over memory performance and inhibitory control. This work was funded by The Beef Checkoff.

F-14 Free Communication/Slide - Older Adults: Methods, Interventions, and Outcomes

Friday, May 29, 2020, 1:00 PM - 3:00 PM
Room: CC-2022

3008 Chair: Loretta DiPietro, FACSM. *The George Washington University School of Public Health and Health Services, Washington, DC.*

(No relevant relationships reported)

3009 May 29 1:00 PM - 1:15 PM

Effect Of Type And Intensity Of Community-based Exercise Interventions In Older Women

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(No relevant relationships reported)

PURPOSE: To assess the effect of different community-based exercise interventions on hemodynamic and functional variables in older women. **METHODS:** 33 sedentary or insufficiently active older women (69 ± 5 ys) were randomly assigned to perform a twice-weekly community-based moderate-intensity continuous aerobic training plus resistance training (MICT+RT), high-intensity interval training plus resistance training (HIT+RT) or resistance training (RT) programs. Anthropometric (weight, height and BMI), hemodynamic (resting blood pressure and carotid-femoral pulse wave velocity) and functional variables (seat-and-reach, handgrip, five times sit-to-stand (FTSS), timed up-and-go (TUG), and 6-minute walking (6MW) tests) were assessed before and after 9 months of follow-up.

RESULTS: There were no significant difference between groups in any variable at baseline. Anthropometric and hemodynamic variables, as well as seat-and-reach and handgrip did not change during follow-up in any group. However, FTSS, TUG and 6MW improved ($P < 0.05$) similarly between groups during follow-up. (Table 1).

CONCLUSION: The present preliminary results suggest that twice-weekly community-based exercise programs of different types and intensity are effective to improve functional capacity, but not anthropometric and hemodynamic variables, in older women.

Table 1. Anthropometric, hemodynamic and functional variables before and after 9 month follow-up

Variable	MICT_RT		HIIT+RT		RT	
	Before	After	Before	After	Before	After
Weight	70 ± 12	74 ± 14	66 ± 9	63 ± 10	72 ± 16	71 ± 16
BMI	28.2 ± 4.2	28.5 ± 5.1	27.0 ± 4.4	26.2 ± 4.4	29.9 ± 5.6	29.5 ± 5.3
Systolic BP	118 ± 11	122 ± 8	124 ± 19	128 ± 15	131 ± 16	127 ± 20
Diastolic BP	64 ± 6	66 ± 7	63 ± 7	69 ± 9	70 ± 12	72 ± 9
PWV	9.4 ± 2.3	9.0 ± 3.0	10.5 ± 10.1	10.1 ± 1.9	10.6 ± 1.7	11.6 ± 2.1
Seat and reach	22.5 ± 7.7	28.0 ± 8.2	23.0 ± 21.5	21.5 ± 8.0	28.5 ± 5.6	28.0 ± 6.5
Handgrip	25.0 ± 5.3	24.0 ± 4.3	22.5 ± 5.9	25.5 ± 4.9	26.0 ± 5.7	27.5 ± 6.9
FTSS	11.6 ± 2.1	7.8 ± 1.6**	11.1 ± 2.9	8.9 ± 1.7**	10.4 ± 3.6	7.6 ± 1.1***
TUG	8.3 ± 1.1	6.2 ± 1.3*	7.6 ± 2.5	5.9 ± 1.1***	7.4 ± 2.0	6.2 ± 1.6*
6MW	482 ± 33	512 ± 43*	464 ± 88	536 ± 53***	462 ± 82	503 ± 53*

FTSS: five time sit-to-stand test; HIIT+RT: high-intensity interval training plus resistance training group; MICT+ moderate-intensity continuous training plus resistance training group; PWV: carotid-femoral pulse wave velocity; RT: resistance training group; TUG: timed up-and-go test; 6MW: six minute walking test; Asterisk: significant difference from before follow-up at the same group (* = $P < 0.05$; ** = $P < 0.01$; *** = $P < 0.001$)

3010 May 29 1:15 PM - 1:30 PM
Associations Between Accelerometer-derived Daily Physical Activity Patterns And Frailty Among Older Adults At Elevated Risk For Falls

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BACKGROUND: With aging, the degradation of free-living physical activity patterns may indicate phenotypic frailty.

PURPOSE: To determine the baseline, cross-sectional association between accelerometer-derived physical activity patterns and frailty in participants of Study to Understand Fall Reduction and Vitamin D in You (STURDY) trial

METHODS: Baseline wrist-worn accelerometer and frailty data were collected from 505 STURDY participants (mean age 77 (SD=5.5) years; 43% women). Accelerometer data collected over 24-hour, 7-day periods were used to derive continuous physical activity metrics, including mean activity minutes/day and activity fragmentation (reciprocal of the average length of activity bouts). Robust, pre-frail and frail statuses were identified using a modified version of the physical frailty phenotype defined as having 0, 1, or ≥2 (of 4) phenotypes, respectively: weight loss, exhaustion, slowness, and weakness. Using multiple logistic regression models, the interaction between age and each accelerometer metric was examined to estimate an odds ratio between frailty and pre-frailty/robustness.

RESULTS: Robust (30%) and pre-frail participants (48%) had similar physical activity patterns, spending approximately 6.5 hours/day in activity with a 25% level of activity fragmentation, while frail participants (28%) appeared to accumulate less activity in a more fragmented manner (5.8 hours/day and 29% activity fragmentation). The odds of frailty (versus pre-frailty/robustness) was lower by a factor of 3% with each higher year of age by higher hour of activity (OR:0.97, 95% CI:0.94-0.99, age x activity interaction $p=0.01$). The interaction between age and fragmentation was not significant ($p=0.39$) but higher fragmentation was associated with a higher likelihood of frailty (OR:1.04, 95% CI:1.01-1.07, $p=0.02$).

CONCLUSION: Our results show an inverse relationship between objectively-measured physical activity and frailty that becomes stronger with age among at-risk older adults. More daily activity breaks (activity fragmentation) was associated with

higher frailty odds; an association that remained stable across age. Our findings warrant further investigation into whether longitudinal declines in objectively-measured physical activity patterns precede frailty onset.

3011 May 29 1:30 PM - 1:45 PM
Abstract Withdrawn

3012 May 29 1:45 PM - 2:00 PM
Effects Of Community-based Exercise Training And Detraining On Hemodynamic Variables In Older Women: Role Of Intensity And Modality

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 (No relevant relationships reported)

Regular exercise is associated with a reduced risk of developing chronic diseases and improved physical capacity. However, to our knowledge, the effects of modality, intensity and consequences of detraining have not yet been investigated in the elderly population. We sought to evaluate and compare the effect of modality and intensity (moderate intensity continuous aerobic training - MICT, high intensity interval aerobic training - HIIT, resistance training - RT, or combined - MICT + RT and HIIT + RT) of a training program, on the behavior of hemodynamic and functional variables of elderly women after 12 weeks of training and 16 weeks after their interruption.

PURPOSE: To verify the effect of exercise modality and intensity on the hemodynamic variables of the elderly.

METHODS: 69 elderly women (69.19 ± 7.89 years) were randomized into MICT (n = 29), RT (n = 15), MICT + RT (n = 12), and HIIT + RT (n = 13). Participants performed physical exercises twice a week during 60 minutes. The variables investigated were blood pressure (BP), heart rate (HR), abdominal circumference (AC) at pre, after 12 weeks of intervention, and after 16 weeks of training interruption (detraining).

RESULTS: Diastolic blood pressure decreased in HIIT + RT between pre and untrained ($p < 0.01$) and in RT between post and untrained ($p < 0.02$). There was a significant increase in HR between post and detraining MICT ($p < 0.02$) and a decrease in MICT + RT between pre and post training ($p < 0.000$), with no significant difference in detraining. AC decreased in HIIT + RT between pre and post ($p < 0.01$), in RT between pre and detraining ($p < 0.009$) and post and detraining ($p < 0.00$). There was an increase in post and detraining WC for MICT ($p < 0.05$) and MICT + RT ($p < 0.03$).

CONCLUSION: Isolated or combined aerobic training can be effective in reducing blood pressure levels. Resistance training was also effective for reducing abdominal fat levels.

Table 1. Blood pressure, heart rate and abdominal circumference during follow-up

		HIIT+RT	MICT+RT	MICT	RT
Systolic blood pressure (mmHg)	Pre	136 ± 17	129 ± 19	131 ± 19	127 ± 17
	Post	132 ± 27	126 ± 17	133 ± 17	120 ± 20
	Detraining	129 ± 14	119 ± 15	126 ± 20	133 ± 14
Diastolic blood pressure (mmHg)	Pre	78 ± 9	68 ± 10	68 ± 11	71 ± 9
	Post	73 ± 13	70 ± 7	71 ± 8	68 ± 10
	Detraining	72 ± 7*	66 ± 9	66 ± 9	72 ± 10†
Heart rate (bpm)	Pre	74 ± 8	73 ± 8	70 ± 8	69 ± 10
	Post	70 ± 7	70 ± 7*	71 ± 8	68 ± 10
	Detraining	75 ± 6	72 ± 12	73 ± 13†	73 ± 8
Abdominal circumference (cm)	Pre	96 ± 13	102 ± 17	98 ± 9	104 ± 12
	Post	91 ± 14*	97 ± 15	97 ± 10	105 ± 12*
	Detraining	97 ± 12	108 ± 21†	99 ± 10†	99 ± 11*†

HIIT+RT: high-intensity interval training plus resistance training; MICT: moderate-intensity continuous training; MICT+RT: moderate-intensity continuous training plus resistance training; RT: resistance training; * different from pre ($P < 0.05$); †: different from pos ($P < 0.05$)

3013 May 29 2:00 PM - 2:15 PM

Effects Of Moderate Versus Vigorous Intensity Exercise Training In Older Adults With Prediabetes

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PURPOSE: Aerobic exercise is recommended to improve glycemic control; however, the optimal intensity of exercise for older adults with prediabetes is unknown. The objective of this pilot study was to compare the effects of moderate vs. vigorous intensity aerobic exercise on glycemic control and non-exercise physical activity (NEPA). **METHODS:** 19 older adults (14F; 68.1 ± 5.8 yrs) with prediabetes (HbA1c 5.7-6.4% or fasting glucose 100-125 mg/dl) were randomized to 12-weeks of supervised aerobic exercise (45-min sessions 4 days/wk) at either moderate (MOD: 60-65% HR_{max}) or vigorous (VIG: 80-85% HR_{max}) intensity. Free-living glycemic control (24h mean; percent of day ≥140 mg/dL) was measured using continuous glucose monitors (CGM, Dexcom). NEPA (>1.5 METs, excluding exercise sessions) was assessed using a thigh worn accelerometer (ActivPAL v4). A 3h Oral glucose tolerance test (OGTT, 75g) was performed at baseline and following the exercise intervention (72-96h following the last exercise bout) to compare to free-living CGM and as measure of insulin sensitivity (Matsuda Index). Data are presented as mean±SE. **RESULTS:** Adherence rates to the exercise interventions were 85±9% and 89±3% in MOD and VIG with mean heart rates during exercise of 99±1 bpm (65% HR_{max}) and 123±4 bpm (79% HR_{max}), respectively. Mean 24h glucose (-8.4±6.4 vs. -2.2±6.7 mg/dl) and percent of day >140 mg/dL (-9.7±11.0% vs. 0.7±4.6%) did not significantly change in MOD or VIG, respectively. However, there was a significant group by time interaction (p=0.05) for change in insulin sensitivity in MOD (+2.4±1.1) and VIG (-0.6±0.8). There were no differences between groups for change in NEPA, fasting glucose, or 2h glucose. Changes in free-living CGM were not significantly correlated with changes in OGTT outcomes. **CONCLUSION:** In older men and women with prediabetes, both MOD and VIG had minimal effects on free-living glycemic control, but MOD induced greater improvements in insulin sensitivity. These preliminary results suggest that a more comprehensive lifestyle intervention combining dietary intervention and exercise may be needed to improve glycemic control in this population.

3014 May 29 2:15 PM - 2:30 PM

The Stay Strong, Stay Healthy Program's Effect On Fall Risk In Older Adults

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Falling and fear of falls among older adults can have significant impacts on daily life such as restricted activity, functional decline, and social isolation. Exercise interventions need to target modifiable risk factors to have the greatest impact. **PURPOSE:** The first aim was to determine the effectiveness of an eight-week Stay Strong, Stay Healthy (SSSH) exercise intervention on older adults' fear of falling and risk of falls. The second aim was to determine the strongest predictors of reported number of falls among older adults. **METHODS:** 60 adults over the age of 60 yrs, were randomized into SSSH, active control (WALK), or sedentary control (CON) groups. 46 participants (SSSH n=15, WALK n=17, CON n=14) completed pre/post intervention questionnaires on physical activity (PA), fear of falling, and sleep quality using the Pittsburgh Sleep Quality Index Survey (PSQI). Participants also completed the 8 ft timed up and go (TUG) and 30 s sit to stand (30STS), dynamic balance tasks and grip strength testing. Repeated measures ANOVAs were used to determine group (SSSH, WALK, CON) × time (pre, post) interaction effects for TUG, 30STS, and grip strength; one-way ANOVAs were used to analyze percent changes (%Δ); and simple linear regression was used to predict the number of falls in the last 12 months; alpha was set at 0.05. **RESULTS:** SSSH and WALK significantly improved 30STS performance by 2.4 repetitions and 1.1 repetitions, respectively, while CON did not improve. PSQI scores significantly increased (worsened) in CON (p=0.040), did not change in WALK, and decreased (improved) by 1.3 points in SSSH (p=0.009). Reported PA did not change for WALK or CON; however, SSSH increased by 60+ min/wk (p=0.049). A significant time effect was observed as TUG times decreased and grip strength did not change for all groups. CON and WALK increased their overall fear of falling scores by 7.7% and 3.9% respectively, while SSSH decreased by 2.3%. The strongest predictive model for the number of falls reported in the past 12 months included PSQI scores, PA, and grip strength (R²=0.282; p=0.003). **CONCLUSIONS:** These data suggest participation in eight weeks of the SSSH significantly improves important modifiable risk factors (e.g., sleep and PA), and reduced fear of falling scores which is consistent with our prediction model for the number of falls sustained.

3015 May 29 2:30 PM - 2:45 PM

The Stay Strong, Stay Healthy Program Improves Physical Function And Fall Risk In Older Adults

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The aging process, even in the absence of chronic disease, is marked by a decline in the mass, quality, and function of skeletal muscle, increasing the risk of falls. **PURPOSE:** The purpose was to determine effectiveness of an 8-week Stay Strong, Stay Healthy (SSSH) exercise intervention on improving older adults' muscle strength, dynamic balance, and fall risk compared to controls. **METHODS:** 60 adults aged ≥60 yrs, were randomized into SSSH, active control (WALK), or sedentary control (CON) groups. 46 participants (SSSH n=15, WALK n=17, CON n=14) completed pre and post intervention general health and physical activity (PA) questionnaires, the Pittsburgh Sleep Quality Index Survey (PSQI), and total body DXA. Participants also completed the 10 m walk test (10MWT), 8 ft timed up and go (TUG), 30 s sit to stand (30STS), back scratch (BS), sit and reach flexibility tests, and the CDC four phase balance task. Repeated measures ANOVAs were used to determine group (SSSH, WALK, CON) × time (pre, post) interaction effects and percent changes (%Δ) were analyzed using one-way ANOVAs, alpha was set at 0.05. **RESULTS:** SSSH and WALK participants significantly improved 30STS performance by 2.4 repetitions (p < 0.001) and 1.1 repetitions (p = 0.008), respectively, while CON did not improve. PSQI scores significantly increased (worsened) in CON (p = 0.040), did not change in WALK, and decreased (improved) by 1.3 points in SSSH (p = 0.009). Average BS distance for WALK or CON did not change, but SSSH participants improved (+ 4.3 cm, p = 0.040). Reported auxiliary PA did not change for WALK or CON; however, SSSH increased by more than 60 min/wk (p = 0.049). **CONCLUSIONS:** Participation in the 8-week SSSH resistance training program significantly improves lower body strength/coordination, dynamic balance, sleep quality, and engagement in auxiliary PA over sedentary and exercise volume matched walking groups.

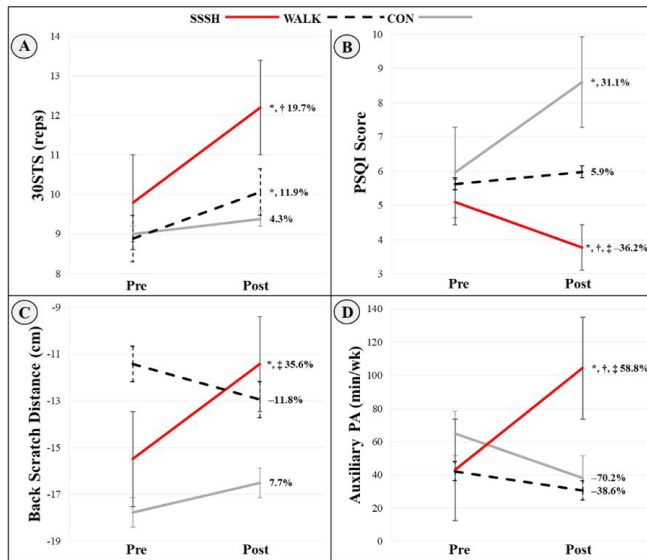


Figure 1. Significant interactions for 30STS, PSQI, back scratch flexibility, and auxiliary physical activity. * denotes a significant within group difference from pre ($p < 0.05$). † and ‡ denote significant magnitudes of change greater than CON or WALK respectively ($p < 0.05$).

3016 May 29 2:45 PM - 3:00 PM

Influence Of Exercise And Gardening Activity On Successful Aging: A Six-year Cohort Study

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(No relevant relationships reported)

Purpose: Population aging has become a prominent social problem in China. This study aimed to examine the influence of exercise and gardening activity on successful aging (SA).

Methods: This study was based on the 2008-2014 data set of Chinese Longitudinal Healthy Longevity Survey (CLHLS). A total of 5245 elderly people aged 65 and older were included in this study. SA was defined as no major illness, being free of disability, normal cognitive function, engaging in social or productive activity, and satisfaction on life. Correlates of SA included demographics (gender and age) and socio-economic feature (education). With activities being measured in 2008 and 2011, SA being assessed both in 2008, 2011 and 2014. Binary logistic regression analysis was used to determine whether these two activities have positive effects on SA.

Results: According to the activity data of 2008 and SA situation in 2014, the regression analyses indicated that regular exercise (OR=1.223, 95%CI: 1.001-1.495) and gardening (OR=1.640, 95%CI: 1.272-2.115) were significant predictors to better SA ($P < 0.05$). From the combination activity data of 2008 and 2011, compared with the sedentary elderly, the elderly participated exercise (OR=1.661, 95%CI: 1.286-2.145, $P < 0.05$) or gardening (OR=1.807, 95%CI: 1.331-2.453, $P < 0.05$) continuously were found to have higher odds to be successful agers in 2014. Moreover, the results showed that the elderly just participated from 2011 have higher probability to be successful agers in 2014 than the sedentary elderly, the odds ratios of exercise and gardening were 1.396 and 1.441 respectively.

Conclusion: These findings suggest that exercise and gardening activity may have positive effects on SA, and continuous participation has better effects.

F-32 Thematic Poster - Blood Flow Restriction

Friday, May 29, 2020, 3:15 PM - 5:15 PM
Room: CC-2010

3070 **Chair:** Truls Raastad. *Norwegian School of Sport Sciences, Oslo, Norway.*
(No relevant relationships reported)

3071 Board #1 May 29 3:15 PM - 5:15 PM

Exercise With Blood Flow Restriction To Improve Muscular And Physical Function After Total Knee Arthroplasty

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After a total knee arthroplasty (TKA), quadriceps strength and physical function can be impaired for several years. Blood flow restriction (BFR) exercise is an effective method to improve muscular and physical function in clinical populations with knee joint pathologies. To date, there are two case studies documenting application of BFR after TKA. A next step is to determine the feasibility of BFR in a larger TKA cohort. **PURPOSE:** To evaluate the effectiveness of a 10wk home-based BFR exercise program to improve muscular and physical function after TKA. **METHODS:** Six adults (age: 59±9yrs, BMI: 33±5) with a unilateral TKA (2.7±1.7yrs post-surgery) performed body weight half squats, isolated knee extension using a resistance band, and walking exercises with BFR 3x/wk for 10wk. During exercise, blood flow in the affected limb was restricted using a 15cm wide thigh cuff inflated to 50% of limb occlusion pressure which was identified using Doppler ultrasound. Outcome measures of vastus lateralis thickness, maximal knee extensor isometric torque, and physical function (repetitions performed during 30s chair stand test, distance covered during 6min walk test) were assessed at baseline and post-training. **RESULTS:** Participants completed 98% of the home-based BFR training sessions and tolerated the exercise program well as joint pain (0.6±0.1cm) and muscle soreness (0.5±0.1cm) were very low (0-10cm visual analogue scale). Vastus lateralis thickness and knee extensor strength in the affected leg increased by 18±11% and 17±13%, respectively (both $P < 0.05$). After training, number of repetitions during the 30s chair stand test increased (11±2 vs. 18±4 repetitions, $p < 0.01$) and this change (6 repetitions) exceeded the minimally important clinical difference. There was a significant increase in distance covered during the 6min walk test (51±28 vs. 556±36m, 9±7%, $p = 0.03$) but this improvement (46m) did not exceed the clinical threshold. **CONCLUSION:** Results from this pilot study are promising and suggest that home-based BFR exercise can be feasible, safe, and effective for improving muscular and physical function after TKA. Further research is needed to confirm these initial findings in a larger randomized TKA control trial.

3072 Board #2 May 29 3:15 PM - 5:15 PM

Acute Physiological Responses To Low-intensity Exercise With Different Levels Of Blood Flow Restriction

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(No relevant relationships reported)

PURPOSE: External pressure is a key factor in blood flow restriction (BFR) training. Previous studies have used a limited range of occlusion pressures to compare the acute physiological and perceptual responses during leg exercise. The aim of this study was twofold: i) to compare the physiological and perceptual responses of low-intensity exercise (LI) with different levels of BFR, and ii) to compare LI with BFR on the bike with high-intensity (HI) exercise without BFR.

METHODS: Twenty-one healthy, moderately-trained male (age: 24.6±2.4 yrs; VO_{2peak} : 47.2±7.0 ml/kg/min, mean±sd) volunteered to perform one maximal graded exercise test on the bike and seven 5-min constant intensity exercise bouts on separate days and in a counterbalanced order. Six bouts were at 40% peak power (P_{peak} ; LI); one without BFR and five with different levels of BFR (40%, 50%, 60%, 70%, 80% of arterial occlusion pressure, LI-BFR_{40/50/60/70/80}). Finally, they performed one HI bout (70%

P_{peak}) without BFR. Oxygen uptake (VO_2), heart rate (HR), blood lactate (BLa), rating of perceived exertion (RPE), and tissue oxygen saturation (TSI) with near-infrared spectroscopy were recorded.

RESULTS: Regardless of pressure, HR, BLA and RPE during LI-BFR were higher compared to LI ($p<0.05$), and TSI reduction was greater in LI-BFR (LI-BFR_{40/50/60/70/80}: $-10.6\pm 3.1\%$, $-10.2\pm 4.0\%$, $-10.1\pm 5.1\%$, $-10.0\pm 4.2\%$, $-11.3\pm 4.9\%$, respectively) than LI ($-6.0\pm 4.2\%$, $p<0.05$). The responses of VO_2 , HR, BLA, RPE and TSI induced by the different levels of BFR applied in LI-BFR were similar. Regardless of pressure, the responses of VO_2 , HR, BLA and RPE induced by LI-BFR was lower than HI ($p<0.05$), except for TSI. TSI change was similar between LI-BFR_{40/50/60/70/80} and HI (LI-BFR_{40/50/60/70/80} range: $-10.0\pm 4.2\%$ to $-11.3\pm 4.9\%$, HI: $-11.5\pm 4.5\%$).

CONCLUSION: It appears that BFR equal to 40% of arterial occlusion pressure is sufficient to reduce TSI. This BFR level seems to stress the physiological mechanisms adequately and there is no need for higher external pressure application. This level of BFR can also produce local hypoxia similar to that during HI. Therefore, low-intensity exercise with BFR could be an alternative exercise mode for individuals who are unable to perform high-intensity exercise.

3073 Board #3 May 29 3:15 PM - 5:15 PM
Central And Systemic Haematological Responses Are Similar Between Continuous And Intermittent Blood Flow Restricted Resistance Exercise

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Resistance training (RT) with blood flow restriction (BFR) induces similar adaptations to traditional RT but uses markedly lower training loads. However, information about the acute exercise pressor, hemodynamic, and local metabolic cost of this training approach is sparse. These data are needed to understand the acute safety implications of this training approach and help identify an optimal BFR protocol. **PURPOSE:** To compare the acute central and systemic cardiovascular, and local metabolic responses to resistance exercise performed with continuous (BFR-C) and intermittent (BFR-I) BFR.

METHODS: 12 resistance-trained males (mean \pm SD) aged 22.3 ± 3.2 yrs, 1.82 ± 0.06 m, and 84.1 ± 9.0 kg performed 4 separate acute resistance training sessions in a random order, each separated by 7 days. Training sessions involved four sets of squat-based RT at 30% of individuals' 1 repetition maximum with 1) no BFR (CON), 2) BFR-C, 3) BFR-I, and 4) traditional high load training at 70% of 1 repetition maximum with no BFR (HL). Systemic blood pressure and derivatives of cardiac output, central aortic blood pressure pulse wave characteristics, and local blood volume and metabolism were assessed periodically during, and after each training session. Data were assessed by two-way ANOVA with Bonferroni-corrected post-hoc comparisons.

RESULTS: All sessions similarly increase average metabolic demand, seen by a decreased tissue saturation index (-15% , 95% CI 13.3 to 17.4, $p<0.0001$) with no difference between conditions ($p>0.05$). Whilst changes in haemoglobin-derived Vastus Lateralis blood volumes were similar between conditions, they were higher with BFR-C than CON ($6.97 \mu\text{mol/L}$, 95% CI 0.2 to 13.6, $p=0.04$) and HL ($7.9 \mu\text{mol/L}$, 95% CI 1.2 to 14.8, $p=0.01$). Training equally increased mean systemic mean arterial pressure (MAP) ($+70.5$ to 76.6 mmHg, $p<0.001$) and cardiac output ($+0.74$ to 0.96 L, $p<0.001$) above baseline, with no difference between conditions. Training also equally increased mean aortic MAP ($+14.8$ to 24.2 mmHg, $p<0.001$) above baseline across conditions.

CONCLUSIONS: BFR-C and BFR-I cause similar exercise pressor responses comparable with both traditional resistance training, and training without BFR. Adding BFR to resistance training didn't exacerbate the magnitude or duration of the associated cardiovascular stress.

3074 Board #4 May 29 3:15 PM - 5:15 PM
The Effect Of Blood Flow Restriction Resistance Training On Exercise-induced Hypoalgesia

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PURPOSE: Exercise-induced hypoalgesia (EIH) describes a reduction in pain sensitivity following exercise, characterised by an elevation in pain threshold or decrease pain intensity ratings following exercise. Recent research suggests that performing light-load resistance exercise with blood flow restriction (BFR-RE) may have a pain-modulation effect. Therefore, the aim of this study was to compare

the magnitude of EIH with BFR-RE to resistance exercise at both low and high intensities. **METHODS:** Twelve recreationally active individuals were recruited to participate. In a randomised crossover design, participants completed 4 experimental trials of resistance exercise ((1) light load resistance exercise (LLRE); (2) BFR-RE with low pressure (BFR40); (3) BFR-RE with high pressure (BFR80) and (4) heavy load resistance exercise (HLRE)). Pressure pain threshold (PPT) was then assessed at multiple body sites (dominant and non-dominant quadriceps and non-dominant trapezius muscle) pre, 5 min, 10 min and 24 hr post exercise. **RESULTS:** There was a two-way interaction effect for the dominant quadriceps site. Post-hoc analysis showed that, compared to LLRE, PPT was higher following BFR40, BFR80 and HLRE. PPT was higher following BFR80 compared to BFR40 and HLRE. At 24h post-exercise, PPTs were $14.5 \pm 6.7\%$ and $23.9 \pm 8.2\%$ higher than pre-exercise values in the BFR40 and BFR80 trials, respectively, whereas PPTs had returned to baseline in the LLRE and HLRE trials. Compared to LLRE, the increase in PPT was greater following BFR40 (0.28 ± 0.13 AU), BFR80 (0.64 ± 0.42 AU) and HLRE (0.34 ± 0.20 AU) in the non-dominant quadriceps. At 24h PPTs had returned to baseline. Compared to LLRE, the increase in PPT was greater following BFR40 (0.31 ± 0.27 AU), BFR80 (0.30 ± 0.17 AU), and HLRE (0.26 ± 0.13 AU) for the trapezius. At 24h PPTs had returned to baseline. **CONCLUSIONS:** In conclusion BFR with higher pressure leads to EIH in both dominant and non-dominant limbs suggesting both central and peripheral mechanisms of action.

3075 Board #5 May 29 3:15 PM - 5:15 PM
Resistance Exercise With Blood Flow Restriction Under Different Occlusion Pressure On Muscular Performance

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 (No relevant relationships reported)

PURPOSE: The study compared the effect of low intensity resistance exercise with blood flow restriction (BFR) in the proximal thigh under different occlusion pressure on muscle morphology and function.

METHODS: Twenty-seven healthy college students who had no training experience were randomly divided into three groups by different occlusion pressure: 0 mmHg (CON), 120 mmHg (LBFR) and 180 mmHg (HBFR). Before and after 12 weeks training with an inflatable cuff (20% 1RM, half squat, 4 sets, 75 repetitions in total, 3 days a week) in three groups, the muscle thickness (MT) of rectus femoris and medius femoris were assessed by ultrasound for all subjects. The maximal isokinetic torque (IT_{max}), relative maximal isokinetic torque (R-IT_{max}) and maximal power (P_{max}) were measured at angular velocities of 60°/sec by ISOMED 2000 System in dominant low limb of all subjects.

RESULTS: The MT of rectus femoris and medius femoris in LBFR increased after training compared with pre-training (2.12 ± 0.22 vs. 1.99 ± 0.16 cm and 2.01 ± 0.09 vs. 1.82 ± 0.15 cm, $p<0.05$), as well as in HBFR (2.15 ± 0.16 vs. 1.95 ± 0.19 cm and 2.02 ± 0.19 vs. 1.86 ± 0.14 cm, $p<0.01$). The IT_{max} after training were higher than pre-training not only in LBFR (213.00 ± 26.04 vs. 204.56 ± 29.16 Nm, $p<0.01$), but also in HBFR (217.00 ± 20.13 vs. 190.33 ± 15.71 Nm, $p<0.01$). A significant increase in R-IT_{max} was noted in LBFR than pre-training (2.87 ± 0.35 vs. 2.74 ± 0.38 Nm/kg, $p<0.01$), and also in HBFR (2.94 ± 0.26 vs. 2.57 ± 0.20 Nm/kg, $p<0.01$). However, there was no significant increase in P_{max} after training in LBFR (124.78 ± 18.93 vs. 119.89 ± 13.32 W, $p>0.05$) or HBFR (122.56 ± 16.44 vs. 120.26 ± 17.43 W, $p>0.05$). There was no significant change in MT, IT_{max}, R-IT_{max} and P_{max} before and after training in CON ($p>0.05$). Besides, the MT, IT_{max} and R-IT_{max} in LBFR and HBFR had a significant change compared with CON respectively after training ($p<0.05$). There was no any significant difference in the MT, IT_{max}, R-IT_{max}, P_{max} between LBFR and HBFR after training ($p>0.05$).

CONCLUSION: BFR training protocols under 120mmHg or 180mmHg pressure are effective in improving muscular morphology and function. But the higher occlusion pressure may not have more benefit in improving muscular performance than the lower occlusion pressure.

3076 Board #6 May 29 3:15 PM - 5:15 PM
Blood Flow Restriction Training During A Dynamic Warm-Up And Its Effects On Various Sprint Times

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 (No relevant relationships reported)

PURPOSE: To examine the effects of blood flow restriction (BFR) during a dynamic warm-up on a 25, 50, and 100-meter run time, rating of perceived exertion (RPE), and heart rate (HR) in recreational athletes. **METHODS:** Fourteen participants (22.3 ± 1.8 years) volunteered to participate in this cross-over study. Participants were randomly assigned to either the BFR or control group during their first trial, then completed the other trial seven days (± 1 day) later. During the BFR training intervention, the cuffs

were placed on the proximal thigh at the level of the gluteal fold and were inflated to 80% of the participants' limb occlusion pressure (LOP), which was assessed prior to participation. Participants completed a five-minute dynamic warm-up wearing the blood flow restriction cuffs, and the same dynamic warm-up was completed during the control intervention without the use of the cuffs. After each warm-up, a three-minute revascularization period was provided before participants ran a 100-meter sprint at maximal effort, in which 25, 50, and 100-meter times were recorded. Heart rate was measured throughout the entirety of the study, and RPE was measured immediately after the sprint for both trials. Time measures, RPE scores, and heart rate were compared using a paired samples t-test ($\alpha < .05$). **RESULTS:** There were no significant differences between control and BFR sprint times, post warm-up HR, or post run HR. There was a significant difference between the control and BFR RPE scores ($3.14 \pm .66$ vs. 4.79 ± 1.42 , $p < .001$). **CONCLUSION:** There is currently minimal evidence investigating the acute effects of BFR. Based on our results, there were no significant differences in sprint times between the control and BFR trials. RPE scores during the BFR trial were significantly higher than the control, indicating that participants felt the intensity of the BFR trial was more difficult although the times did not vary. Although not statistically different, average heart rates in the BFR trial were lowered by up to nine beats per minute compared with the control. This may be attributed to the perceived difficulty of the BFR trial as participants possibly could not exert themselves as much as when completing the control trial. These results do not support acute use of BFR to increase short-term performance, but more research should be performed.

3077 Board #7 May 29 3:15 PM - 5:15 PM
Physiological Responses To Acute Arm Cranking With Blood Flow Restriction

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(No relevant relationships reported)

Aerobic exercise with blood flow restriction (BFR) is emerging as an effective method to improve both aerobic capacity and muscular function. Using an inflatable cuff, blood flow is usually restricted during walking and cycling. The extent to which BFR can be applied during upper-body aerobic exercise such as arm cranking is not well documented. Arm cranking with BFR might offer an exercise option for clinical populations that need to exercise upper-body muscles (e.g., wheelchair users, individuals with shoulder injuries). **PURPOSE:** To evaluate physiological and perceptual responses to acute submaximal arm cranking with BFR. **METHODS:** Five active adults (age: 23 ± 3 yrs, arm cranking VO_{2peak} : 33 ± 8 ml/kg/min) performed 4 intermittent arm cranking protocols (6x2 min, 1min recovery): 1) low-load arm cranking (LL, 40% VO_{2peak}), 2) low-load arm cranking with BFR (BFR, 40% VO_{2peak}), and 3) high-load arm cranking (HL, 80% VO_{2peak}). For BFR, blood flow was restricted using 5cm cuffs inflated to 70% of limb occlusion pressure as identified using Doppler ultrasound. Cardiorespiratory and perceptual responses (VO_2 , HR, perceived effort) and tissue perfusion (tissue saturation, deoxyhemoglobin concentrations) were measured using a metabolic cart and near-infrared spectroscopy, respectively. **RESULTS:** Oxygen consumption during BFR (1.15 ± 0.32 ml/kg/min) did not differ from LL (1.04 ± 0.26 ml/kg/min, $P=0.31$) and was less than HL (2.28 ± 0.60 ml/kg/min, $P<0.01$). Compared to LL (104 ± 6 b/min), heart rate during BFR increased (115 ± 13 b/min, $P=0.04$) but was less than HL (166 ± 19 b/min, $P<0.01$). BFR required greater perceived effort in the arms (12 ± 3) compared to LL (9 ± 2 , $P=0.03$) but less effort than HL (16 ± 2 , $P=0.01$). In general, BFR decreased tissue saturation and increased deoxyhemoglobin concentrations compared to arm cranking without BFR (all $P<0.05$). **CONCLUSION:** These results suggest that arm cranking with BFR has potential to increase metabolic stress without excessive cardiorespiratory strain. This exercise mode may provide a useful alternative to HL for populations that need to exercise upper-body muscles for rehabilitation. These findings provide guidance for future acute and chronic studies examining the feasibility and efficacy of arm cranking with BFR.

3078 Board #8 May 29 3:15 PM - 5:15 PM
Combining Blood Flow Restriction Training With Heat To Maximize Hypertrophy And Strength In Rugby Players

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 (No relevant relationships reported)

PURPOSE: We assessed whether blood flow restriction (BFR) training with the addition of heat stress (BFRH) improves hypertrophy, muscle strength and sport-specific physical performance in rugby union players, compared to BFR training alone. **METHODS:** Nineteen elite U23 rugby union male players were randomly assigned to BFRH ($n = 7$), BFR ($n = 6$) or traditional high-load resistance training (CON, $n = 6$) groups. BFRH and BFR groups trained twice weekly for 3 weeks using BFR exercise (half squat, 4 sets of 30-15-15-15 repetitions at 30% 1 maximum repetition (1RM)

with 30 s of passive recovery; 50% of resting arterial occlusion pressure) in hot (37°C) and cool (22°C) conditions, respectively. Before and after the intervention, thigh circumference, half squat 1RM, squat jump force-velocity profile, and performance in vertical jump, sprint and repeated-sprint ability (RSA) tasks were measured. Muscle damage marker (creatin kinase) was measured before and after (0.1-24 h) the first and last training session. **RESULTS:** Thigh circumference significantly increased ($P<0.001$) from pre- to post-training in both BFRH (+6%, $P<0.001$) and BFR (+4%, $P<0.05$). Significant time \times group interaction revealed improvement in half squat 1RM (+12% and +19%, $P<0.01$) and maximal force component (+102% and +116%, $P<0.001$) of the force-velocity profile for BFRH and BFR. Vertical jump performance did not change. 10-m sprint (-5% and -3%, $P<0.001$) and RSA best and total times (both -2%, both $P\leq 0.001$) improved similarly in BFRH and BFR. Although not significant, muscle damage was lowered after the last session in BFRH only. No pre- to post-training changes occurred in CON.

CONCLUSIONS: Combining BFR training with heat stress can potentially induce hypertrophy and improve rugby union-specific physical performance while also inducing lower muscle damage than BFR training alone. Such gains could be of benefit during competitive period or rehabilitative setting.

F-33 Thematic Poster - Carbohydrate and Time Restricted Feeding

Friday, May 29, 2020, 3:15 PM - 5:15 PM
 Room: CC-2011

3079 Chair: Javier Gonzalez. *University of Bath, Bath, United Kingdom.*

(No relevant relationships reported)

3080 Board #1 May 29 3:15 PM - 5:15 PM
Effects Of 4 Weeks Of Time Restricted Feeding On Performance, Metabolism And Blood Outcomes In Elite Cyclists.

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(No relevant relationships reported)

The effects a particular kind of short term fasting called time restricted feeding (TRF) have been recently investigated on resistance training athletes; no data are available, instead, on endurance athletes. **PURPOSE:** We sought to investigate the effects of 4 weeks of 16/8 TRF (with windows of 16 hours of fasting and 8 hours of feeding) on elite cyclists. **METHODS:** 16 elite under-23 cyclists were randomly assigned to a TRF group or to a control group (CTRL) with a traditional meal pattern. The TRF group consumed 100% of its estimated daily energy needs in an 8-hour time window: from 10:00 AM to 6:00 PM whilst the CTRL group consumed 100% of its estimated daily energy needs in 3 meals between 7:00 AM and 9:00 PM. During the experimental period, training loads were similar in the two groups. Athletes were tested before and after 4 weeks of the intervention. Fat and lean body mass were measured by bioelectrical impedance analysis, VO_{2max} and basal metabolism were measured by indirect gas analyzer. In addition, blood counts, free testosterone, SHBG, IGF-1, IL-6, TNF alpha, VES, PCR, total cholesterol, triglycerides, TSH, free T3, insulin, adiponectin, and cortisol were measured. **RESULTS:** After 4 weeks, there was a significant decrease of body weight (TRF: $-1.26 \text{ kg} \pm 1.57$ vs. CTRL: $+0.22 \pm 0.96 \text{ kg}$, $p=0.038$) and fat mass in the TRF group ($p=0.0093$) compared to CTRL group with no differences in lean body mass. Performance tests showed no significant differences between groups even though there was a significant increase in the peak power output/body weight ratio ($p=0.024$) in the TRF group due to weight loss. Free testosterone and IGF-1 decreased significantly ($p=0.004$ and $p=0.048$ respectively) in the TRF group; leukocyte count decreased more in the CTRL group ($p = 0.039$). Lymphocyte count increased in TRF group ($p<0.001$) whilst neutrophils decreased in both groups ($p<0.001$), thus the neutrophils to lymphocytes ratio (NLR) decreased significantly ($p=0.003$) in TRF group. No significant changes in other blood chemistry values were observed. **CONCLUSIONS:** Our results suggest that a TRF program with an 8-hour feeding window causes fat loss, maintains lean mass and performance indexes and improves peak power output/body weight ratio. The changes of white blood cells parameters worth further investigation.

3081 Board #2 May 29 3:15 PM - 5:15 PM

The Effects Of The 16/8 Diet On Cardio-metabolic Outcomes In Competitive Male Runners

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(No relevant relationships reported)

Purpose: The objective of the present study was to investigate the effects of the 16/8 diet on cardio-metabolic risk factors in competitive male runners. **Methods:** This ongoing study is a randomized cross-over intervention that consists of two 4-week arms: a "normal diet" arm (ND: 12 hours fasted and 12 hours fed) and a "16/8" (TRF: 16 hours fasted and 8 hours fed) arm along with a 2-week washout. Sixteen subjects will complete the study and will participate in 4 test days (12 hour fasted), one at the beginning and end of each arm, where they will undergo a DXA scan, resting energy expenditure measurement and a fasting blood draw for biomarker quantification. Overall calories, macronutrient intake and exercise training will be held constant over the 2 interventions. **Preliminary Results:** Data on 9 subjects shows no significant differences between groups in changes in body mass (+0.41 ND vs. -0.72 kg TRF, p=0.25), fat mass (-0.29 ND vs. -0.63 kg TRF, p=0.65), fat free mass (+0.56 ND vs. -0.25 kg TRF, p=0.18) and body fat (-0.42 ND vs. -0.61 % TRF, p=0.72) with the 4 week intervention. Changes in resting energy expenditure (+152.3 ND vs. +11.3 kcal TRF, p=0.18), resting respiratory exchange ratio (-0.003 ND vs. -0.04 TRF, p=0.36), blood glucose (-3.9 ND vs. -1.9 mg/dl TRF, p=0.61), total cholesterol (+1.0 ND vs. -3.0 mg/dl TRF, p=0.68), HDL cholesterol (-1.7 ND vs. 0.0 mg/dl TRF, p=0.71), LDL cholesterol (0.0 ND vs. -3.8 mg/dl TRF, p=0.41), and triglycerides (+17.9 ND vs. *4.3 mg/dl TRF, p=0.46) also did not differ between interventions. **Conclusion:** So far, with limited power, there does not appear to be any physiological health benefits in male runners adhering to a 16/8 diet when compared to a normative eating timeframe.

3082 Board #3 May 29 3:15 PM - 5:15 PM

The Effect Of Continuous Energy Restriction Vs Intermittent Fasting, With Resistance Training, On Lean Mass

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(No relevant relationships reported)

PURPOSE: To determine if two energy restricted diets (continuous energy restriction (CER) and 5:2 intermittent fasting (IF)) combined with resistance training (RT) results in lean body mass (LBM) retention while reducing bodyweight.

METHODS: Thirty-four young, untrained males and females were randomised to undertake the following diets for 12 weeks: CER (consume 80% of estimated energy requirements (EER) every day), or IF (consume approximately 30% of EER twice per week on fast days and 100% of EER every other day). Fast days included meals of protein shakes, a soup and vegetables. Both groups aimed to be isocaloric with an average energy restriction of 20% EER, and isonitrogenous consuming an average protein intake of 1.5 grams per kilogram of bodyweight per day. Both groups completed 2 supervised RT sessions and 1 unsupervised workout per week. The IF group completed their exercise on non-fast days. Body composition was assessed by dual x-ray absorptiometry. Data was analysed using an intention-to-treat linear mixed model, assuming AR(1) dependence across time. In addition, a change analysis was conducted for participants who completed both the baseline and 12 week assessments. **RESULTS:** For females, bodyweight was significantly reduced (mean decrease 3.1%, p=0.009), and LBM significantly increased (mean increase 5.8%, p<0.001), with no difference observed between diets. Similarly for men, there was no significant diet effect on bodyweight; both groups experienced an overall reduction of 6.3% (p<0.001). Combined, men in both diet groups experienced a significant increase in LBM (mean increase 1.4%, p=0.021), however there was a trend towards a greater increase in LBM in the IF compared to the CER group (mean increase CER = 0.7%, IF = 2.0%).

CONCLUSIONS: Across both diet groups, males and females experienced a significant reduction in bodyweight while, on average, increasing LBM. Neither diet was more effective for bodyweight reduction, however there was a trend towards greater LBM accrual in IF compared to CER males. Gender specific responses to

the intervention were evident, with a greater increase in LBM for females. Moderate energy restriction with high protein intake and RT can lead to concomitant weight loss and LBM accrual.

3083 Board #4 May 29 3:15 PM - 5:15 PM

Impact Of Time-Restricted Feeding On Cardiometabolic Health And Performance Among Firefighters

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(No relevant relationships reported)

PURPOSE: Firefighters (FF) have an elevated risk for heart disease and sudden cardiac death (SCD) due to physiological and psychological stressors such as low cardiovascular fitness levels, disturbed sleep patterns, frequent snacking, smoke exposure, and intense physical exertion. Research suggests time-restricted feeding (TRF) may improve cardiometabolic health markers and performance variables. Therefore, the purpose of this study was to examine the effects of an 8-week TRF intervention on cardiometabolic health markers and performance variables.

METHODS: Twenty apparently healthy male professional structural FF completed a battery of health and fitness assessments prior to and following an 8-week TRF dietary intervention while performing a standardized resistance training program. The FF were assigned to either the normal diet (n=4) or TRF group (n=16) based on their preference. The TRF group followed a daily 14 hr fast vs. 10 hr feeding protocol.

RESULTS: Despite no interaction effect, there were significant improvements for both groups for push-ups completed (41.7 and 37.1 reps; p = 0.007) and ventilatory threshold in absolute (2.47L/min to 2.58L/min; p = 0.01) and relative (65.8%VO_{2peak} to 69.7%VO_{2peak}; p = 0.001) terms. The control group had significantly lower mean body fat percentage compared to the TRF group (14.27 and 20.5%, respectively; p < .0001). The TRF group had significantly higher VO_{2peak} values compared to the control group (3.80 L/min and 3.65 L/min, respectively; p = 0.016).

CONCLUSIONS: While TRF did not directly improve health or performance variables, the diet did not hinder health or performance outcomes. The standardized resistance training program resulted in improvements for muscular endurance and ventilatory threshold. The improved performance variables may result in reduced risk for heart disease and SCD while optimizing markers of performance.

3084 Board #5 May 29 3:15 PM - 5:15 PM

The Effect Of Fasted Cycling Exercise At Different Times Of The Day In Overweight Individuals

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(No relevant relationships reported)

Intermittent fasting has become an increasingly popular intervention for metabolic health. Combining intermittent fasting with exercise may lead to benefits for weight management. **PURPOSE** To investigate the effect of fasted exercise at different times of the day on metabolic responses and appetite regulation in overweight males.

METHODS Twelve healthy males (Mean ± SD; age 26 ± 4 y; body fat 23 ± 2%) completed four, 60 min cycle ergometry trials at 60% VO_{2peak} in a randomised order; in the morning fasted (AMFAST), evening fasted (PMFAST) and after consuming a breakfast meal in the morning (AMFED) and evening (PMFED). Circulating levels of ghrelin, glucagon-like peptide-1 (GLP-1), pancreatic polypeptide (PP), peptide tyrosine tyrosine (PYY), insulin, triglycerides, non-esterified fatty acid (NEFA), glucose, and cholesterol were measured at baseline, post-breakfast, pre-exercise, post-exercise, pre-soup ingestion, then every 30 min post soup-ingestion for 2 h. Appetite was assessed at 15 min intervals throughout. Substrate utilisation was measured every 30 min and continuously throughout exercise. **RESULTS** Area under the curve (AUC) values for NEFA were greater in PMFAST compared to all trials (186.5 ± 46.3 vs. AMFAST 120.5 ± 42.6, AMFED 80.8 ± 23.8, PMFED 91.1 ± 36.4 mmol/L 4.75 h; P<0.05). AMFAST NEFA was also greater than AMFED (P=0.029). AUC values were greater for GLP-1 in AMFED trial compared to PMFAST (8660.2 ± 12232.5 vs 5967.0 ± 12027.5 mmol/L 4.75 h, P<0.05), and PP values for PMFED greater compared to all trials (155411.9 ± 86064.1 vs. AMFAST 90165.4 ± 90145.6, AMFED 107162.5 ± 72846.2, PMFAST 105364.0 ± 81320.2 mmol/L 4.75 h, P<0.05). A time of day effect was seen for cholesterol with PM greater than AM (P<0.05). Fat oxidation was greater during AMFAST and PMFAST exercise compared to FED trials (P<0.05). Ratings of appetite did not change between trials once all participants consumed the lunch meal post exercise (P>0.05). No differences were seen in AUC between trials for ghrelin, PYY, glucose or insulin. **CONCLUSION** Fasted exercise elicited greater NEFA responses, and some appetite hormones appear to respond differently to varying

exercise conditions and time of day in overweight males. Regardless of the time of day, fasted exercise favours fat metabolism and may induce a short-term negative energy balance.

3085 Board #6 May 29 3:15 PM - 5:15 PM
Changes In Fat And Carbohydrate Oxidation From Rest To Exercise After Different Fasting Lengths

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An overnight fast (10-12 hours) is a popular pre-exercise trial control in fuel use studies, but can lead to premature fatigue during exercise in participants. Measuring substrate oxidation at rest could be an alternative, but it is unclear how length of fasting effects fuel use responses from rest to during exercise. **PURPOSE:** The purpose was to examine the changes in fat (fatox) and carbohydrate (carbox) oxidation rates during rest and exercise after various fasting lengths. **METHODS:** Participants (24.5 ± 5.1 yrs) randomly performed 3 experimental trials. Trials were preceded by a standard meal (19.4 ± 1.8% of daily energy expenditure) followed by a fast for 12 hours (hrs), 3 hrs or 1 hr. Each trial consisted of 30 min of rest and 30 min of exercise at 55% of peak oxygen uptake (VO_{2peak}). VO_2 and carbon dioxide production (VCO_2) were averaged over the final 10 minutes of rest and exercise. The equations fatox = $1.695 * VO_2 - 1.70 * VCO_2$, and carbox = $4.585 * VCO_2 - 3.226 * VO_2$ were used to calculate oxidation rates ($g \cdot min^{-1}$). Two-way repeated measures (RM) ANOVAs and one-way RM ANOVAs analyzed differences. Significance was established if $p < 0.05$. **RESULTS:** Participants exercised at a similar VO_2 and % of VO_{2peak} in the 12hr (1.58 ± 0.28 L · min⁻¹; 56.8 ± 2.4 % of VO_{2peak}), 3hr (1.60 ± 0.30 L · min⁻¹; 57.7 ± 4.6 % of VO_{2peak}), and 1hr (1.64 ± 0.30 L · min⁻¹; 59.1 ± 1.7 % of VO_{2peak}). There was no significant interactions for fatox and carbox, but there were significant main effects of time. Fatox increased from rest to exercise in the 12hr (0.30 ± 0.04 $g \cdot min^{-1}$ vs. 7.34 ± 3.00 $g \cdot min^{-1}$), 3hr (0.30 ± 0.10 $g \cdot min^{-1}$ vs. 7.56 ± 3.53 $g \cdot min^{-1}$) and 1hr (0.34 ± 0.10 $g \cdot min^{-1}$ vs. 8.43 ± 4.00 $g \cdot min^{-1}$) trials. Additionally, carbox increased from rest (12 hr = 0.30 ± 0.07 $g \cdot min^{-1}$; 3hr = 0.27 ± 0.09 $g \cdot min^{-1}$; 1hr = 0.34 ± 0.10 $g \cdot min^{-1}$) to exercise (12hr = 1.92 ± 0.55 $g \cdot min^{-1}$; 3hr = 1.90 ± 0.64 $g \cdot min^{-1}$; 1hr = 2.18 ± 0.81 $g \cdot min^{-1}$). Relative percent changes from rest to during exercise were not different between 1hr, 3 hrs and 12 hrs for fatox (2489.1 ± 1008.9 % vs. 2257.5 ± 853.3 % vs. 2200.8 ± 901.7 %) or carbox (660.2 ± 294.8 % vs. 579.6 ± 231.2 % vs. 492.5 ± 241.9 %). **CONCLUSIONS:** Fatox and carbox responses from rest to exercise were similar between trials. This suggests that a standard meal and resting oxidation rates could control for differences in substrate use during exercise, regardless of fasting length.

3086 Board #7 May 29 3:15 PM - 5:15 PM
Low Carbohydrate Availability, Not Energy Availability, Alters The Immune Response To Exercise In Elite Race-walkers

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 (No relevant relationships reported)

PURPOSE: To compare the effects of a ketogenic low carbohydrate (CHO) high fat (LCHF) diet, and a low energy availability (LEA) diet, on innate immune response during a short-term training intervention in endurance athletes. **METHODS:** Twenty elite male race walkers completed one of three 5-7 day diet/training phases in a parallel groups design. During the initial 5 day Harmonization phase, all athletes consumed a high energy availability (HEA) diet equating to 40 kcal kg^{-1} fat free mass (FFM) day^{-1} . Athletes were then assigned to either a HEA (n=6), LCHF (<50 g CHO day^{-1} and isocaloric to HEA, n=7) or a LEA diet (15 kcal kg^{-1} FFM day^{-1} , n=7) for the 7 day Intervention phase. Subsequently, all athletes were placed back on a HEA diet for a further 5 days (Re-feed phase). On day 5 of each phase, athletes completed a 25 km hybrid laboratory-field race walk protocol at ~75% VO_{2max} . Venous blood samples were collected pre-, post-, and 1 h post-exercise and analyzed for serum ferritin, white blood cell counts, cortisol and blood glucose concentration. **RESULTS:** Serum ferritin decreased from Harmonization to Re-feed in all 3 groups (HEA: 30%, 20-40% (mean change, 95% CI); LCHF: 38%, 22-54%; LEA: 40%, 17-63%, $p < 0.01$), however, the magnitude of decrease was similar between groups. During the Intervention phase, the LCHF had a larger post-exercise increase in total white blood cells (67%, 61-72%), neutrophils (77%, 71-82%), monocytes (49%, 32-65%) and lymphocytes (41%, 31-51%) than both HEA ($p < 0.001$) and LEA ($p < 0.001$). Similarly, a small increase in cortisol (14%, -10-39%) and a decrease in blood glucose levels (46%, 18-74%) were evident during the post-exercise period during LCHF,

which was significantly different to, and occurred in the opposite direction to changes seen in HEA and LEA. No differences in any marker measured occurred between HEA and LEA, or between the Harmonization and Re-feed phases.

CONCLUSIONS: Adherence to a ketogenic LCHF diet for 5 days resulted in transient perturbations to the immune response to exercise, however, the LEA intervention did not influence immune markers. It appears that the acute restriction of CHO, rather than energy intake, has a more detrimental impact on the immune response to exercise in elite endurance athletes.

3087 Board #8 May 29 3:15 PM - 5:15 PM
The Effect Of Acute Carbohydrate Restriction On Squat Performance And Serum Energy Substrate Levels

Amber Normann, Abbey Brown, Kurt Escobar, Joshua Cotter, FACSM, Evan Schick. *California State University, Long Beach, Long Beach, CA.* (Sponsor: Dr. Joshua Cotter, FACSM)

(No relevant relationships reported)

Carbohydrate restrictive diets have become increasingly prevalent among recreational and professional athletes as a means of losing weight and improving body composition. Currently, few data indicate a clear relationship between carbohydrate restriction (CR) and performance in resistance exercise (RE). **Purpose:** To investigate the acute effects of CR on squat performance and serum energy substrate levels in recreationally trained individuals. **Methods:** Seven healthy recreationally trained males (22.6 ± 3.47 yrs., 80.74 ± 8.40 kg, 178.05 ± 5.00 cm) completed RE under two conditions in randomized order: 1) control (CON) and 2) a (CR) condition, which included a carbohydrate depletion exercise trial (CDEX). In CR, subjects first performed the CDEX, which consisted of 60 minutes of cycling at >75% of participants' heart rate (HR) max followed by four 1-minute bouts at >95% HR max with two minute rest in between sets. CDEX was then followed by 48 hours of reduced carbohydrate (CHO) intake (<5% daily caloric intake). RE in both CON and CR consisted of squats, loaded via inertial resistance using a Yo-Yo™ flywheel squat device. Fasting blood glucose and triglyceride (TG) levels were measured pre-exercise in both conditions as well as throughout the CDEX. **Results:** Total caloric intake was significantly ($p < 0.001$) lower during CR (mean ± SD: 1661.24 ± 691.6 kcal) compared to the CON (2433.85 ± 527.4 kcal). No differences were found in total grams of protein (PRO) or fat intake between conditions. Percent total daily caloric intake from CHO ($p < 0.001$) was significantly lower in the CR condition (7.40 ± 3.32% CHO), while percent total daily caloric intake from PRO and fat were significantly higher in the CR (32.90 ± 8.54% PRO, 58.17 ± 11.96% fat) compared to CON (37.81 ± 9.26% CHO, 20.03 ± 5.53% PRO, 37.47 ± 11.80% fat). Fasting blood glucose levels ($p = 0.017$) were significantly lower in the CR (84.57 ± 4.79 mg/dL) compared to the CON (93.28 ± 6.90 mg/dL) yet there was no difference in blood TG levels ($p = 0.177$; 64.43 ± 15.13 mg/dL vs. 59.29 ± 14.16 mg/dL). Total average power output ($p = 0.05$) and total peak power output ($p = 0.047$) were significantly lower in the CR. **Conclusion:** While CDEX combined with CR may acutely reduce fasting blood glucose, this may be at the sacrifice of RE performance, especially during the initial phase of CR adaptation.

F-34 Thematic Poster - Cognition and Emotions

Friday, May 29, 2020, 3:15 PM - 5:15 PM
 Room: CC-2000

3088 Chair: Walter Bixby, FACSM. *Anne Arundel Community College, Elon, NC.*
(No relevant relationships reported)

3089 Co-Chair: Allyson G. Box. *University of Illinois Urbana-Champaign, Urbana, IL.*
(No relevant relationships reported)

3090 Board #1 May 29 3:15 PM - 5:15 PM
Cognitive Reappraisal Enhances Affective Valence During Exercise At The Ventilatory Threshold
 Kell Grandjean da Costa¹, Heather L. Urry¹, Eduardo Bodnariuc Fontes², Grace Elliott¹, Grace E. Giles³. ¹Tufts University, Medford, MA. ²Federal University of Rio Grande do Norte, Natal, Brazil. ³U.S. Army CDC-Soldier Center, Natick, MA.
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Affective valence during exercise is thought to switch between positive and negative at the ventilatory threshold (VT), the upper boundary of “moderate” intensity exercise. Cognitive strategies may shift the exercise intensity at which affective responses are positive and negative. The emotion regulation strategy cognitive reappraisal (CR) involves reevaluating emotional stimuli to reduce negative and increase positive emotional experience. **PURPOSE:** Here we investigated if cognitive reappraisal would increase emotional valence, demonstrated by higher scores on the feeling scale (FS), and reduce felt arousal scale (FAS) scores and ratings of perceived exertion (RPE) during 60-min of exercise performed at the VT. **METHODS:** 26 young recreational runners (n = 13 women, Age 25.4 ± 4.3 years old; BMI 21.3 ± 2.3 kg/m²; maximal oxygen consumption (VO₂max) = 55.02 ± 7.31 ml/kg/min) performed three sessions each separated by one week. During the first session, runners performed a maximal exertion test on a treadmill to assess their VO₂max and VT. During the next two sessions, runners were trained in CR or UR (unregulated) instructions, in counterbalanced order. They then ran at their VT for 60 minutes, during which they were reminded of the emotion regulation instructions and were instructed to provide RPE, FS, and FAS during the last 30 seconds of every 10-minute period. FS, FAS, RPE were analyzed for main effects of time and condition with non-parametric repeated measures (Friedman test) with post-hoc pairwise comparisons of Durbin-Conover test. **RESULTS:** Runners ran at VT velocity of 6.92 ± 0.46 mph corresponding to 46.8 ± 5.2 % of the VO₂ max. Similar levels of RPE were reported during the CR, 11.74 ± 1.64, and UR, 11.82 ± 1.88, sessions. However, they reported marginally higher FAS during CR, 2.9 ± 0.98, than UR, 2.6 ± 0.95, X²=20.3; df=11, p=0.042. They also reported higher FS during CR, 2.54 ± 1.47, than UR, 2.1 ± 1.52, X²=65.2; df=15, p<0.001. Post-hoc analysis showed that FS was higher during CR than UR (p<0.01) only at time points 30 (CR: 2.57 ± 1.4 vs UR 1.84 ± 1.65), 40 (CR: 2.53 ± 1.54 vs UR 1.76 ± 1.57) and 50 (CR: 2.57 ± 1.52 vs UR 1.88 ± 1.73) minutes of exercise. **CONCLUSION:** Cognitive reappraisal can be used as a strategy to increase emotional valence after 30 min of exercise at light to moderate intensity in recreational runners.

3091 Board #2 May 29 3:15 PM - 5:15 PM
Where Are My Keys? Can Lifestyle Factors Predict Cognitive Function In Older Adults?
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(No relevant relationships reported)

Strong evidence shows that physical activity (PA) affects the structure of the nervous system and can improve cognitive function (CF) in older adults. Additionally, recent studies have shown that a healthy diet may protect against aging-related impairments in hippocampal structure or function. **PURPOSE:** To investigate the influence of PA and adherence to dietary guidelines on CF in a sample of healthy older adults. **METHODS:** Demographics, habitual PA (Baecke’s Questionnaire Sport score), and cognitive function (Montreal Cognitive Assessment; MoCA) were collected at consent in a sample of 359 healthy adults (50-75 years) in a memory function study. Dietary

guidelines adherence (Alternate Healthy Eating Index 2010; aHEI), and two indices of cognitive function (Modified Benton Recognition Task (ModBent) and Modified Rey Auditory Verbal Learning Test (ModRey) were collected in the randomized subsample of these participants (N=211).

The relationship between lifestyle factors and three outcomes (MoCA, ModBent, ModRey) were assessed using Pearson correlations in the full sample and subsample. Linear models were fit for MoCA on the full sample, and for each of the three outcomes on the randomized subsample. Each series of models included age, gender, and education. PA and aHEI scores were then added to each model and their standardized regression coefficients (change in R²) were assessed to determine whether they contributed additional predictive value towards CF.

RESULTS: In the full sample, the correlation between MoCA total score and PA was weak (r = .111). In the subsample, correlations between aHEI and MoCA and between aHEI and ModRey were also weak (r = .175 and r = .141, respectively). Correlations between PA and aHEI and between age and ModRey were weak (r = .222 and r = -.219, respectively). Adding PA or aHEI did not significantly explain a greater proportion of variance in cognitive task scores beyond demographic factors alone. **CONCLUSIONS:** In an older adult population, there is a weak direct relationship between performance on CF tasks and lifestyle factors. Reviewing the individual standardized regression coefficients finds that education and age were the most sensitive to changes in CF task scores, and adherence to dietary guidelines was more sensitive than a measure of habitual PA.

3092 Board #3 May 29 3:15 PM - 5:15 PM
Does An Acute Bout Of Aerobic Exercise Bolster Reactivity To A Sad Mood Induction In Clinically Depressed Individuals? A Study Of Responders And Non-responders
 Anthony J. Bocchine¹, CJ Brush², Andrew A. Ude¹, Gregory H. Pappas¹, Kelsey L. Piersol¹, Brandon L. Alderman¹.
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Major depressive disorder (MDD) is a debilitating mental health condition that presents a major public health burden. Respiratory sinus arrhythmia (RSA) reactivity has been proposed as an index of impaired emotion and self-regulation in depression. Acute exercise has consistently been shown to improve affect, but it is unknown whether exercise affects RSA reactivity to emotional challenge. In addition, previous studies have not addressed nonresponse to sad emotion inductions, which limits understanding of important individual differences in affective processing. **PURPOSE:** To determine the effects of a single bout of moderate-intensity aerobic exercise on RSA and affective responses to a sad mood induction. Additionally, to characterize responders and non-responders to the sad mood paradigm and whether acute exercise impacts emotional responding to the emotion induction paradigm. **METHODS:** Using a within-subjects design, young adults diagnosed with MDD completed a 30-min exercise and sedentary control session in counterbalanced order on two separate days. Following a recovery period, RSA reactivity was assessed using electrocardiography (ECG) during a 3-min sad mood induction. The Positive and Negative Affect Scale (PANAS) was used to assess affective responses throughout each session and sadness to the mood induction was assessed on a 9-point Likert scale. **RESULTS:** Individuals with depression demonstrated dampened RSA withdrawal during the sedentary control day. Following exercise, RSA withdrawal increased, p < .05, although post-exercise changes in NA and PA were not related to neurocardiac reactivity to the sadness induction. There were significantly more responders than non-responders to the mood induction following the exercise condition, p < .05. **CONCLUSIONS:** These findings indicate that acute aerobic exercise may be an effective approach to increase emotional regulation and behavioral flexibility in clinically depressed individuals. Future research should continue to examine individual differences in emotional responding as well as investigating who will successfully respond to exercise treatment.

3093 Board #4 May 29 3:15 PM - 5:15 PM
Effects Of Age, Body Composition, And Inflammation On Cognitive Function In Females.
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(No relevant relationships reported)

PURPOSE: To investigate the correlation between individual parameters (age, body composition, and inflammation) and cognitive performance. **METHOD:** Fifty-six healthy women (age range: 20–60 yrs) were recruited and completed four cognitive tests, including attention, speedup test, Stroop tests (word, square, congruent,

incongruent, and neutral conditions), and memory span test. All cognition tests were conducted in a counter-balanced order. Blood samples were collected to determine the ratio of neutrophil and lymphocyte (NLR) and the ratio of platelet and lymphocyte (PLR) which were considered as indicators of inflammation. The body composition was measured by using Dual Energy X-ray Absorptiometry. The correlation between age, body composition, inflammatory factors, and cognitive variables was analyzed by Pearson's correlation coefficient (r). $P < 0.05$ was considered statistically significant. **RESULTS:** There were negative correlation between age and attention test ($r = -0.47$, $p < 0.005$), Stroop tests (word: $r = -0.65$, $p < 0.001$; square: $r = -0.69$, $p < 0.001$; congruent: $r = -0.61$, $p < 0.001$; incongruent: $r = -0.70$, $p < 0.001$; neutral: $r = -0.70$, $p < 0.001$). The results also showed that the higher the body fat % (BF%), the worse the cognitive test performance (attention test, $r = 0.46$, $p < 0.005$; Stroop's word tests, $r = 0.49$, $p < 0.005$; Stroop's square test, $r = 0.61$, $p < 0.001$; Stroop's congruent test, $r = 0.44$, $p < 0.01$; Stroop's incongruent, $r = 0.56$, $p < 0.001$; Stroop's neutral test, $r = 0.59$, $p < 0.001$). Similarly, the higher the body lean mass (BLM%), the better the cognitive test performance. There was positive correlation between age, NLR and PLR, but there was no significant correlation between inflammatory markers and cognitive performance. Furthermore, after controlled age, although the above net correlation was eliminated, the correlation between Stroop's square test and BF% ($r = -0.343$, $p = 0.035$), square and BLM% ($r = -0.334$, $p = 0.040$), neutral test and BLM% ($r = 0.32$, $p = 0.050$) still exists. Besides, after controlled BF%, the age-related correlation effects are unchanged, and only the correlation between BLM% and the speed of answering represent significant ($r = 0.393$, $p < 0.015$). **CONCLUSION:** In addition to age, body fat is an important factor affecting cognitive performance. Supported by MOST 107-2410-H-845-018-MY3

3094 Board #5 May 29 3:15 PM - 5:15 PM

Exercise-Based Cardiac Rehabilitation Improves Cognitive Function Among CVD Patients

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PURPOSE: To investigate the effects of cardiac rehabilitation (CR) exercise training on cognitive performance and if the changes are associated with alterations in prefrontal cortex (PFC) oxygenation among patients with cardiovascular disease (CVD). **METHODS:** Twenty (M=15, F=5; 64.8±11.6 yrs) participants from an outpatient CR program were enrolled in the study. Each participant completed a cognitive performance test battery (the NIH Fluid Cognition test battery which measured 5 cognitive constructs) and a submaximal graded treadmill evaluation (a measure of cardiorespiratory capacity) on separate occasions at pre and again upon completion of 18 individualized CR sessions (approximately 6 weeks later). A functional near-infrared spectroscopy (fNIRS) device was used to measure left- and right- PFC (LPFC and RPPFC) oxygenation parameters (O₂Hb = oxyhemoglobin, HHb = deoxyhemoglobin, tHb = total hemoglobin, Hbdiff = oxyhemoglobin difference) during the NIH Fluid Cognition evaluation. **RESULTS:** Patients showed improvements in cardiorespiratory capacity (increased by 1.4 METs) and various cognitive constructs (processing speed, attention, executive function, and working memory scores). A significant increase in PFC oxygenation, primarily in the LPFC region, occurred at post-CR test (in four of the five cognitive tests). Correlation analyses revealed negative associations between changes in cognition (executive function (LPFC O₂Hb: $r = -0.445$, $p = 0.049$; LPFC tHb: $r = -0.487$, $p = .030$) and fluid composite score (RPPFC Hbdiff: $r = -0.467$, $p = 0.038$; LPFC Hbdiff: $r = -0.447$, $p = .048$)) and PFC changes. The change in cardiorespiratory capacity was positively associated with the change in working memory score ($r = 0.546$, $p = 0.016$). **CONCLUSION:** CVD patients enrolled in CR showed significant improvements in multiple cognitive domains along with increased cortical activation. The negative associations between cognitive functioning and PFC oxygenation suggest an improved neural efficiency, which is identified as higher cognitive performance for a given (or reduced) amount of cortical activation.

3095 Board #6 May 29 3:15 PM - 5:15 PM

IMPACT OF AUTONOMY ON ENJOYMENT AND AFFECTIVE VALENCE DURING HIGH-INTENSITY INTERVAL TRAINING

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High-intensity interval training (HIIT) is a popular modality for conducting intense aerobic exercise. Research indicates that HIIT is generally well-tolerated and produces relatively positive affective valence and enjoyment responses, especially when compared to intense continuous exercise. Recent research has started considering how autonomy and choice might impact psychological responses to HIIT. **PURPOSE:** The purpose of this study was to determine the impact of autonomy and variation on enjoyment and affective valence during HIIT exercise. **METHODS:** Twenty-one physically active participants (12 male, 9 female; mean BMI = 27 ± 3 ; mean age = 28 ± 6) completed three, 20-minute HIIT trials after completion of maximal testing. Work and recovery were conducted at 90% and 10% of peak work, respectively. All trials included a total of 10 minutes of work and 10 minutes of recovery. Trials included: a standard interval bout with repeating 60-sec work and recovery segments (Traditional), an interval bout with a mix of predetermined 30-, 60-, 90-, & 120-second segments (Varied), and a bout with a self-selected number of 30-, 60-, 90-, & 120-second segments (Autonomous). In-task affective valence and enjoyment were measured four times during work and recovery. Data was analyzed using ANOVA. **RESULTS:** Affective valence declined during the Traditional and Varied trials (-0.75 units; $P < 0.05$) but not during the Autonomous trial ($P > 0.05$). There was also a trend for the Autonomous trial to produce greater pleasure than the Traditional or Varied trials (-0.5 units; $P = 0.06$). Enjoyment increased during the trials (-0.5 units; $P < 0.05$) and enjoyment was higher in the Autonomous trial than the Varied trial (-0.5 units; $P < 0.05$). **CONCLUSIONS:** Findings indicate that all HIIT trials produced at least moderate levels of pleasure and enjoyment, with Autonomous HIIT resulting in the most desirable responses, especially when compared to Varied HIIT. These findings suggest that HIIT sessions that include self-selected interval durations can produce more positive responses, which provides the basis for recommending autonomy for exercisers participating in HIIT exercise sessions.

3096 Board #7 May 29 3:15 PM - 5:15 PM

Abstract Withdrawn

3097 Board #8 May 29 3:15 PM - 5:15 PM

The Sustained Effects Of Acute Aerobic Exercise On Inhibitory Control In Children With ADHD

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(No relevant relationships reported)

Despite mounting evidence supporting the beneficial effects of acute aerobic exercise on cognitive control in children with attention-deficit/hyperactivity disorder (ADHD), little is known regarding the sustained effect of acute aerobic exercise. **PURPOSE:** To examine the sustained effects of a single bout of aerobic exercise on inhibitory control in children with ADHD. **METHODS:** Twenty-four children diagnosed with ADHD (mean age = 9.8 ± 1.3 years; 23 boys) underwent a moderate-intensity (60% of heart rate reserve) aerobic exercise session and a video-watching session in counterbalanced order. Following the exercise/video-watching session, each participant was administered congruent and incongruent trials from a modified flanker task under electroencephalography (EEG) at 30 minutes and 60 minutes following intervention. Response accuracy, reaction times (RT), and standard deviation of RT (SDRT) were reported as behavioral outcomes, and the P3 component of an event-related brain potential (P3-ERP) was collected as a measure of brain function. A 3-way repeated-measure ANOVAs was used to analyze behavioral and P3-ERP data. **RESULTS:** Higher response accuracy was observed following exercise relative to video-watching across both time points and trial types (Exercise: $90.5 \pm 6.2\%$ vs. Video: $84.1 \pm 11.1\%$, $p = .002$). SDRT, an index of response variability, was smaller during congruent trials following exercise compared to video-watching at the 30-minute time point (Exercise: 129.8 ± 27.4 ms vs. Video: 142.2 ± 32.9 ms, $p = .04$). Further, P3-ERP latency at the parietal site (Pz) was shorter following exercise relative to video-watching across trial types at the 30-minute time point (Exercise: 426.9 ± 71.5 ms vs. Video: 517.9 ± 62.5 ms, $p < .001$). **CONCLUSION:** The data suggest that the beneficial effects of acute, moderate-intensity exercise are only sustained for about 30-40 minutes following exercise cessation in children with ADHD. Such a finding differs from typically developing children, who demonstrate acute exercise benefits to brain and

cognition for approximately 60-70 minutes. Future research should provide a more direct comparison to better understand the sustained effects of acute exercise across different populations of children.

Supported by MOST grant NSC102-2410-H-003-128.

F-35 Thematic Poster - Functional Movement with Parkinson's Disease

Friday, May 29, 2020, 3:15 PM - 5:15 PM

Room: CC-2007

3098 Chair: Chris J. Hass, FACSM. *University of Florida, Gainesville, FL.*

(No relevant relationships reported)

3099 Board #1 May 29 3:15 PM - 5:15 PM
The Influence Of Overground Locomotor Training Program On Dynamic Balance In People With Parkinson's Disease

Randy Jamil Pugh, Clinton J. Wutzke, Andrew E. Pechstein, Kerry B. Rosen, Lobna S. Elsarafy, Emily M. Leonard, Andrew A. Guccione. *George Mason University, Fairfax, VA.* (Sponsor: Randall Keyser, FACSM)
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(No relevant relationships reported)

PURPOSE: People with Parkinson's disease (PD) have impaired balance during walking that contributes to reduced physical activity and lower quality of life.

Overground locomotor training (OLT) is one method to improve dynamic balance for people with PD during walking. The purpose of this study is to examine the effect of an OLT program on dynamic balance during overground walking in people with PD.

METHODS: Five participants with PD (age: 68.9±6.7 yrs) were enrolled in a 12-week OLT program with an emphasis on power, stepping and stability within all planes of movement. Participants completed a 10-minute walk test (10MWT) overground wearing portable tri-axial motion sensors at baseline (PRE) and after (POST) intervention. Temporospatial data were collected pre- and post-intervention to obtain time in double limb support (TDLS) and calculate gait stability ratio (GSR) during the 10MWT. TDLS represents one's strategy for maintaining dynamic balance during gait. GSR is the ratio between number steps per minute and gait velocity. For both TDLS and GSR, lower values following intervention represent improved dynamic balance during walking. Gait characteristics were analyzed separately for each limb using paired Student's *t* tests.

RESULTS: Average TDLS was reduced for both limbs after intervention (PRE (L: 18.88±3.03; R: 18.89±3.04%); POST (L: 15.10±2.66; R: 15.11±2.68), *p*<.001). GSR improved following intervention (PRE (L: 82.83±9.58; R: 82.61±8.83); POST (L: 79.41±6.52; R: 78.88±6.54) *p*<.05).

CONCLUSION: Individuals with PD demonstrated improved dynamic balance during walking following the 12-week intervention. Decreased TDLS and GSR are gait characteristics that provide an opportunity to increase physical activity and improve quality of life. Incorporating OLT with multiplanar movements and stepping strategies should be considered as a treatment strategy to address impaired dynamic balance in people with PD.

3100 Board #2 May 29 3:15 PM - 5:15 PM
Do Individualized Physical Therapy Interventions Improve Balance And Gait Initiation In Persons With Parkinson'S Disease?

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Resting tremor, bradykinesia, rigidity, and loss of postural reflexes are the cardinal signs of Parkinson's disease (PD). Persons with PD frequently have balance impairments and postural instability which correlates with the increase in fractures and soft tissue injuries when compared to age-matched peers without PD. Persons with PD also frequently present with increased postural sway during quiet stance in addition to impaired weight shifting when transitioning between states of static and dynamic equilibrium such as during gait initiation and termination. Previous intervention studies lasting at least 12 weeks implemented a variety of methodologies such as strength training, aerobic training, tai chi, and dance therapy and produced

long-term benefits. Previous studies are inconclusive whether a multi-faceted approach for physical therapy intervention based on preferences of the participants will affect balance and gait initiation in those persons with PD. **PURPOSE:** To investigate if 12 weeks of individualized and supervised physical therapy intervention improves balance and gait initiation in persons with PD. **METHODS:** Six adults diagnosed with mild to moderate PD (mean age= 68.8 years±10.3 years), Hoehn and Yahr Levels I-III (Level I, n=2) (Level II, n=3) (Level III, n=1) participated in a 12-week program. The interventions were tailored to address functional deficits and participants' goals. Pre- (PRE) and post-testing (POST) included the Mini-BESTest, which measures 4 balance control systems. Gait initiation assessments were also performed as the participants voluntarily initiated gait from a quiet stance position on force plates. A paired sample *t*-test was used to compare PRE and POST. **RESULTS:** Four participants met or exceeded the minimal clinically important difference for the Mini-BESTest. The Mini-BESTest scores improved significantly (PRE, 18.5±5.8; POST, 24.7±3.5; *p*=0.021). There was no significant change in gait initiation parameters related to center of pressure movement. **CONCLUSION:** The 12-week individualized and supervised physical therapy program improved dynamic and static balance, but not gait initiation. The intervention was individualized towards the functional deficits and goals that were obtained in pre-testing. A limitation for this study was the small sample size.

3101 Board #3 May 29 3:15 PM - 5:15 PM
Improved Coordination And Coordination Variability In Response To Deep Brain Stimulation In Individuals With Parkinson's Disease

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(No relevant relationships reported)

Parkinson's disease (PD) is a progressive neurodegenerative disease associated with motor impairments. Deep brain stimulation (DBS) is associated with vast improvements in the motor symptoms of PD. Recent evidence has identified improvements in movement complexity during treadmill walking in response to DBS [1]. However, the effects of DBS on gait coordination have not been well elucidated. **PURPOSE:** to evaluate the effects of DBS on ankle and knee joint coordination and coordination variability during a treadmill walking task. **METHODS:** Five individuals with PD performed a four-minute treadmill walking task while 3D kinematics were collected over two 30-s periods. Participants completed testing in the DBS-ON followed by DBS-OFF conditions to avoid the confounding factor of fatigue. Kinematics were recorded simultaneously using an 9-camera motion capture system (120 Hz, Qualisys Inc., Goteburg, Sweden). Visual 3D was used to calculate segmental angles and velocities. Custom software (MATLAB, MathWorks) calculated continuous relative phase angles. Mean absolute relative phase (MARP) and deviation phase (DP) were used to quantify joint coordination (MARP) and coordination variability (DP). A paired samples *t*-test was used to determine the effects of DBS on MARP and DP. **RESULTS:** At the ankle, DBS was associated with greater MARP values (*p*=0.016; DBS-ON: 3.2±1.5; DBS-OFF: 2.1±0.9) and DP values (*p*=0.047; DBS-ON: 2.2±1.0; DBS-OFF: 1.4±0.4). At the knee, DBS was associated with greater MARP (*p*=0.021; DBS-ON: 6.8±2.8; DBS-OFF: 5.1±2.8) and DP values (*p*=0.045; DBS-ON: 2.9±1.5; DBS-OFF: 2.0±0.6). **CONCLUSIONS:** DBS allows individuals with PD to perform walking tasks with greater freedom of coordination and coordination variability. Increased availability of coordinative patterns may represent a greater number of successful strategies available to the system to optimize mechanical and metabolic efficiency during walking.

[1] Powell, Blackmore, Puppa, Lester, Murray, Reed-Jones, Xia 2018.

3102 Board #4 May 29 3:15 PM - 5:15 PM
Effects Of Motor Timing Training On Golf Swing Motion In Parkinson's Disease.

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(No relevant relationships reported)

Individuals with Parkinson's disease often show deficits in motor timing, specifically during tasks that require rhythmic motor patterns such as gait and finger tapping. However, it is not clear if rehabilitation training that focuses on improving motor timing can improve rhythmicity during coordinated movements. In this study, we utilized a computer-based rehabilitation tool, called Motor Timing training (MT), which trains individuals to improve motor timing by reacting to an auditory or visual reference cue. Changes in motor timing and coordination were measured using a golf swing motion. **PURPOSE:** The purpose of this study was to examine if MT training with golf swing motion improves motor timing in Parkinson's disease.

METHODS: Participants completed 12 MT sessions, three times weekly training for 4 weeks. The aim of each session was to perform the golf swing motion to match the audible beat. Visual feedback was given to the participants to encourage them to hit the 'target zone' (± 15 ms) during the golf swing. Motor timing was assessed using the Long Form Assessment (LFA) which evaluated timing and accuracy during fourteen movement tasks of the hands and feet. A wireless kinematic sensor system was utilized to measure pelvic acceleration in 3 axes (X, Y, Z) during the backswing and down swing. To determine variation of pelvic movement, the coefficient of variation (CV) were applied for analyzing the data. Paired t-test were used to compare pre- and post-intervention measures. **RESULTS:** There was a significant difference between pre-post training in the pelvis of X-axis on the back swing [$t=2.783$, $p=.039$] and there was a significant difference between pre-post training in the pelvis of Y-axis on the down swing [$t=3.873$, $p=.012$]. Motor timing also showed significant improvements as measured with LFA [$t=3.102$, $p=.027$]. **CONCLUSIONS:** These results suggest that MT training can improve motor timing and reduce the variation of pelvis movement during the golf swing in Parkinson's disease. In light of these findings, future studies will also examine if MT training promotes improved motor timing and golf swing mechanics in individuals who show impaired range of motion.

3103 Board #5 May 29 3:15 PM - 5:15 PM

Effects Of Motor Timing Training On The Golf Performance In Parkinson'S Disease

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BACKGROUND: Motor timing is essential for improving motor skills and it is a critical factor to determine the success in a golf swing. However, individuals with Parkinson's disease have deficits in motor timing due to bradykinesia, tremor, and rigidity. Rehabilitative training that employs a metronome beat to set a rhythm (Interactive Metronome) could provide rehabilitative training to improvement in motor timing and variability in golf performance. **PURPOSE:** The purpose of this study is to investigate the effects of 10 sessions of Interactive Metronome training on motor timing and variability in the golf performance of older adults with Parkinson's disease. **METHODS:** The participants with Parkinson's disease completed 10 sessions, 35-40 minutes per session, three times a week for 4 weeks. The speed and tempo of the golf swing with a seven iron were measured. Motor timing was analyzed by using Long Form Assessment (LFA) which evaluates timing and accuracy when performing movement tasks of the hands and feet. The speed and tempo data were obtained using a golf simulator. Paired sample t-test was used to compare the pre and post measure outcomes. **RESULTS:** After 10 sessions, there was a significant improvement in motor timing between pre-post testing (pre: 158.16 ± 75.05 , post: 94.66 ± 67.76 , $t=3.102$, $p=0.027$). However, tempo variability (pre: 22.81 ± 14.00 , post: 11.05 ± 7.16 , $t=1.739$, $p=0.143$) and speed variability (pre: 5.99 ± 3.58 , post: 4.49 ± 1.81 , $t=-.721$, $p=0.503$) were not significantly different. **CONCLUSION:** These findings indicate that Interactive metronome training can promote improvements in motor timing and golf performance in older adults with Parkinson's disease. In addition, motor timing training could be widely utilized along with the exercise to reduce the symptoms of Parkinson's disease.

3104 Board #6 May 29 3:15 PM - 5:15 PM

Sample Entropy Analysis Of Dance Interventions In People With Parkinson's Disease And Older Adults

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Dance comprises a broad range of techniques and styles, which have been utilized in classes specifically designed for individuals with Parkinson's disease (PD) and healthy older adults (OA). Previous studies have shown that a series of dance sessions can improve balance, posture, and gait for people diagnosed with PD and healthy older adults. However, these studies have not analyzed the features of body limb movement during dance. Sample Entropy (SamEn) analysis can be used to examine the complexity of movements in order to provide direction in the development of optimal dance interventions for these populations. **PURPOSE:** To identify dance movement patterns resulting in the greatest improvement in tests of gait, balance and upper extremity function using partnered and non-partnered dance to music in PD and OA. We hypothesize that entropy-driven variation in movement will enhance improvements in motor performance and that PD participants will show greater sample entropy during dance than OA participants. **METHODS:** Participants with and without PD participating in structured group dance classes were recruited for this study. Motion capture was used to examine movement patterns and sample entropy analysis was used to calculate the complexity of movements during dance. **RESULTS:** Participants with

PD had a greater spread of SamEn in left hip abduction during tango movements than right hip abduction ($p < 0.0001$). A greater SamEn in right hip rotation during tango movements than left hip rotation ($p < 0.0001$) was seen during tango but no significant difference during fox trot. Furthermore, PD group had no significant difference in left/right knee flexion SamEn during tango but left knee flexion SamEn was higher during fox trot than right knee flexion SamEn ($p = 0.006$). OA participants saw a much smaller, but still significant, spread in SamEn in left hip abduction during Tango than right hip abduction ($p = 0.002$), with no significant difference in hip rotation SamEn. **CONCLUSION:** We interpret our entropy results as showing a decrease in PD left hip abduction control compared to the right hip during tango. Our PD participants reported that the left side was more affected. These types of data could be used to optimize dance interventions in regards to dance type, music beat/rhythm in order to improve limb control.

3105 Board #7 May 29 3:15 PM - 5:15 PM

Relationship Between Lower Extremity Muscle Function And Gait Variability In Individuals With PD

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PURPOSE: Increased variability in motor function can significantly impair performing activities of daily living. The difficulty in performing daily motor tasks is increased in pathological populations, e.g., Parkinson's disease (PD). The muscular capabilities, e.g., torque production and force control, in PD, are reduced compared to older adults. It is unclear if the reduced muscular capabilities in PD are related to increased difficulty performing regular movements, i.e., gait. This study examined the relationship between muscular capabilities of the lower extremity and gait variability in persons with PD.

METHODS: 12 PD and 11 age-matched controls underwent gait and lower extremity muscle testing. Gait was evaluated by having the subjects perform ten over-ground walking trials over a 9-m walkway at a self-selected speed using an 8-camera motion capture system. Linear measures of gait, including stride length, stride time, step width, and velocity, were calculated. Gait variability and force variability were examined using the coefficient of variation ($CV = \text{standard deviation}/\text{mean} \times 100\%$). Lower extremity testing consisted of 1) maximal isometric torque production and 2) submaximal force control using a tracing paradigm at 5, 10, and 20% of their maximal torque production in multiple directions at the hip and ankle. Pearson's correlations were applied to analyze associations between gait variability and force variability. **RESULTS:** In the PD group, stride time was positively correlated with 20% of ankle dorsiflexion CV ($r(21)=.62$, $p<.05$) and velocity was positively correlated with 10 and 20% of ankle plantarflexion CV ($r(21)=.59$, $p<.05$) and 20% of hip extension CV ($r(21)=.63$, $p<.05$). Maximal torque production of the dorsiflexors ($r(21)=.75$, $p<.05$) and plantar flexors ($r(21)=.67$, $p<.05$) were positively correlated stride time variability in the PD group.

CONCLUSION: The results highlight an association between lower-extremity muscle function and gait function in PD. Interestingly, in those with PD, both maximal strength and control of muscle strength were found to be related to the temporal parameters of gait variability. These results suggest that gait dysfunction could be the result of specific pathological impairments and provide unique opportunities for specialized interventions.

F-36 Thematic Poster - Sex Differences During Exercise Hyperthermia and Stress

Friday, May 29, 2020, 3:15 PM - 5:15 PM
Room: CC-2009

3106 Chair: Oscar E. Suman, FACSM. *Shriners Hospitals for Children/University of Texas Medical Branch, Galveston, TX.*

(No relevant relationships reported)

3107 Board #1 May 29 3:15 PM - 5:15 PM

Sex Differences In Physical Performance Under Simulated Military Operational Stress

Phil J. Agostinelli. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: Bradley C. Nindl, FACSM)
(No relevant relationships reported)

PURPOSE: Military personnel are in a constant effort to maintain operationally specific physical performance under high levels of stress. Physical exertion, cognitive

overload, sleep deprivation, and caloric restriction are all factors of operational stress in the military. This study aims to investigate how Simulated Military Operational Stress (SMOS) effects performance on the operationally relevant tasks both in men and women. **METHODS:** As part of an ongoing study; Forty male soldiers (26±5yrs, 176±8cm, 85±15kg, 20±7%BF) and eleven female soldiers (25±5yrs, 167±12 cm, 63±6kg, 26±7%BF) completed a SMOS protocol lasting 5 days (D) and nights (N). Days 3 & 4 (D3, D4), subjects consumed 50% of caloric demands. N1, 2, & 5 (D1, D2, and D5) subjects slept from 2300-0700. N3-4, subjects slept from 0100-0300 and 0500-0700. Familiarization was completed D1. During D2 & 5 participants underwent a Tactical Mobility Test (TMT), consisting of the following: 2-min water can carry (WCC) (20 kg each hand), fire & movement course, 20-m casualty drag (CD) (91kg), 300-m shuttle run unloaded (SRU) and loaded (SRL) (16 kg), 2-mi paced, and 2-mi best effort timed ruck march (RM) (15 kg). Two-way mixed ANOVAs with Bonferroni Post Hoc ($p < 0.05$) were used to identify if the difference in TMT performance form D2-5 was different between men and women. **RESULTS:** Regardless of sex a main effect for SRU across days was found. SRU increased by 6% from D2 to D4 and D5 (D2: 97.2±20, D4:103.3±22.8, $p=0.047$; D5: 103.5±18.8, $p=0.011$); additionally, D5 increased by 4% from D3 (D5: 103.5±18.8, D3: 99.3±20.2; $p=0.047$). **CONCLUSION:** Short-term exposure to military operational stress leads to a decline in anaerobic capacity; regardless of sex. Operational tasks involving muscular strength, endurance, and aerobic endurance such as the WCC, CD, and RM were well maintained over 5-days of during SMOS equally between men and women. The preliminary findings of this study suggest simulated military operational stress effects women and men equally. Future investigation with a larger sample size is needed. This study was funded by the Department of Defense (Award # W81XWH-17-2-0070). The results and opinions herein are those of the authors and do not necessarily constitute endorsement of the Department of Defense.

3108 Board #2 May 29 3:15 PM - 5:15 PM
Abstract Withdrawn

3109 Board #3 May 29 3:15 PM - 5:15 PM
Females Have An Increased Sensitivity To Thermal Stress During Matched Exercise Metabolic Heat Production
Lauren Schoech, Kyleigh Allie, Paolo Salvador, Mauricio Martinez, Eric Rivas. *Texas Tech University, Lubbock, TX.* (Sponsor: Oscar Suman, FACSM)
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(No relevant relationships reported)

PURPOSE: Females report greater sensitivity in cold compared to hot conditions. However, it is unclear how thermal sensitivity is affected when the change for internal temperature (ΔT_{in}) and metabolic heat production (MHprod) are matched. This project tested the hypothesis that females have enhanced sensitivity to thermal stress during exercise hyperthermia when ΔT_{in} and MHprod is matched. **METHODS:** Twenty-two healthy active (7 day activity: 8620±3008 steps/day; VO_{2max} : 49±10 mL/kg/min) adults (11M/11F, 22.4±4.9y, 169±7.6cm, 68.3±13kg) exercised at similar MHprod (M: 7.1±1.5 W/kg, F: 6.9±1.4 W/kg; $P=0.32$) for 60 min (cycle ergometer) in cool (24.0±0.0°C; 14.4±3.6%Rh) and hot (42.3±0.2°C; 27.9±5.5%Rh) conditions in random order separated by at least 7 days. The ΔT_{in} , heart rate (ΔHR), and thermal stress indices for comfort (TC, -4 very cold to +4 very hot), sensation (TS, -4 very cold to +4 very hot), perception (TP, 1 so cold I am helpless to 13 so hot I am sick), feeling (TF, +5 very good to -5 very bad), and focus (F, 0 internal focus [bodily sensations] to 100 external focus [external environment]) were measured every 10 minutes. A 2-way repeated-measures analysis of variance on area under the curve was used to examine Interaction (I) and Main Effect (ME) for condition × sex. Values are expressed as means ±SD with significance set at $P < 0.05$.

RESULTS: Males and females had similar increase in hot compared to cool for ΔT_{in} (Cool: $\Delta 0.5 \pm 0.1^\circ C$, Hot: $\Delta 1.5 \pm 0.6^\circ C$; ME: condition; $P < 0.0001$) and ΔHR (Cool: 58±15 b/min, Hot: 71±15 b/min; ME: condition; $P < 0.01$). Females reported that TC and TS felt hotter in both conditions (ME: sex; $P < 0.0001$) and both groups increased in hot compared to cool (ME: condition; $P \leq 0.04$). Females reported that TS was elevated compared to males in cool compared to hot (I: condition × sex; $P < 0.005$). TP felt hotter in the cool but similar increase in hot for females compared to males (I: condition × sex; $P < 0.02$). Females reported TF was more positive compared to males in hot (I: condition × sex; $P < 0.0001$). Females reported greater external focus in cool compared to males (ME: sex; $P < 0.0002$). **CONCLUSIONS:** These data indicate that sex differences exist for thermal stress. Females perceive thermal stress in hot and cool conditions to a greater extent than males exercising at similar metabolic heat production.

3110 Board #4 May 29 3:15 PM - 5:15 PM
Recovery Of Heart Rate Variability And Hemodynamics After Heated Exercise In Active Females

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(No relevant relationships reported)

Previous research has demonstrated that men who exercise in heat have challenged autonomic recovery, though little research has been conducted in females. **PURPOSE:** The purpose of this study was to assess the recovery of autonomic function in women who performed moderate-intensity exercise in heat. **METHODS:** Seven women (31.7±7.6 years, 67.3±4.1 kg, 25.7±5.6 % Fat, 43.9±5.1 mL/kg/min) completed two identical bouts of graded treadmill walking (~60% VO_{2peak}). One bout was hot (35-40°C, > 40% relative humidity (RH)), and the other served as a control (18-22°C, < 40% RH). For 24 h before and after each bout, participants had heart rate variability (HRV), specifically RMSSD, monitored. After each exercise bout, HR and BP were monitored during 30 min of supine recovery and 10 min of orthostatic tolerance assessment. **RESULTS:** RMSSD was more suppressed following exercise in the heat and remained lower than in the control condition for one hour ($p < 0.05$). During supine recovery, heat exposure led to higher HR ($p = 0.002$) and lower DBP ($p = 0.016$). SBP ($p = 0.037$) and DBP ($p = 0.008$) were both lower after 10 min of supine recovery following hot exercise than after control temperature. Average response did not reveal orthostatic hypotension despite heat causing a higher HR ($p = 0.011$) and lower SBP ($p = 0.026$) after 10 min of orthostatic exposure. **CONCLUSIONS:** Exercise in heat causes greater disruptions in cardiovascular autonomic functioning for at least one hour after exercise. Women who exercise in heat should be wary of an exacerbated HR response following exercise in the heat and low recovery blood pressures with associated symptoms.

3111 Board #5 May 29 3:15 PM - 5:15 PM
Sex Difference In Cerebral Blood Flow During Exercise Hyperthermia

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PURPOSE: Young healthy females are more prevalent to orthostatic hypotension compared to males. It is unknown if females show similar cerebral blood flow hemodynamics (middle cerebral artery, $MCA_{V^{mean}}$) compared to males during exercise hyperthermia. We tested the hypothesis that females have an attenuated $MCA_{V^{mean}}$ response to exercising in hyperthermic conditions.

METHODS: Twenty-two healthy active adults (7 day activity: 8620±3008 steps/day; VO_{2max} : 49±10 mL/kg/min) adults (11M/11F, 22.4±4.9y, 169±7.6cm, 68.3±13kg) exercised at similar metabolic heat production (M: 7.1±1.5 W/kg and F: 6.9±1.4 W/kg; $P=0.32$) for 60 min (cycle ergometer) in cool (24.0±0.0°C; 14.4±3.6%Rh) and hot (42.3±0.2°C; 27.9±5.5%Rh) conditions in random order with 7 days washout. $MCA_{V^{mean}}$ absolute and percent change from rest, $MCA_{V^{mean}}$ conductance ($MCA_{V^{mean}}CVC$), cardiac output index (COi) and systemic vascular resistance index (SVRi), and the difference between conditions (hot minus cool) were examined by a mixed model 2-way repeated-measures analysis of variance for Interaction (I) and Main Effect (ME) for time and sex. Significance was set at $P < 0.05$.

RESULTS: Thermal (ΔT_{in} , Cool: $\Delta 0.5 \pm 0.1^\circ C$, Hot: $\Delta 1.5 \pm 0.6^\circ C$; ME: condition; $P < 0.0001$) and cardiovascular strain (ΔHR Cool: 58±15 b/min, Hot: 71±15 b/min; ME: condition; $P < 0.01$) were similar between sex and increased in hot compared to cool condition. During the cool condition, absolute $MCA_{V^{mean}}$ and $MCA_{V^{mean}}CVC$ were higher in females compared to males (ME: sex $P < 0.005$). In contrast, $MCA_{V^{mean}}$ and $MCA_{V^{mean}}CVC$ increased then decreased over time in hot compared to the cool condition (ME: time; $P < 0.0001$). COi increased in hot compared to cool condition (ME: condition; $P < 0.008$). Females had greater SVRi compared to males in both conditions (ME: sex; $P < 0.008$). However, the %change and the difference between conditions, females compared to males had an attenuated $MCA_{V^{mean}}$ (ME: sex; $P < 0.03$) and $MCA_{V^{mean}}CVC$ (I: time × sex; $P < 0.01$).

CONCLUSIONS: These data indicate that sex differences exist for exercise cerebral blood flow. Females have higher $MCA_{V^{mean}}$ in cool and have an attenuated $MCA_{V^{mean}}$ response during exercise hyperthermia compared to males. This sex difference may be due to differences in blood pressure and systemic vascular resistance.

3112 Board #6 May 29 3:15 PM - 5:15 PM
Post-Exercise Hyperthermia Cerebral Blood Flow Hemodynamics Are Similar Between Males And Females

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PURPOSE: Females have greater orthostatic intolerance and increased adrenergic sensitivity to passive heat stress compared to males. It is unknown how cerebral blood flow is affected during post-exercise heat stress. We tested the hypothesis that females would have lower middle cerebral artery blood flow velocity (MCAV^{mean}) during post-exercise hyperthermia. **METHODS:** Twenty-two healthy active adult (7 day activity: 8620±3008 steps/day; VO₂max: 49±10 mL/kg/min) subjects (11M/11F, 22.4±4.9y, 169±7.55cm, 68.3±13kg) exercised at a similar metabolic heat production (M: 7.1±1.5 W/kg and F: 6.9±1.4 W/kg; P=0.32) for 60 minutes (cycle ergometer) in cool (24±0.0°C; 14.4±3.6%Rh) and hot (42.3±0.2°C; 27.9±5.5%Rh) conditions in random order with a 7 day washout. During 1-hour post-exercise recovery, Transcranial Doppler examined MCAV^{mean}, pulsatility index (PI) and intracranial pressure (ICP). Systemic vascular responses for mean arterial pressure (MAP), augmentation index (AIx), pulse wave velocity (PWV), systemic vascular resistance (SVR), and change in intestinal temperature (ΔTin) and heart rate (ΔHR) and were measured during 1-hour recovery. Area under the curve (AUC) variables were analyzed using a mixed model 2-way repeated-measures analysis of variance for interaction (I) and main effects (ME) for Condition x Sex. Alpha priori was set at P<0.05. **RESULTS:** Exercise thermal (ΔTin, Cool: Δ0.5±0.1°C, Hot: Δ1.5±0.6°C; ME: Condition; P<0.0001) and cardiovascular strain (ΔHR Cool: 58±15 b/min, Hot: 71±15 b/min; ME: Condition; P<0.01) was similar between groups that increased in hot compared to cool condition. During recovery both sexes had a similar AUC MCAV^{mean}, however, MCAV^{mean} was lower in hot compared to cool (ME: Condition; P<0.03). Females also showed reduced stiffness (AUC PWV and AIx) compared to males (ME: Condition; P<0.0001; ME: Sex, P<0.0008). Females had greater AUC SVR compared to males in both conditions (ME: sex; P<0.01). There were no differences for MAP, PI, or ICP between the Condition or Sex. **CONCLUSIONS:** These data suggest that no sex difference exists for MCAV^{mean} during recovery. Both sexes have lower MCAV^{mean} in hot compared to cool conditions. However, the peripheral vascular mechanisms for this attenuation may differ as females have lower arterial stiffness and higher SVR.

F-37 Free Communication/Slide - Cardiometabolic Disease

Friday, May 29, 2020, 3:15 PM - 5:15 PM
 Room: CC-3014

3113 Chair: Steven K. Malin, FACSM. *University of Virginia, Charlottesville, VA.*
 (No relevant relationships reported)

3114 May 29 3:15 PM - 3:30 PM
Effect Of Pre-Operative Aerobic Exercise On Surgical Outcomes And Cardiometabolic Health In Bariatric Surgery Patients

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PURPOSE: Examine if adding pre-operative aerobic exercise to standard medical care (EX+SC) improves surgical outcomes and enhances cardiometabolic health 30 d after surgery compared to SC only in bariatric surgery candidates. **METHODS:** Patients receiving bariatric surgery were match-paired to pre-operative SC (n=7 (6F), age 39.0±5.3 y, BMI 46.4±3.0 kg/m²) or EX+SC (n = 7 (7F); age 43.9±4.2 y, BMI 45.1±2.5 kg/m²; walking 30min/d, 5d/wk, 65-85% HR_{peak}) for 30 d. Fitness (VO₂peak), body composition (waist circumference and BodPod), lipids/lipoproteins, systemic inflammation (C-reactive protein (CRP)), and arterial stiffness (augmentation index (AIx); 120min mixed meal tolerance test) were assessed pre-intervention, post-intervention (~2 d prior to surgery), and 30 d post-operation. **RESULTS:** SC and

EX+SC reduced body weight (SC -8.4±0.8% vs. EX+SC -9.3±0.8%), fat mass (SC -9.6±1.1% vs. EX+SC -12.0±1.7%), and waist circumference (SC -5.6±1.4% vs. EX+SC -2.1±2.8%) similarly (all P<0.04). Treatment had no effect on CRP (P=0.58) but lowered fasted systolic blood pressure (SC -4.5±3.1% vs. EX+SC -7.9±3.0%), low-density lipoprotein (SC -20.1±4.5% vs. EX+SC -26.2±4.9%), and total cholesterol (SC -19.7±3.8% vs. EX+SC -21.6±4.6%) as well as AIx total area under the curve (SC -40.7±14.0% vs. EX+SC -19.7±11.2%) similarly for both groups (all P<0.02) pre-intervention to 30 d post-surgery. EX+SC had a shorter length of hospital stay than SC (41.3±4.4 vs. 56.7±5.7 hrs; P=0.05). Although VO₂peak (SC -5.8±5.0% vs. EX+SC 1.7±5.2% pre- to post-intervention) and lean mass (SC -2.4±0.8% vs. EX+SC -0.4±1.4% pre- to post-intervention) were not significantly different between groups after the interventions, increased VO₂peak prior to surgery correlated to a shorter length of stay (r=-0.58, P=0.03). Increased VO₂peak (r=-0.78, P=0.001) and lean mass (r=-0.56, P=0.04) pre- to post-intervention was also associated with decreased CRP 30 days post-operation. **CONCLUSIONS:** EX+SC did not enhance the effect of SC on cardiometabolic risk factors. However, adding aerobic exercise to SC appears to benefit the bariatric patient as increased pre-operative VO₂peak related to a shorter length of stay and increased VO₂peak and lean mass prior to surgery correlated to decreased systemic inflammation 30 d post-surgery.

3115 May 29 3:30 PM - 3:45 PM
High Intensity Exercise Training In Patients With Hypertrophic Cardiomyopathy

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 (No relevant relationships reported)

Patients with hypertrophic cardiomyopathy (HCM) are excluded from high intensity activities due to perceived fear of sudden cardiac death though data from athletes with HCM suggest competitive sport may be safe for some. Low cardiorespiratory fitness in sedentary HCM patients may confer a greater lifetime cardiovascular event risk than exercise *per se*. While moderate intensity exercise training in patients with HCM modestly increases fitness, high intensity exercise may be superior. **PURPOSE:** To compare the efficacy of five months of moderate intensity exercise and high intensity exercise training to improve cardiorespiratory fitness (VO₂max) in patients with HCM. **METHODS:** Eight patients with HCM (50 ± 7 years, 3 female) were assessed for maximal oxygen uptake (VO₂max, Douglas Bag method), cardiac output (Q_t, acetylene rebreathing), and peripheral oxygen extraction (av-O₂ diff, Fick equation) before randomization and after 5 months of moderate or high intensity exercise training. Patients completed 3-4 sessions of moderate intensity exercise each week, while the high intensity group also incorporated a weekly interval training session. **RESULTS:** Five months of moderate intensity exercise increased absolute VO₂max by 3% and relative VO₂max by 4%, while high intensity exercise consistently increased absolute VO₂max by 6% and relative VO₂max by 5% (Figure). Maximal Q_t did not change after moderate intensity exercise (+0.0L [95% CI -2.0 to 1.7]) but increased in all three patients after high intensity exercise (+1.2L [95% CI -1.4 to 3.9]), while maximal av-O₂ diff remained stable in both groups (moderate intensity: +0.8mL/100mL [95% CI -1.0 to 2.6]; high intensity: -0.5mL/100mL [95% CI -3.6 to 2.7]). **CONCLUSION:** Preliminary findings show similar increases in cardiorespiratory fitness following five months of moderate and high intensity exercise training in patients with HCM, although improvements were more consistent after high intensity exercise.

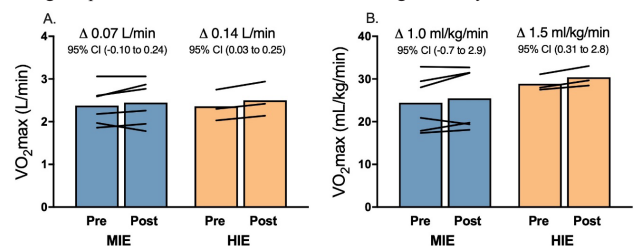


Figure. Similar increases in absolute (A) and relative (B) cardiorespiratory fitness following five months of moderate intensity exercise (MIE) and high intensity exercise (HIE). The increase in VO₂max was consistent in all three patients who completed high intensity exercise training whereas the training response to moderate intensity exercise was more variable.

3116 May 29 3:45 PM - 4:00 PM
Abstract Withdrawn

3117 May 29 4:00 PM - 4:15 PM
Adding Resistance Training To Endurance Training Improves Glucose Metabolism In Individuals With Metabolic Syndrome

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Elevated fasting blood glucose is one of the five components of metabolic syndrome (MetS) which is a cluster of anthropometric, metabolic and cardiovascular derangements. Insulin resistance (IR) has been identified as an important risk factor to develop diabetes (i.e. T2D) and MetS. Both, aerobic (AT) and resistance training (RT) prevent the development of T2D although it is unclear which is most effective. It has been suggested that mechanisms to improve IR are different between AT and RT. Thus, we hypothesized that the combination of both modes of training could provide additive effects to treat IR.

Purpose: To determine whether the addition of resistance training (RT) to high-intensity interval training (HIIT) was able to improve glucose metabolism in patients with metabolic syndrome (MetS). **Methods:** One hundred MetS patients (age, 56±8 years; weight, 92±17 kg; and Mets factors, 3.8±0.8 components) were randomized to undergo one of the following 16-wk program: (a) 4 x 4-min high-intensity interval training at 90% of HR_{max} plus 3 sets of 8-12 rep at 60-85% 1RM of 3 legs free-weight exercises (HIIT+RT group; n=35), (b) 5 x 4-min high-intensity interval training at 90% of HR_{max} (HIIT group; n=43) or (c) no exercise control group (CONT group; n=22). We measured the evolution of all five MetS components (i.e. Z-score), CRF (i.e. VO_{2max}), legs strength and power (i.e. leg press 1RM and countermovement jump (CMJ)) and fasting glucose (FG) and insulin (FI) to calculate HOMA-IR before and after intervention. Pre-intervention FG was similar among groups (110±23; 115±21; 121±30, mg·dL⁻¹ for HIIT, HIIT+RT and CON, respectively). **Results:** After 16 weeks of training, HIIT+RT improved CMJ and 1RM leg press above HIIT and CON (P<0.010). After 16 weeks of training FG (4%; p=0.046) and HOMA-IR (18%; p=0.032), decreased only in HIIT+RT. However, both training groups improved similarly their VO_{2max} (HIIT+RT, 7%, p=0.001; HIIT, 11%, p<0.001) and Z-score (HIIT+RT, 43%, P=0.022; HIIT, 63%, P=0.004). **Conclusion:** Our findings suggest that in initially sedentary individuals with MetS, RT combined with HIIT further improves the insulin-sensitizing effects of exercise reducing glucose concentrations.

3118 May 29 4:15 PM - 4:30 PM
Exercise Training Volume And The Fitness-fatness Index (FFI) In Adults With Metabolic Syndrome

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Cardiorespiratory fitness and fatness (central obesity) are purported to be mediating factors of metabolic syndrome (MetS), and consequent cardiovascular disease (CVD)/mortality risk. The recently developed fitness-fatness index (FFI) combines these and has been reported to be a better indicator of CVD and all-cause mortality risk, beyond the capacity of either fitness or fatness alone. **PURPOSE:** To investigate the effects of different exercise volumes on FFI in adults with MetS. **METHODS:** Ninety-nine adults diagnosed with MetS according to the International Diabetes Federation criteria were randomized to one of the following 16-week exercise intervention: i) moderate-intensity continuous training (MICT) at 60-70% HR_{peak} for 30 min/session (n=34, 150 min/week); ii) 4 x 4 min bouts of high-intensity interval training (4HIIT) at 85-95% HR_{peak}, interspersed with 3-min active recovery at 50-70% HR_{peak} (n=34, 38min/session, 114 mins/week); and iii) 1 x 4 min bout of HIIT at 85-95% HR_{peak} (n=31, 17 min/session, 51 min/week). Fitness (VO_{2peak}) was determined via indirect calorimetry during maximal exercise testing and fatness was the ratio of waist circumference-to-height (WHtR). FFI was calculated as VO_{2peak} in METs divided by WHtR. A positive response to the exercise intervention was determined as a 1FFI increase. **RESULTS:** Seventy-seven participants completed pre and post testing to determine FFI. There was a greater proportion of participants who responded positively to a change in FFI following 4HIIT (56%, 14/25) compared to MICT (31%, 8/26)

and 1HIIT (42%, 11/26), but with no significant between-group difference (p=0.19). After excluding 21 participants who had <85% adherence rate to the training sessions, a total of 56 were included in the analysis (4HIIT, n=15; MICT, n=20; 1HIIT, n=21). A similar trend in FFI responders was found (4HIIT, 60%; MICT, 30%; 1HIIT, 38%; between-group difference, p=0.19). **CONCLUSION:** This study suggests that there may be a threshold of exercise volume (intensity and duration) that must be obtained to improve FFI, and thus CVD and all-cause mortality risk in adults with MetS.

3119 May 29 4:30 PM - 4:45 PM
Water-based Exercise Training For Coronary Heart Disease

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Exercise training is an important component of coronary heart disease (CHD) management, however engagement in gym-based exercise (GEX) remains sub-optimal. Water-based exercise (WEX) may provide an alternative, especially for patients with obesity or arthritis due to the buoyancy effect of water.

PURPOSE: To examine the effectiveness of WEX for people with CHD.

METHODS: Participants were randomised to 12 weeks of WEX, GEX, or control. Training groups undertook three, one-hour sessions of circuit training per week.

Aerobic capacity (VO_{2peak}), muscular strength (one repetition maximum; 1RM), body fat (DXA) and endothelial function (flow mediated dilation; FMD) were assessed at baseline and 12 weeks. Data were analysed using STATA 16 with mixed effects linear regression.

RESULTS: Forty-five participants completed the study; WEX (n= 15), GEX (n=18), control (n=12). Data reported are estimated mean and 95% confidence interval.

Outcome	Week 0	Week 12	p
VO _{2peak} (mL.kg ⁻¹ .min ⁻¹) WEX	25.9 (23.5-28.7)	27.4 (24.7-30.8)	0.03
VO _{2peak} (mL.kg ⁻¹ .min ⁻¹) GEX	25.2 (23.1-27.7)	26.8 (24.4-29.7)	0.004
Hamstrings (kg) WEX	49.3 (43.3-55.7)	54.0 (47.3-61.2)	0.01
Hamstrings (kg) GEX	50.7 (44.8-57.2)	57.5 (51.0-64.2)	<0.001
Biceps (kg) WEX	10.4 (8.7-12.0)	10.3 (8.6-12.0)	0.80
Biceps (kg) GEX	10.5 (8.9-12.1)	11.5 (9.8-13.1)	0.003
Body fat (kg) WEX	28.7 (24.9-32.5)	27.8 (24.1-31.6)	0.02
Body fat (kg) GEX	28.4 (24.7-32.2)	27.4 (23.7-31.2)	0.003
FMD (% change from baseline) WEX	3.9 (2.8-5.0)	5.0 (3.8-5.8)	0.02
FMD (% change from baseline) GEX	4.8 (3.7-5.9)	5.2 (4.1-6.3)	0.39

No changes were evident in controls.

CONCLUSION: WEX and GEX improved aerobic fitness, leg strength and fat mass similarly, while WEX alone improved endothelial function. These findings support WEX as an alternative to GEX in patients with CHD.

Supported by the Spinnaker Foundation, The Heart Foundation (Australia), and the Australian Government Research Training Programme.

3120 May 29 4:45 PM - 5:00 PM
Aerobic Exercise Training Enhances The Blood Pressure-lowering Effect Of Antihypertensive Medication.

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(No relevant relationships reported)

Hypertension is an important risk factor for suffering cardiovascular diseases and many hypertensive individuals are under pharmacological treatment (antihypertensive

medication; AHM). Aerobic exercise training in hypertensive individuals has been shown to reduce their blood pressure. However, information is scarce on the effects of aerobic training and AHM on the control of hypertension. **PURPOSE:** To analyze the effects of AHM on 21-h ambulatory blood pressure (ABP) before and after an aerobic exercise training program in hypertensive individuals. **METHODS:** Twenty-seven participants chronically medicated with angiotensin receptor blockers or angiotensin-converting enzyme inhibitors antihypertensive medicine (AHM) underwent high-intensity interval training (HIIT; 3 sessions per week, 4x4' at 90 HR_{MAX}/3' at 70% HR_{MAX}) during 4-months. Before and after training, 21-h ABP was monitored under 2 conditions in a double-blind, placebo randomized design: a) PLAC trial substituting for 3 consecutive days antihypertensive medicine by placebo, and b) AHM trial, taking their prescribed antihypertensive medicine. Cardiorespiratory fitness (CRF), body weight and aldosterone to plasma renin activity ratio (ARR) were measured as secondary outcomes. Differences among the 4 trials (i.e., PLAC_{PRE}, AHM_{PRE}, PLAC_{POST}, AHM_{POST}) were analyzed by one-way repeated-measures ANOVA. **RESULTS:** CRF increased significantly from 2.45±0.02 to 2.58±0.02 L·min⁻¹ (P=0.025), body weight decreased from 95.6±2.5 to 93.6±2.4 kg (P=0.007), whilst ARR only decreased significantly after training (-10.8±2.6 a.u., P=0.002). At baseline, AHM reduced daytime ambulatory mean arterial pressure by 4.5±1.1 mmHg, being that reduction enhanced to 7.4±1.1 mmHg after 4-months of training (P=0.047). However, at nighttime this difference faded out and the reductions of AHM before (6.1±1.5 mmHg) and after training (4.7±1.2 mmHg) remained similar (P=0.437). **CONCLUSIONS:** The present data show that 4 months of HIIT enhances the effects of antihypertensive medication on blood pressure during daytime. This effect fades out during the night, a time where BP naturally falls. These results demonstrate that aerobic training could be used as a strategy to improve pharmacological treatment in hypertensive individuals.

3121 May 29 5:00 PM - 5:15 PM

Effects Of Statins Therapy And Exercise On Postprandial Triglycerides In Overweight Individuals With Hypercholesterolemia.

Ricardo Mora-Rodriguez, Juan F. Ortega, Felix Morales-Palomo, Miguel Ramirez-Jimenez, Alfonso Moreno-Cabañas, Laura Alvarez-Jimenez. *University of Castilla La Mancha, Toledo, Spain.*

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(No relevant relationships reported)

PURPOSE: To determine the effects of statins on postprandial lipemia (PPL) and to study if exercise could enhance statin actions.

METHODS: Ten hypercholesterolemic (blood cholesterol 204±36 mg·dL⁻¹; LDL-c 129±32 36 mg·dL⁻¹) overweight (BMI 30±4 kg·m⁻²), metabolic syndrome (MetS) individuals chronically medicated with statins (> 6 months) underwent 5-hr PPL tests in four occasions in a randomized order; a) substituting their habitual statin medication by placebo medicine during 96 hours (PLAC trial), b) taking their habitual statin medicine (STA trial), c) placebo medicine combined with a bout of intense aerobic exercise (EXER+PLAC trial) and d) combining exercise and statin medicine (EXER+STA trial).

RESULTS: Before the fat meal, statin withdrawal (i.e., PLAC and EXER+PLAC) increased blood triglycerides (TG; 29%), LDL-c (37%) and total cholesterol (23%; all P<0.05) evidencing treatment compliance. After the meal, statin withdrawal increased 5-h postprandial TG (PPTG) compared to its matched trials (94% higher PLAC vs STA and 45% higher EXER+PLAC vs EXER+STA; P<0.05). EXER+PLAC trial did not lower PPTG below the PLAC trial (i.e., incremental AUC of 609±152 vs 826±190 mg·dL⁻¹·5 h; P=0.09). Neither adding exercise to statin resulted in larger reductions in PPTG (i.e., EXER+STA vs STA iAUC of 421±87 vs 421±84 mg·dL⁻¹·5 h; P=0.99).

CONCLUSIONS: In hypercholesterolemic MetS individuals, chronic statin therapy blunts the elevations in TG after a fat meal (i.e., iAUC of PPTG) reducing the cardiovascular risk associated to their atherogenic dyslipidemia. However, a single bout of intense aerobic exercise before the high fat meal does not reduce PPTG but neither interferes with the effects of statin treatment.

F-38 Clinical Case Slide - Cardiovascular and Gastrointestinal

Friday, May 29, 2020, 3:15 PM - 4:55 PM

Room: CC-2005

3122 **Chair:** Robert B. Kinningham, FACS. *University of Michigan, Ann Arbor, MI.*

(No relevant relationships reported)

3123 **Discussant:** Meagan Wasfy. *Massachusetts General Hospital, Boston, MA.*

(No relevant relationships reported)

3124 **Discussant:** Barry A. Franklin, FACS. *Beaumont Health, Royal Oak, MI.*

(No relevant relationships reported)

3125 May 29 3:15 PM - 3:35 PM

Cardiac-Football

Brady Fleshman. *University of Kentucky, Lexington, KY.*

(Sponsor: Robert Hosey, FACS)

(No relevant relationships reported)

HISTORY: A 20 year-old male Division I football player with no significant past medical history presented with syncope and collapse one hour ago. Patient was doing cone drills and was feeling short of breath with mid-sternal chest tightness. The trainers had him sit out the rest of the drill. Five minutes after resting he asked the trainer if he could go back in and they said no. Ten seconds later, he passed out from a standing position. Upon awakening a few seconds later, he was asymptomatic. He was immediately escorted from practice to the clinic. Patient states over the last week he had not been keeping up with his peers in practice.

PHYSICAL EXAMINATION: No acute distress. Moist oral mucosa. Heart rate 100, regular rhythm, no murmurs with Valsalva, sitting, standing, squatting or grip squeeze. Lungs are clear and no labored or auscultation bilaterally without wheezing.

DIFFERENTIAL DIAGNOSIS: Vasovagal syncope, hypoglycemia, seizure, arrhythmia, hyponatremia **TEST AND RESULTS:** Labs showed normal CMP and TSH. CBC showed normocytic anemia (Hgb 13.1). Serum protein electrophoresis was normal. Coxsackie B virus antibody testing showed a 1:320 titer of Coxsackie type B-3. Additional history revealed that four weeks prior to collapse he had upper respiratory symptoms. Cardiac testing: EKG was normal. Echocardiogram showed borderline reduced LVEF 51% and mild hypokinesia of the left ventricle. A Holter monitor showed rare premature atrial and ventricular contractions and patient was asymptomatic while wearing. Stress echocardiogram showed supraventricular tachycardia at nine minutes of exercise, concerning for atrial flutter. The arrhythmia lasted for 10-15 minutes and then resolved spontaneously. Patient wore a Zio patch (heart rhythm monitor) for one week and it showed paroxysmal atrial flutter.

FINAL WORKING DIAGNOSIS: Paroxysmal atrial flutter **TREATMENT AND OUTCOMES:** It is thought that patient had viral myocarditis syndrome from Coxsackie virus causing patients symptomatic atrial flutter. He was started on Flecainide 50mg twice-daily oral tablet. Patient is allowed to continue with full contact football without restrictions while on medication. Cardiology will consider Zio patch monitor and possibility of ablation post-season but will need to briefly be on anticoagulation.

3126 May 29 3:35 PM - 3:55 PM

Abdominal Bloating - Cross Country

Christine Linh Vuong. *Kaiser Permanente, Fontana, CA.*

(Sponsor: Robert Sallis, FACS, FACS)

(No relevant relationships reported)

HISTORY: A 17-year-old college cross country runner presents with 4 years of abdominal distension and bloating, most symptomatic after a run. Symptoms have been worsening, but do not interfere with her ability to run. She denies abdominal pain, but states that it is uncomfortable after running. She denies constipation or diarrhea, but notes that she usually has a bowel movement after running. There is no improvement of her symptoms after a bowel movement. She has had rare occasions of mucus and blood in her stools. She denies nausea or vomiting. She admits to frequent urination, but does drink a lot of water and denies dysuria or hematuria. She denies change in symptoms with her menses, which are regular.

KUBs in 2016 and 2017 showed stool in the colon and nonspecific bowel gas pattern. LFTs, H.pylori, ESR, CRP were normal in 2017. She was diagnosed with constipation and irritable bowel syndrome. She tried a daily probiotic, the low FODMAP diet, and gave up dairy for months without improvement of her symptoms.

PHYSICAL EXAM: The abdomen appears distended. Decreased bowel sounds in all quadrants. Dull to percussion. The abdomen is firm, but no guarding or rebound. Prior to a run, abdominal girth measured at 90cm at the umbilicus. After a run, no change.

DIFFERENTIAL DIAGNOSES: Exercise induced bowel ischemia, Inflammatory Bowel Disease, ascites, organomegaly, abdominal mass, pregnancy, diastasis recti.

TEST AND RESULTS:

Stool calprotectin negative. WBC 11.6, hemoglobin 13.4, platelets 303. LFTs within normal limits. Serum HCG negative. Creatinine 0.81

CT abdomen and pelvis with contrast: Large cystic lesion in the abdomen and pelvis measuring 28 x 19 x 38 cm. The origin of this lesion is unclear. Secondary moderate to severe right and mild to moderate left hydronephrosis.

FINAL WORKING DIAGNOSIS:

Large cystic abdominal mass, originating from the pelvis

TREATMENT AND OUTCOMES:

1. Emergent laparotomy showing large left ovarian cyst. 10L of fluid drained. Left salpingo-oophorectomy performed.
2. Pathology consistent with serous cystadenoma. Fallopian tube without significant abnormality. No malignant cells in the pelvic washing.
3. After surgery, abdominal girth measured 75cm at the umbilicus.
4. Gradual return to running 2 weeks post-op.

3127 May 29 3:55 PM - 4:15 PM

Diarrhea (Infectious Disease)-Swimming And Diving

Jordan P. Hilgefert, Christina Murphy, Amy Miller, Keri Denay, FACSM. *University of Michigan, Ann Arbor, MI.* (Sponsor: Keri Denay, FACSM)

Email: jordanhilgefert@gmail.com

(No relevant relationships reported)

History: 19-year-old men's collegiate swimming athlete with PMH of anxiety & major depressive disorder presented with 3-days of nausea, vomiting & diarrhea. He reported several teammates with similar symptoms. He returned for reassessment 1 week following initial evaluation endorsing 2 days of symptom improvement followed by return of several episodes of emesis, diarrhea & fatigue.

Physical Examination:

General: Well-developed, Well-nourished, NAD

HEENT:

-Head: NC, AT

-Eyes: conjunctiva clear, EOMI, PERRL, no discharge

-Ears: hearing normal on gross assessment, TMs normal

-Nose: nares clear, no deformity

-Throat: MMM, no erythema or exudate

NECK: normal ROM, no lymphadenopathy

PULM/CHEST: CTAB, no wheezes, rales or rhonchi

CV: RRR, no MRG. CR < 2 sec

ABD: BS+, soft, non-tender, non-distended, no organomegaly

SKIN: no visualized rashes or skin lesions, skin is warm and dry

PSYCH: appropriate mood and affect

Differential Diagnosis:

- 1) Viral gastroenteritis
- 2) Bacterial gastroenteritis
- 3) Parasitic infection
- 4) Irritable bowel syndrome
- 5) Anxiety

Tests and Results: Initial CBC, BMP and TSH were remarkable only for mild thrombocytosis (447 K/mm³) and hypoglycemia (63 mg/dL). After incomplete resolution of symptoms, GI PCR panel was obtained and found to be positive for cryptosporidium.

Final Diagnosis: Cryptosporidiosis

Treatment and Outcomes:

- 1) He was treated with Nitazoxanide 500 mg PO BID x 3 days and held out of the pool for 2 weeks.
- 2) Athletes with exposure to university pools presenting with diarrhea were tested for cryptosporidium via PCR. 6 were positive and all were held out of the pool for 2 weeks.
- 3) The public health department and environmental health experts were consulted to assist with management.
- 4) Administrators from every university and local swimming clubs who shared a common pool with our athletes were notified of potential exposure to cryptosporidium. One head-to-head swimming meet was cancelled in an effort to limit potential exposure.
- 5) University pools were shut down and treated twice with a high-concentration chlorine.

6) Water samples were collected serially before and after treatment cycles to ensure eradication prior to re-opening the pools.

3128 May 29 4:15 PM - 4:35 PM

Emesis- Football

Lauren E. Cianci, Tesa E. Johns, Peter H. Seidenberg, FACSM. *Penn State University, University Park, PA.* (Sponsor: Peter H. Seidenberg, FACSM)

Email: laurencianci@gmail.com

(No relevant relationships reported)

HISTORY: An 18-year-old NCAA D-I football athlete developed emesis during exercise. During his freshman season, he had recurrent URIs and emesis during practice. The vomiting appeared to be post-tussive during intense exercise. The athlete has not experienced this before but has a history of asthma and allergies. Symptoms improved temporarily with a non-sedating antihistamines and a H2 blocker. But, after one week, the vomiting returned. A PPI, fluticasone nasal spray and albuterol were then added, which appeared to help. Symptoms returned in the spring and montelukast was added to his regimen. He continued to complain of mucus accumulating in his throat that would cause him to gag which would occur with intense exercise and then even while trying to sleep. An EGD was performed which was normal. The athlete was then referred for allergy testing and immunotherapy.

PHYSICAL EXAMINATION: Afebrile. Pulse ox 98% on room air. NAD, A&O. Nasal mucosa is pale, boggy and swollen with clear d/c; TM clear bilaterally; OP with posterior cobble stoning; no tonsillar exudate or erythema. No cervical LAN. CV: RRR. Lungs CTAB. Abdomen ND, BS (+), mild epigastric TTP, and no rebound or mass.

DIFFERENTIAL DIAGNOSIS:

1. Sinusitis
2. Allergic rhinitis
3. GERD
4. Gastritis
5. asthma

TESTS AND RESULTS:

Chest radiograph: normal

Spirometry Testing:

- normal FVC
- FEF max was decreased
- Increased RV/TLC
- diffusion 68% of predicted

EGD: normal

Allergy testing: (+) ragweed pollen, several weed pollens, tree pollens, several grasses, dust mites, cockroach, animal dander

FINAL/WORKING DIAGNOSIS:

Allergic rhinitis accompanied by emesis due to hypersensitive gag reflex stimulated by postnasal drip

TREATMENT AND OUTCOMES:

1. Continue antihistamines and fluticasone nasal spray
2. Weekly immunotherapy injections
2. Dust mite bed covers to reduce exposure
3. Medication compliance

With the above measures, the athlete's symptoms were controlled and he continues to play football without difficulty.

3129 May 29 4:35 PM - 4:55 PM

General Medicine / Gastroenterology-Cycling

Laura Beth Anderson, Amie Kim. *Icahn School of Medicine at Mount Sinai Medical Center, New York, NY.*

Email: amie.kim@gmail.com

(No relevant relationships reported)

HISTORY: 31 year old male presents with left (L) groin pain. While cycling, he twisted rightward with sharp pull and "fullness" to L lateral abdomen and groin. This developed into new GI symptoms including constipation and acid reflux. In 4 months, his BMI decreased from 23 to 17 due to inability to tolerate food bolus. Additional urologic symptoms developed including perineal numbness and pain, incomplete void, and soreness with sexual activity.

PHYSICAL EXAMINATION: Positive affect, marked cachexia. Long torso relative to lower extremity length. Abdomen soft, no hernia. Marked tenderness to palpation at L perineum, inguinum, radiating to L lateral abdomen and obliques. Resisted sit-up with pain reproduced, 5/5 strength. L hip extension, 50 degrees L, 70 degrees right. No inguinal lymph nodes. Normal scrotal exam. L4-S1 motor 5/5, sensory intact to light touch. Gluteal squeeze intact **DIFFERENTIAL DIAGNOSIS:** athletic pubalgia, labral tear, iliopsoas tendonitis, osteitis pubis, small bowel dysmotility

TEST AND RESULTS: Hip ultrasound-rectus femoris transversalis fascia with invagination, herniating 0.2 cm at area of tenderness. Joint fluid at L anterior femoral recess. Iliopsoas bursa at L pelvic crest asymmetrically increased. Pubic symphysis

osteitis. No snapping iliopsoas tendon. **MRI pelvis with IV contrast**-trace pelvic ascites. No small bowel obstruction or mass. No abdominal hernia with Valsalva. No musculotendinous injury at pubic symphysis. **Scrotal ultrasound**-L epididymal cyst. **Endoscopy/colonoscopy**-no findings, with biopsies. **Mayo Clinic-nuclear medicine gastric emptying test**-significantly delayed 6 hour small and large bowel transit 9% (mean 58%). **Anorectal manometry**-markedly increased anal resting pressures with normal function. **Nuclear medicine gastric accommodation**-no findings. **FINAL WORKING DIAGNOSIS:** Athletic pubalgia with secondary small bowel dysmotility **TREATMENT AND OUTCOMES:** Marked improvements in musculoskeletal, neurologic, and gastrointestinal symptoms with dedicated pelvic floor PT. Has transitioned to plyometrics and high resistance activities. Acupuncture with athletic pubalgia protocol. Continues supportive boxer briefs, probiotic supplements, daily laxative. Stool transplant evaluation pending. Sports hernia surgical evaluation pending

F-39 Clinical Case Slide - Medical Issues II

Friday, May 29, 2020, 3:15 PM - 4:55 PM
Room: CC-2022

3130 Chair: Robert E. Sallis, FACSM. *Kaiser Permanente Medical Center, Fontana, CA.*
(No relevant relationships reported)

3131 Discussant: Jill Sadoski. *Michigan State University, East Lansing, MI.*
(No relevant relationships reported)

3132 Discussant: Brian A. Davis, FACSM. *University of California-Davis, Sacramento, CA.*
(No relevant relationships reported)

3133 May 29 3:15 PM - 3:35 PM
Chest And Neck Pain In A Tennis Player
 Kathryn Elizabeth McLellan, Jeffrey Kovan, Nathan Fitton, Jill Moschelli. *Michigan State University, East Lansing, MI.*
 (Sponsor: James Dunlap, FACSM)
(No relevant relationships reported)

History: An 18-year old male D-1 tennis player presented to the office with new onset pain in his chest and neck. It started the night prior to presentation in the center of his chest. He fell asleep without pain, but the next day noted pain in his upper chest and neck. He described it as a stiffness and as a weight pressing down on his chest. The pain was constant and worse with swallowing, speaking, neck extension, and head rotation. He also reported feeling more out of breath than usual. Two days prior to symptom presentation, he performed baseline strength testing. He denied fever, pain with neck flexion, radiation to either arm, syncope, wheezing, sore throat, N/V/D or headache. He had no personal or family history of asthma, pneumothorax, or cardiac disease. He denied current or prior smoking, drug use, and vaping.

Physical Exam: Vitals: Ht 182 cm, Wt 77.1 kg, BP 119/74, HR 74 bpm, Temp 36.6 C (oral), BMI 23.2

Gen: NAD, nontoxic

ENT: no pharyngeal erythema or tonsillar swelling

Neck: no lymphadenopathy. Supple, full ROM but pain in full extension. No TTP of spine or soft tissues.

CV: RRR, no M/R/G

Resp: CTA bilaterally, good air entry, no wheeze, no accessory muscle use

Chest: No TTP of ribs, sternum, costo-sternal joint, or intercostal spaces. No palpable subcutaneous crepitus to the chest or neck.

Skin: no erythema of the skin of neck or chest

Differential diagnosis:

Acute coronary syndrome

Pneumomediastinum

Strain

Infection

Asthma

Testing:

X-ray of Chest/Neck: Lucency seen along paravertebral regions of upper thorax raising concern for pneumomediastinum. No pneumothorax.

Final Diagnosis: Spontaneous pneumomediastinum

Treatment/Outcome:

Patient was held from activity until follow-up weekly X-rays demonstrated resolution of free air in the neck.

Symptoms and X-ray findings resolved within two weeks.

He was cleared at 2 weeks with a gradual progression of activity and avoidance of full exertion or weight lifting.

One week later, he was cleared to return to full activity with no restrictions. He was advised to avoid breath-holding with activity. He has had no recurrence of symptoms.

3134 May 29 3:35 PM - 3:55 PM
Severe Bleeding In A Collegiate Water Polo Athlete

Casey N. Maxwell. *Princeton University, Princeton, NJ.*

(Sponsor: Margot Putukian, FACS)

Email: cmaxwell@princeton.edu

(No relevant relationships reported)

HISTORY: 18 y/o male presents during review of incoming student-athlete health history documents with history of "severe hemophilia A", self-treated with Factor VIII infusions every other day & "extra doses" as needed. Letter from pediatric hematologist clearing him to participate: "there is no medical reason he cannot participate in competitive water polo." PMH: Two hospitalizations due to blood infection (2003 & 2005), ADHD diagnosis (2009), Type 2 SLAP lesion right shoulder (2016), Wisdom Teeth Extraction (3/2017).

PHYSICAL EXAMINATION: Visible keloid scarring present at two sites on the right and left side of patient's chest consistent with port removals. BP: 129/92mmHG. Pulse: 64bpm. Height 77in. Weight 225.2lbs. PE otherwise benign.

DIFFERENTIAL DIAGNOSIS:

Hemophilia A

Von Willebrand Disease

TEST AND RESULTS:

VWF profile: Normal

Random Factor VIII level: 12% (~30hours after infusion)

Post-infusion Factor VIII level: 147% down to 77% at 6 hours.

Hepatitis A/B/C Immune Status, HIV Antibody: negative

Normal PT. Prolonged PTT which corrects with normal plasma mixing.

Unremarkable CBC, CMP

FINAL WORKING DIAGNOSIS: Severe Hemophilia A.

TREATMENT AND OUTCOMES: Prophylactic Treatment of Advate 5000units daily, during water polo season, just prior to participation in practice or game. If practice/games extend post-infusion 8 hours or beyond, patient to self-infuse additional 5000units. Self-infusion every other day when not participating in water polo. In case of an emergency/life-threatening bleeding, patient to infuse first and then, if stable, seek care at RWJ-Rutgers ER (or other regional Hemophilia Treatment Center while traveling). If clinically warranted, patient to seek care at closest ER and bring factor with him. Annual re-evaluations to be performed at Hemophilia Treatment Center Rutgers-RWJ. Patient has been fortunate to participate in competitive collegiate water polo for 2+ seasons with no adverse sequelae.

3135 May 29 3:55 PM - 4:15 PM

Calf Pain-Brazilian Jujitsu Fighter

Alyssa Neph, Kevin Burnham. *University of California, Davis,*

Sacramento, CA. (Sponsor: Brian Davis, MD, FACSM)

Email: aneph@ucdavis.edu

(No relevant relationships reported)

HISTORY: 29 yo male Brazilian jujitsu fighter with a history of Henoch-Schonlein purpura and eczema presents to clinic for 6 months of right anterolateral calf pain without a clear injury. He reports constant, dull, aching pain, worse with dorsiflexion and resisted plantar flexion. He notes associated pitting edema, dry leathery skin, hypopigmentation, and hyperesthesia that began 3-4 months ago. He has stopped jujitsu due to symptoms. Tib-fib xrays and venous duplex were negative. He tried acetaminophen, ibuprofen, physical therapy, topical clobetasol, and oral prednisone with short-term improvement. **PHYSICAL EXAMINATION:** Skin of the anterolateral calf is indurated with hair loss, a leathery appearance, and areas of depigmentation. The distal lateral calf is warm and erythematous, with swelling posterior to the lateral malleolus. Tinel's sign is negative at the fibular head. Pulses are normal bilaterally with ankle plantar and dorsiflexion. Ankle ROM is full. Light touch sensation is intact in L2-S2 dermatomes and strength is 5/5 in lower extremities.

DIFFERENTIAL DIAGNOSIS: Complex regional pain syndrome, Cellulitis, Scleroderma, Eosinophilic fasciitis, Chronic exertional compartment syndrome, Vascular insufficiency **TEST AND RESULTS:** Lab work: inflammatory markers and rheumatologic labs negative except for elevated CK (356) of unknown significance. EMG/NCS: low amplitude right vs left sural sensory nerve suggesting sural neuropathy although within normal limits; no fibular neuropathy or radiculopathy. MRI right leg: nonspecific skin thickening of anterolateral shin with fascial edema and mild fibularis longus myositis. Skin biopsy: linear morphea versus eosinophilic fasciitis **FINAL WORKING DIAGNOSIS:** Segmental Linear Morphea (localized scleroderma)

TREATMENT AND OUTCOMES: Dermatology referral led to biopsy; subsequently, treatment with PO methotrexate (MTX), high dose IV methylprednisolone for three cycles, and topical clobetasol ointment BID. UVA1 phototherapy was also started due to extensive disease and ankle and knee joint involvement. Subjective improvement in ROM, skin stiffness, and strength per patient after 2 cycles of methylprednisolone. Switched to SQ MTX for better absorption and lower cost. Patient continues to improve as he remains on the above treatment protocol.

3136 May 29 4:15 PM - 4:35 PM

An Unexpected Curveball Causing Fatigue In A Softball Player

Om Sam¹, Stanley Hunter², Nina Millet¹. ¹UHS, Johnson City, NY. ²UHS, Binghamton, NY.
Email: omsam3288@gmail.com

(No relevant relationships reported)

HISTORY: 19 year old caucasian female softball player with no past medical history presented to the office for fatigue and reduced exercise tolerance for a month. She also complained of muscle cramps in her calves, decreased appetite, intermittent headaches, nausea and one episode of non-bloody, non-bilious emesis. Her athletic performance had decreased despite no changes in her training regimen. She measured her glucose via a glucometer with readings in the 70s. She maintained proper fluids, electrolyte and nutrient intake. She denies any changes in her weight, menstrual cycle, depression and recent illness.

10 point ROS was negative. Social history is unremarkable except for occasional alcohol intake. Regular menstrual cycle.

PHYSICAL EXAMINATION: Vital signs within normal limits. No signs of acute distress. Normal mentation and affect. No jaundice or pallor. Regular rhythm and rate. No murmurs appreciated. Lungs clear to auscultation. Abdomen is soft, non-tender, with normal bowel sounds, no masses appreciated. 5/5 strength and sensation to light touch intact in all extremities. Biceps and knee jerk reflex 2+.

DIFFERENTIAL DIAGNOSIS: Iron-deficiency anemia. Thalassemia.

Hypothyroidism.

TEST AND RESULTS: CBC: RBC 5.58, H&H 11.6/37.8, MCV 67.7, MCHC 30.7, MCH 20.8 - Microcytic anemia. Peripheral blood smear reveals anisocytes. CMP: Na 133-hyponatremia. Iron panel: Ferritin 20,1, Transferrin saturation 36, Total FE binding 376, Serum iron 137 - Normal iron panel TSH 1.120 - normal. Vit D 47 - normal. Haptoglobin 23 (low), LDH 606 (N), Total bilirubin 0.9 (N) - No signs of hemolysis. Hgb electrophoresis: Hgb A 95 (low), Hgb A2 4.7 (high), Hgb F, 0.3 (N), Hgb variant 0- Beta thalassemia trait. EKG: normal

FINAL WORKING DIAGNOSIS: Beta-thalassemia trait

TREATMENT AND OUTCOMES: Initial treatment with iron supplementation for 3 weeks showed no improvement. Although it may take 6-8 weeks for Hgb levels to return to normal. Repeat Hgb after 3 weeks should have revealed a mild improvement. Iron panel was ordered to confirm diagnosis, which was normal. Further family history revealed thalassemia, which was then confirmed with Hgb electrophoresis. Folic acid 2 mg daily started, iron supplementation discontinued. Cessation of activity for 4 weeks to promote recovery, then gradual return to full activity. Follow-up in 2 months.

3137 May 29 4:35 PM - 4:55 PM

Almost Vaping Your Way To Medical Disqualification

Eric Emmanuel Coris, William Anderson, Yuri Chulskiy, Sanders Chae, Byron Moran. *The University of South Florida, Tampa, FL.*

Email: ecoris@usf.edu

(No relevant relationships reported)

HISTORY:

18 year old male freshman Division I football athlete with a history of abnormal pre-participation EKG. Initial EKG was significant for left axis deviation, incomplete right bundle branch block, prominent p wave, t wave inversion in V1 and V2. He had no symptoms, and denied significant past medical history. Echocardiogram revealed significantly enlarged right atrium, pulmonary hypertension.

PHYSICAL EXAMINATION:

Normal, except CV: RRR without M/G/R; nl S1, prominent S2 in pulmonic area, Intermittent fixed split S2, normal PMI.

DIFFERENTIAL DIAGNOSIS:

Pulmonary hypertension/Anomalous pulmonary return/Arrhythmogenic right ventricular dysplasia/Interstitial lung disease/Sarcoid/Intracardiac shunt/Atrial septal defect/Ventricular septal defect/Obstructive sleep apnea/Obstructive lung disease/HIV/Granulomatous lung disease/Hypersensitivity Pneumonitis

TEST AND RESULTS:

CT angiogram of the chest revealed mild enlargement of the right atrium. Ill-defined opacities bilaterally with tiny focal lucencies which may represent focal developing cavitation. Mixed solid and ground-glass opacities with focal internal lucencies mainly located peripherally. Small lucent central regions are suggested within these regions.

Further significant history of two months prior to initial EKG, and the day after initial EKG two vaping episodes. No tobacco, no THC reportedly contained but some type of flavoring was present. Believes he split one e cigarette with another person. Prior to that episode he vaped every other weekend, for a few weekends, two months prior to the initial EKG. No symptoms ever noted after vaping that he was aware of. Did have rhinorrhea and sneezing for several months this summer, he felt related to seasonal allergic rhinitis.

FINAL WORKING DIAGNOSIS:

Vaping induced hypersensitivity pneumonitis

TREATMENT AND OUTCOMES:

Athlete refrained from further vaping. Held from competitive activity until completion of workup, athlete was gradually progressed through increasing cardiopulmonary exercise to return to play. Returned to full play over a 2 week progressive period with no symptoms. Follow up CT of the chest and pulmonary function tests returned to normal.

F-40 Clinical Case Slide - Spine

Friday, May 29, 2020, 3:15 PM - 5:15 PM

Room: CC-3020

3138 **Chair:** Stanley Alan Herring, FACSM. *University of Washington, Seattle, WA.*

(No relevant relationships reported)

3139 **Discussant:** Samuel K. Chu. *Shirley Ryan AbilityLab, Chicago, IL.*

(No relevant relationships reported)

3140 **Discussant:** Poonam P. Thaker, FACSM. *Presence Resurrection Sports Medicine Fellowship, Chicago, IL.*

(No relevant relationships reported)

3141 May 29 3:15 PM - 3:35 PM
"Tingling In The Scrum": Paresthesias And Neck Pain - Rugby

Jonathan Smits¹, Pierre Rouzier, FACSM², John Herbert Stevenson¹. ¹University of Massachusetts Medical School, Worcester, MA. ²University of Massachusetts, Amherst, MA.

(No relevant relationships reported)

HISTORY: A 19 year old female college student "new to club rugby" presented to the campus health clinic for evaluation of neck stiffness and extremity tingling following last week's practice. She was unable to recall a specific injury. However, she reported later feeling neck stiffness with associated soreness. She also reported paresthesias involving both hands, left worse than right, and her left foot. Her symptoms were improving but she had not resumed practice.

She reported being a multi-sport high school athlete with participation in varsity field hockey and lacrosse without prior concussion, head or neck pain, or extremity abnormalities. She had also been in an auto accident years prior without subsequent injury. History was notable for resolved low back pain, and a family history of back pain.

PHYSICAL EXAMINATION: Spine exam demonstrated FROM with no C/T/L spinous process tenderness. Spurling maneuver was negative. Tightness was appreciated in left trapezius muscle compared to right. Shoulders demonstrated FROM with normal rotator cuff strength. Upper and lower extremities with equal sensation, reflexes, and pulses. Grip strength normal. Straight leg raise and slump tests were negative.

DIFFERENTIAL DIAGNOSIS:

1. Cervical strain
2. Herniated cervical disc
3. Cervical spondylolysis
4. Vertebral fracture
5. Spinal stenosis
6. Spinal infection
7. Autoimmune disease

TESTS AND RESULTS:

1. Cervical spine x-rays: straightening without bony pathology
2. MRI brain & cervical spine:
 - Mild disc narrowing at C5-6
 - Chiari I malformation with pointed tonsils herniated 1.1 cm from foramen magnum
 - Syrinx spanning C5-T4 with max diameter 3 mm in upper thoracic cord

FINAL WORKING DIAGNOSIS:

Chiari I malformation with C5-T4 syringomyelia

TREATMENT AND OUTCOMES: The athlete was initially restricted from rugby activities until follow-up evaluation. She noted interval improvement and wished to pursue strength training at season end. Her symptoms then recurred with overhead lifting, and later with chiropractic treatments. Upon return to campus, brain and cervical MRI were ordered as recommended by a neurologist. Due to the above MRI findings, she stopped recreational activity and was referred for urgent neurosurgical evaluation. She will undergo decompression surgery.

3142 May 29 3:35 PM - 3:55 PM

Neck Injury - Football

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(No relevant relationships reported)

HISTORY: 21-year-old senior high school football offensive line men sustained a neck injury while tackling. During the third quarter of a midseason game, he tackled an opponent player, and they both landed on the ground. The patient was facing down with opposing player just underneath his anterior torso. Shortly after the play, given he was near the ball, a pile up of players landed on his upper back. He sustained a hyperextension injury of his cervical neck since his head was laying on the player he tackled. Patient described an immediate “pop” sensation in his neck and had “complete weakness & numbness” of his R upper & lower extremities.

PHYSICAL EXAMINATION: After safely placing patient in supine position on spine board, examination demonstrated he as alert and orientated x 4, had spinous process tenderness from C4-C7. Sensory testing along both extremities revealed significantly decreased and almost absent sensation in R upper & lower extremity. He was unable to raise / move his R arm or leg. His distal pulses and breathing were within normal ranges.

DIFFERENTIAL DIAGNOSIS: Cervical Cord Compression, Cervical Fracture, Cervical Disc Herniation, Cervical Facet Radiculopathy,

TESTS AND RESULTS:

Cervical X-RAYS: No osseous abnormality.

Cervical CT Scan: L neural foramina stenosis at C3/C4, R neural foramina stenosis at C6/7. Mild to moderate spinal canal stenosis at C6/7 and C7/T1.

Thoracic CT Scan: Normal CT chest, abdomen, pelvic, and thoracic spine.

MRI Cervical Spine: C6-7 where a right paracentral / foramina disc protrusion. Mild central canal stenosis at T1-2 level due to diffuse disc bulge.

FINAL WORKING DIAGNOSIS: C6-7 cervical disc herniation with mild to moderate cervical cord stenosis at C6/7 and T1-2.

TREATMENT AND OUTCOMES: R-sided weakness resolved after 4 weeks of supportive care, watchful waiting and physical therapy.

3143 May 29 3:55 PM - 4:15 PM

Trampoline Training Trauma: A Diver's Injury

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(No relevant relationships reported)

Trampoline Training Trauma: A Diver's Injury

History:

A 15 year old male presented to the emergency department with back pain after sustaining an injury while practicing a diving routine on the trampoline. He was in forward rotation when he landed awkwardly on his chin and upper chest, sending his back into hyperextension with his legs landing above his head. He felt immediate low back pain and complete loss of sensory and motor function of his legs for about 30 seconds. All sensory and motor function subsequently returned and he was able to ambulate from the trampoline into the home. He denied ongoing sensory or motor deficits in his legs, loss of consciousness, neck pain, urinary or bowel incontinence, or upper extremity weakness.

Physical examination:

Examination revealed a well appearing male who was able to ambulate slowly but independently with normal gait. He had midline tenderness in the upper lumbar vertebrae. There was normal alignment of the spine without step offs. His strength was 5/5 and reflexes were 2+ in lower extremities. He did not have deficits to touch sensation and did not have saddle anesthesia.

Differential diagnoses:

1. Spinal cord contusion
2. Lumbar vertebral fracture
3. Lumbar sprain
4. Acute spondylolysis or spondylolisthesis
5. Lumbosacral neurapraxia

Tests and results:

Xray of cervical spine, chest, and pelvis: unremarkable

CT cervical spine: unremarkable

MRI cervical-thoracic-lumbar:

- traumatic injury of the lumbar spine with disruption of the interspinous ligament at the L1-L2 level
- small ventral extradural hematoma contained by the posterior longitudinal ligament at L2-L4

MRI lumbar spine, hospital day #2:

- decrease in size and cradiocaudal extent of the ventral extradural collection
- edema within psoas and paraspinal muscles at L2-L4

Final diagnosis:

Extradural hematoma of lumbar spine at L2-L4

Tear of interspinous ligament at L1-L2

Treatment and outcomes:

1. Admission to PICU for close neurologic monitoring with neurosurgery and trauma on consult. He did not report further numbness or tingling in lower extremities
2. Physical therapy
3. Stepped down to general pediatric floor on hospital day #2
4. Discharged on hospital day #3 with lumbar sacral orthosis brace
5. Experienced ongoing headaches for several weeks
6. Back to activity as tolerated, continue to monitor recovery

3144 May 29 4:15 PM - 4:35 PM

Neck Injury-Motor Vehicle Accident

Briana N. Fedorko¹, Brent F. Fedorko². ¹Pivot Physical Therapy, Cambridge, MD. ²Salisbury University, Salisbury, MD.

(No relevant relationships reported)

HISTORY: A 57-year-old male was involved in a motorcycle accident, landing on his right side. Injuries included a flaccid right arm and hand, laceration of his right thigh, and a fracture of the 3rd metatarsal of his right foot. Patient's chief complaint was pain in right shoulder and neck and an inability to complete ADLs.

PHYSICAL EXAMINATION: Patient demonstrated flaccid right upper extremity with very little finger movement. Patient was able to achieve some finger flexion of all 5 digits and thumb opposition to index finger, although could not achieve pad to pad contact. All PROM of joints was preserved. Sensation was grossly intact. Patient tolerated initial examination well with mild discomfort during objective measures. No red flags arose during medical screening/systems review.

DIFFERENTIAL DIAGNOSIS: 1. Cerebrovascular accident 2. Brachial plexus stretch injury 3. Brachial plexus avulsion injury

TESTS AND RESULTS: MRI of cervical spine without contrast – small disc herniation, MRI of brachial plexus with and without contrast - edema involving right scalene and adjacent fascial planes extending into brachial plexus as well as into right C6/C7 and C7/T1 neural foramen to confirm nerve root sleeve tears, CTA of neck – negative for artery involvement, EMG study showed that the brachial plexus was not avulsed, but not currently sending EMG signals to hand.

FINAL WORKING DIAGNOSIS: Brachial plexus stretch injury

TREATMENT AND OUTCOMES: 1. Therapeutic exercises (ROM, strength, endurance, stability), 2. Therapeutic activity (work specific, ADL specific), 3. Neuromuscular rehabilitation (muscle re-education, sequencing, coordination, neurodynamics), 4. Patient education (home exercise program, home safety).

Patient has been responding well to a treatment plan combining aspects of the above mentioned interventions. Has been showing greater activation of right hand and forearm muscles with ability to complete weak grip at this stage. Right upper extremity remains supported in sling.

3145 May 29 4:35 PM - 4:55 PM

Abstract Withdrawn

3146 May 29 4:55 PM - 5:15 PM

Bilateral Forearm And Elbow Pain - Tennis

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(No relevant relationships reported)

HISTORY: A 75 year-old female tennis player was referred for bilateral elbow pain with suspected lateral epicondylitis. She noted 3 months of pain in her left more than right ventral forearms with radiation into her lateral elbows as well as posterior

bilateral shoulder pains. The forearm pain was constant and worsened by single backhand with tennis, lifting weights. She reported reduced grip strength and her racquet falling out of her hands.

PHYSICAL EXAMINATION:

Cervical range of motion was within functional limits. Elbow examination showed full active and passive range of motion, minimal tenderness along lateral epicondyle and just distal at tendinous origin, and no pain with resisted wrist extension and middle finger extension. She had finger extension weakness without pain bilaterally 3/5 and otherwise motor testing was 5/5 C5-T1 myotomes. Sensation was intact in C5-T1 dermatomes bilaterally. Reflexes were 2+ and symmetric of biceps and brachioradialis and 3+ at the triceps bilaterally.

DIFFERENTIAL DIAGNOSIS:

1. Bilateral lateral epicondylitis
2. Cervical spine stenosis with myelopathy
3. Posterior interosseous neuropathy

TEST AND RESULTS:

Cervical Spine anterior-posterior and lateral radiographs:

- Grade 2 anterolisthesis of C7 on T1 is seen with bilateral pars fracture of C7.

Moderate multilevel degenerative disc disease.

MRI of the Cervical Spine without Contrast:

- Advanced facet arthropathy at C7-T1. Anterolisthesis of C7 on T1 causing moderate/severe spinal stenosis with mild cord deformity. Severe bilateral foraminal stenosis at this level.

FINAL/WORKING DIAGNOSIS:

Cervical central spine stenosis with myelopathy

TREATMENT AND OUTCOMES:

1. Neurosurgery referral recommended urgent C7-T1 anterior cervical discectomy and fusion followed by C5-T2 posterior spinal fusion
2. She was placed in hard cervical collar at all times and surgery was performed 1 week after neurosurgery evaluation
3. At 1 week postoperative, patient felt 80% improvement in pain in forearms and elbows along with subjectively improved grip strength
4. She continued the hard cervical collar until repeat radiographs at 6 weeks post surgery.
5. Patient was instructed to avoid playing tennis. She was also informed to avoid bending, twisting of her neck or lifting greater than 5 pounds until further evaluation in 6 week visit.

F-53 Free Communication/Poster - Body Composition

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

3180 Board #1 May 29 1:30 PM - 3:00 PM Comparison Of DXA And Ultrasound For Measurement Of Body Composition In Physically Active College Students

Jeremy T. Barnes¹, Jason D. Wagganer¹, Jeremy P. Loenneke, FACSM², Monica L. Kearney¹, William M. Miller³, Majid M. Syed-Abdul⁴. ¹*Southeast Missouri State University, Cape Girardeau, MO.* ²*The University of Mississippi, University, MS.* ³*The University of Mississippi, Cape Girardeau, MS.* ⁴*The University of Missouri, Columbia, MO.*

(No relevant relationships reported)

Body composition is a frequently assessed component of health-related fitness. Recently, a portable computer based A-mode ultrasound system has become commercially available for estimating percent body fat (%fat). If a single-site estimate of %fat is valid against the dual-energy X-ray absorptiometry, this would have immediate implications for assessing body composition in field based settings. However, little is known how these estimates compare with each other. **PURPOSE:** The aim of this study was to determine the accuracy of the A-mode ultrasound device as a way to estimate %fat. **METHODS:** Participants %fat was estimated using an A-mode ultrasound device biceps measurement and DXA, which served as the criterion estimate. Participants (75 males, 87 females) were physically active college students [age 21 (SD 3) yrs, height 1.73 (SD 0.10) m, body mass 76.09 (SD 15.74) kg and BMI 25.4 (SD 4.1) kg/m²]. Methods were compared using a Bland-Altman plot with DXA serving as the criterion method. The coefficient of determination and standard error of the estimate were assessed using linear regression. Total error was calculated to determine the average deviation of individual scores from the line of identity. **RESULTS:** DXA estimate %fat was 25.9 (SD 11.5%) and the A-mode ultrasound estimate was 22.6 (SD 10.9%). The A-mode ultrasound device underestimated %fat by -3.3 (SD 8.0) % (p<0.00001). With a standard deviation of 8, the calculated 95% limits of agreement (SD x 1.96 ± mean difference) were -12.3 to 19.04% fat. The coefficient of determination was 0.55 with a standard error

of the estimate of 7.6 %fat. The average deviation of individual scores from the line of identity was 8.6% (total error). **CONCLUSIONS:** The development of time efficient methods for estimating %fat are important for better screening large samples; particularly in field settings. Although a single site estimate of %fat is efficient, it did not provide valid estimates when compared to DXA in this population. The limits of agreement were wide, indicating poor agreement between the two assessments of %fat. Future studies may want to consider investigating multiple measures using sites A-mode ultrasound as this may better estimate overall %fat.

3181 Board #2 May 29 1:30 PM - 3:00 PM The Accuracy And Reliability Of Body Composition Measurement Techniques: Using The Right Instruments In Research And Practice

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(No relevant relationships reported)

PURPOSE:

Isolated body composition measurement techniques are regularly used as time- and cost-effective alternatives to the gold standard four compartment (4C) model in clinical, sports and research settings. However, isolated measurements of body composition are subject to error. This large, population-representative validation study is the first to assess the accuracy and between-day reliability of common body composition measurement techniques, in reference to the 4C model.

METHODS:

Participants (n=45, age = 52±21, body mass index=26.8±3.7 kg/m²) completed two consecutive days of body composition testing under controlled conditions (fasted, nil exercise). Body composition assessment methods bio-electrical impedance spectroscopy (BIS), dual-energy x-ray absorptiometry (DXA) and air-displacement plethysmography (BODPOD) were compared to the 4C model (combined measurement of total body water, bone mineral mass, body density and body mass). A priori cut points for accurate and reliable isolated measurement techniques were an intra-class correlation co-efficient (ICC) ≥0.95 and co-efficient of variation (CV) of ≤3%.

RESULTS:

Compared to the 4C model, DXA was the only accurate isolated measurement technique (ICC=0.968); as all other measurements were below the limits of agreement (ICC=0.763-0.886). For measurement of reliability, DXA had the lowest between-day error (CV=2.8%) compared to the 4C model, however the confidence intervals (CI) exceeded the acceptable limits of measurement error (1.7%-3.9%). When BIS and DXA were combined, measurement error was within acceptable limits [CV=2.1(1.2-3.0% CI)]. All other isolated body composition techniques had an average between-day CV of 3.4-5.1%.

CONCLUSION:

Unlike BIS and BODPOD, DXA is an accurate body composition measurement technique compared to the 4C model. The between-day reliability of DXA is meaningfully enhanced when combined with BIS. It is recommended that researchers and health and sports practitioners implement DXA and BIS assessment techniques where possible, for accurate and reliable measurement of body composition.

3182 Board #3 May 29 1:30 PM - 3:00 PM Training Effects Of Alternated And Pulsed Currents On Body Mass Of Competitive Athletes

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(No relevant relationships reported)

Neuromuscular electrical stimulation (NMES) is widely used for strength training in healthy individuals and athletes. Previous studies have shown that alternated mid-frequency currents (MF) and low-frequency pulsed currents (PC) have similar effects on quadriceps evoked strength and level of discomfort in this population. However, little is known about the effects and best parameters of NMES to induce body mass loss.

Purpose: To evaluate the effects of 6 weeks of training with 2 different NMES currents - medium alternated and low frequency pulsed current - on body mass of competitive athletes. **Methods:** A double-blind controlled and randomized experimental study was carried out with 33 athletes (22.2 ± 2.6 yrs, 74.7 ± 9.8 kg, 176.8 ± 6.0 cm), divided into 3 groups: mid-frequency current (MF, n=12), pulsed current (PC, n=11) and control group (CG, n=10). Body mass was assessed before and after the intervention through a body mass scale (BC-418, Tanita Corporation of America Inc., Illinois, USA). NMES training was performed 3 times per week and consisted of 18 sessions, 15 min/session (36 involuntary isometric quadriceps contractions per session), 6s duration in each contraction interspersed with 18s rest. Data were expressed as means ± standard

deviation (SD) and normality was checked using the Shapiro-Wilk test. A two-way analysis of variance (ANOVA) with repeated-measures and Tukey post-hoc test were used to analyze data (group and time effects). Statistical significance was accepted with $p < 0.05$. **Results:** After the training period, body mass did not change in any group (PRE: PC = 76.1 ± 8.1 kg, MF = 74.7 ± 9.8 kg, CG = 73.5 ± 21.5 kg; POST: PC = 76.7 ± 8.9 kg, MF = 74.7 ± 9.4 kg, CG = 74.0 ± 11.3 kg; $p > 0.05$). All currents produced similar evoked torque and levels of discomfort ($p > 0.05$). **Conclusion:** Quadriceps NMES training applied through alternated or pulsed currents produced similar effects and did not change body mass in competitive athletes.

3183 Board #4 May 29 1:30 PM - 3:00 PM
**Changes In Body Composition Following A
 Competitive Season In Division I Collegiate Female
 Gymnastics Athletes**

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 (No relevant relationships reported)

A large muscle mass to total body mass ratio benefits power athletes such as gymnasts. While collegiate gymnastics athletes train strength and power in the pre-season but reduce training during the competitive season, the degree to which body composition changes during the competitive season is not known. **PURPOSE:** This study examined changes in body composition in a team of female Division I collegiate gymnastics athletes before and after their competition season. It was hypothesized that percent body fat (%BF), total fat mass (TFM), and bone mineral content (BMC) would remain unchanged from pre- to post-season. **METHODS:** Fifteen female collegiate gymnasts (age = 19 ± 1 year, ht = 1.62 ± 0.05 m, wt = 62.7 ± 7.2 kg) volunteered to undergo measures of body composition assessment before and after their spring competitive season. During pre-season (PRE), participants were instructed to arrive to the laboratory in a euhydrated state. Following written informed consent, participants provided a mid-stream urine sample which was used to screen for pregnancy and to determine urine specific gravity (USG) using a handheld digital refractometer. Participants then performed a dual-energy x-ray absorptiometry (DXA) scan to determine TFM, %BF, and BMC. Immediately after the competitive season, participants returned to the laboratory and repeated all procedures (POST). Data were analyzed using paired-samples t-tests with significance set at $p < 0.05$. **RESULTS:** BMC significantly increased across the season (6.422 ± 0.206 g PRE vs. 6.485 ± 0.203 g POST; $p < 0.05$). While there was a downward trend in both TFM (34.158 ± 2.211 kg PRE vs. 32.905 ± 2.335 kg POST; $p < 0.1$) and %BF (25.68 ± 1.16 % PRE vs. 24.99 ± 1.23 % POST; $p < 0.1$), these were not significantly different at the a priori $p < 0.05$ level. There was no change in body weight. **CONCLUSION:** The significant increase in BMC, combined with the downward trend in TFM and %BF, with no change in body weight, suggests athletes maintained body composition in a favorable manner during the competitive season. The increase in BMC further suggests that stimuli during the competitive season were strong enough to elicit favorable changes in bone remodeling during in-season competition.

3184 Board #5 May 29 1:30 PM - 3:00 PM
**Correlation Between Visceral Fat Measured By
 Bioelectrical Impedance And Dual Energy X-ray
 Absorptiometry In Males**

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 (No relevant relationships reported)

Measurement of abdominal adiposity/visceral adipose tissue is clinically relevant in determining individuals' risks of developing cardiometabolic conditions. Bioelectrical impedance (BIA) can be utilized to estimate visceral adipose tissue as an indicator for cardiometabolic dysregulation. **PURPOSE:** To determine the correlation between multi-frequency BIA-derived areal visceral fat (cm^2) and dual energy x-ray absorptiometry (DXA)-derived volumetric visceral fat (cm^3) in normal weight college-aged males. **METHODS:** Visceral fat was measured three times in the following order: 1) BIA, 2) DXA and 3) BIA in college aged males during the early morning. The mean of the two BIA measurements was used for statistical analyses. All three measures were completed in the same session lasting no longer than 30 minutes. To ensure participants were normally hydrated [urine specific gravity (USG) range: 1.022-1.028], USG was determined immediately prior to the testing session. Correlations between BIA areal visceral fat and DXA volumetric visceral fat and a correlation between BIA visceral fat level and DXA android/gynoid (A/G) percent fat ratio Pearson r correlation coefficients were calculated. **RESULTS:** Assessments were done on 102 males (mean age = 20.35 ± 1.38 years; mean body mass index = 25.40 ± 3.36 $\text{kg} \cdot \text{m}^{-2}$). Correlation analysis indicated a moderately high direct correlation between BIA areal visceral fat ($47.54 \pm 32.78 \text{cm}^2$) and DXA volumetric visceral fat (172.20

$\pm 274.36 \text{cm}^3$), $r = .678$, $p < .001$. There was a moderately direct correction between BIA visceral fat levels (4.26 ± 3.24) and DXA A/G percent fat ratio (0.83 ± 0.20), $r = .570$, $p < .001$. **CONCLUSIONS:** In normal weight adults, visceral adiposity and A/G percent fat ratio have much stronger associations with cardiometabolic dysregulation than android and gynoid percent fat. The results of this investigation indicate areal visceral fat and visceral fat level derived from BIA may be a set of useful and meaningful indicators of cardiometabolic disease risk when access to DXA is not available. Future research should explore the predictability of BIA-derived areal visceral fat and visceral fat levels, while controlling for factors such as sex, age, and BMI, on cardiometabolic risk.

3185 Board #6 May 29 1:30 PM - 3:00 PM
**Effects Of Compression Apparel On Body Composition
 Measurements By Air Displacement Plethysmography
 In College Males**

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 (No relevant relationships reported)

Body composition measured by air displacement plethysmography (ADP) accounts for the effects of trapped isothermal air in hair by having the subject wear a swim cap to compress the hair on the head. It is recommended that even subjects with very little hair wear a swim cap. Currently, there are no recommendations that account for the effects of trapped isothermal air in body hair. **PURPOSE:** The purpose of this study was to investigate the impact of exposed body hair and the effect of wearing limb length single layer compression apparel on body composition measurements using ADP in college males. **METHODS:** Forty male college students (age 20.0 ± 1.2 yrs; BMI 24.1 ± 3.1 kg/m^2) volunteered to participate in the study. Percentage of body fat was evaluated by ADP. To assess the impact of body hair on body composition measurements, ADP measures were performed in two conditions: wearing single layer compression shorts (CS) apparel with a swim cap (as recommended) and wearing limb length single layer compression (LC) apparel with the same swim cap. The order of apparel was conducted in random order to avoid any potential order effects. **RESULTS:** Wearing limb length single layer compression apparel to compress body hair increased body mass by an average of 0.3 kg (± 0.02); however, there was no significant difference in body density between the CS condition (1.0580 ± 0.014 g/cm^3) and the LC condition (1.0629 ± 0.015 g/cm^3 , $p < 0.001$). The mean percentage of body fat in the LC condition ($15.9 \pm 6.5\%$) was significantly lower than the mean percentage of body fat in the CS condition ($18.0 \pm 6.2\%$, $p < 0.001$). **CONCLUSIONS:** The effect of trapped isothermal air in body hair impacts body composition measurements by ADP. Covering exposed body hair in males when assessing body composition via ADP results in a significantly lower percentage of body fat compared to the minimal clothing recommendation. Attention should be paid to minimizing exposed body hair on males when assessing body composition by air displacement plethysmography. The present results suggest that this minimization may be achieved with males by wearing limb length single layer compression apparel.

3186 Board #7 May 29 1:30 PM - 3:00 PM
**Athlete-specific Prediction Equations For Appendicular
 Upper And Lower Body Lean Soft Tissue With BIA**

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 (No relevant relationships reported)

Given sport specific physiological demands, knowing the distribution of lean soft tissue among the body segments is of relevance for optimizing athletic performance, monitoring response to specific training regimens, as well as for evaluating potential injury risk. Bioelectrical impedance (BIA) is a widely used portable, low cost, and easy technique to assess body composition. However, most equations used by BIA to predict lean tissue are not specific for the athlete population. **Purpose:** The aim of this investigation was to develop and cross-validate prediction equations to estimate dual-energy X-ray absorptiometry (DXA)-derived appendicular lean soft tissue (LST) of the arms and legs based on whole body BIA in a population of athletes. **Methods:** Two-hundred sixty-five athletes (age 22.2 ± 4.6 yrs) from a variety of sports had LST of the arms and legs assessed by DXA and whole-body reactance (Xc) and resistance (R) measured by BIA. Using measures of height, the resistance index ($\text{RI} = \text{height}^2/\text{R}$) was calculated. Prediction equations were established using a cross validation method where 177 athletes (2/3 of the sample) were used for equation development and the remaining 88 athletes (1/3 of the sample) were used for equation validation. **Results:** The developed prediction equations were as follows: arm LST = $0.940 \cdot \text{sex}$ (0=male; 1=female) + $0.042 \cdot \text{total body weight (kg)} + 0.080 \cdot \text{RI} + 0.024 \cdot \text{Xc} - 3.927$; leg LST = $1.983 \cdot \text{sex}$ (0=male; 1=female) + $0.154 \cdot \text{total body weight (kg)} + 0.127 \cdot \text{RI} -$

1.147. Both equations cross-validated very well for the arms (mean difference=0.11 kg, $R^2=0.89$, $SEE=0.61$) and for the legs (mean difference=0.05 kg, $R^2=0.81$, $SEE=1.95$ kg). There were no differences ($p > 0.05$) in the mean values for both arm and leg LST equations and LST assessed with DXA.

Conclusion: The developed BIA-based prediction equations seem to provide a valid estimation of upper and lower body LST in athletes.

3187 Board #8 May 29 1:30 PM - 3:00 PM
Test-retest Reliability Of Various Methods For Body Composition Assessments

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(No relevant relationships reported)

Multi-compartment body composition assessment techniques are common in research and for assessing intervention success. Establishing the validity and reliability of assessment techniques help to ensure appropriate outcomes. **PURPOSE:** To identify the intra (same day) and inter (between-day) test-retest reliability of BIA, BIS, and DEXA composition assessments conducted on two consecutive days in a healthy population. **METHODS:** 40 healthy, collegiate-aged participants (male: $n=20$; 24.6 ± 4.1 yr, 177.5 ± 6.7 cm, 88.1 ± 13.3 kg; female: $n=20$; 22.8 ± 4.5 yr, 163.6 ± 6.5 cm, 64.6 ± 14.3 kg) completed two study visits with 24 hours. All participants arrived fasted (10 h) and after abstaining from exercise (24 h). Each visit consisted of two consecutive rounds (four total measurements) of assessments including body weight, BIA (InBody 570), DEXA scan, and BIS. Pearson correlations, intraclass correlation coefficient (ICC), coefficient of variation (CV), and standard error of the mean (SEM) were computed to assess relationship and reliability between measurement techniques. A p -value of 0.05 was used to assess all statistical outcomes. **RESULTS:** Intra-test and inter-test ICC, CV, and SEM values for all three measurement techniques are provided in table 1. Strong, positive correlations between BIA vs DEXA FM ($r = 0.95$), DEXA vs BIS FM ($r = 0.89$), BIA vs DEXA FFM ($r = 0.99$), and DEXA vs BIS FFM ($r = 0.96$) were observed. **CONCLUSION:** All three methods yielded high intra- and inter-test retest reliability with strong correlations between measurements and excellent CV and ICC values suggesting good repeatability with the largest variation being observed for BIS FM and FFM.

Table 1: ICC, CV, and SEM values for BIA, DXA, and BIS analysis				
		ICC	CV (%)	SEM (grams)
BIA Fat Mass	Intra	1.00	1.20	52.13
	Inter	1.00	2.36	94.33
DXA Fat Mass	Intra	0.99	1.92	138.97
	Inter	0.99	1.26	127.83
BIS Fat Mass	Intra	0.99	4.22	179.51
	Inter	0.98	5.86	280.90
BIA Fat-Free Mass	Intra	1.00	0.36	59.03
	Inter	0.99	0.68	110.04
DXA Fat-Free Mass	Intra	1.00	0.38	56.34
	Inter	0.99	0.75	110.90
BIS Fat-Free Mass	Intra	0.99	0.97	118.21
	Inter	0.99	1.72	285.12

3188 Board #9 May 29 1:30 PM - 3:00 PM
The Impact Of Residual Lung Volume Method On Multi-compartment Model Body Composition Assessment

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(No relevant relationships reported)

PURPOSE: Researchers use both direct and indirect nitrogen analysis to determine residual lung volume (RLV) for body composition assessment. However, the agreement between direct and indirect methods, and thus the impact on percent fat (%fat), has yet to be examined. The purpose of this study was to compare multi-compartment %fat using direct and indirect measures of RLV.

METHODS: Thirty-four healthy adults (53% female; 37.7 ± 15.5 y; 27.6 ± 7.0 kg·m⁻²) participated in this study. RLV was measured via oxygen dilution using direct (DIR)

and indirect (IND) nitrogen analysis. Participants also completed hydrostatic weighing, dual energy X-ray absorptiometry, and bioimpedance spectroscopy for body density, bone content, and total body water. Two, three, and four-compartment (2C, 3C, and 4C) model %fat was calculated using RLV from both DIR and IND nitrogen analysis. Agreement for each model was assessed using paired t tests and Bland-Altman analysis. Significance was accepted at $p < 0.05$.

RESULTS: Strong correlations (ICCs > 0.98) were observed for all %fat models between RLV methods. Measures of %fat using IND were larger than DIR (mean differences, 0.7 to 1.6%fat, all $p < 0.001$). However, the magnitudes of the differences were small (Cohen's d , 0.08 to 0.17). Additionally, the range of individual differences between IND and DIR was less than 4.0%, with 3C and 4C producing especially narrow limits of agreement ($\pm 1.4\%$ fat and 1.9% fat) compared to 2C ($\pm 3.4\%$ fat).

CONCLUSIONS: Multi-compartment models using DIR and IND nitrogen analysis to determine RLV demonstrated strong agreement. The more complex models (3C and 4C) were less affected by RLV method than the 2C model and produced limits of agreement less than $\pm 2.0\%$ fat. The results presented here indicate that DIR and IND nitrogen analysis may be used interchangeably for the assessment of body composition when using 3C and 4C models.

3189 Board #10 May 29 1:30 PM - 3:00 PM
Body Composition And Anaerobic Fitness Testing During A Complete NCAA III Men's Hockey Season

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PURPOSE: Determine the effects of a competitive Division III men's hockey season on anthropometric and anaerobic fitness markers.

METHODS: Seven Division III men's hockey players participated in this season-long study. Athletes reported at four time-points: pre-season (Oct), mid-season 1 (Dec), mid-season 2 (Feb), and post-season (Apr). Each time-point included athletes' height, weight, body composition via air plethysmography, and anaerobic capacity via 30-s Wingate cycle test (WCT). During this season the team appeared in the Frozen Four of the Division III National Tournament, ultimately losing in the championship game. A repeated measured ANOVA was utilized to determine differences in fitness outcomes over the course of the season.

RESULTS: Data for the seven athletes is presented as mean and standard deviation for Oct, Dec, Feb, and Apr time-points. Neither weight (87.9 ± 6.6 , 87.6 ± 7.2 , 88.5 ± 6.7 , 88.2 ± 8.3 kg) nor percent fat (14.4 ± 4.2 , 13.1 ± 3.6 , 14.2 ± 3.0 , $14.3 \pm 3.8\%$) differed significantly throughout the season. Additionally, fat mass (FM) nor fat-free mass (FFM) differed significantly over the course of the season. Peak power (958 ± 96 , 902 ± 144 , 947 ± 139 , 908 ± 145 W, $p = 0.01$) and peak power per kilogram of body weight (10.9 ± 1.0 , 10.3 ± 1.2 , 10.6 ± 0.9 , 10.3 ± 0.9 W/kg, $p = 0.04$) only differed significantly from Feb to Apr. There was also a significant decrease in mean power from Feb to Apr (734 ± 67 , 705 ± 88 , 729 ± 97 , 713 ± 100 W, $p = 0.04$). The only significant difference in mean power per kilogram of body weight occurred from Oct to Dec (8.4 ± 0.5 , 8.0 ± 0.5 , 8.2 ± 0.6 , 8.1 ± 0.6 W/kg, $p = 0.04$). Lastly, fatigue index also decreased significantly from Feb to Apr (51.4 ± 4.3 , 52.2 ± 8.2 , 50.8 ± 3.6 , $46.4 \pm 5.7\%$, $p = 0.03$).

CONCLUSIONS: Anthropometric measurements did not change significantly over the course of the season. Other than an improvement in fatigue index at the end of the season, anaerobic measurements from the WCT either didn't change or worsened over the course of the season. These findings illustrate that championship caliber teams do not necessarily need to improve lab-based anaerobic performance markers (as measured by a 30s Wingate cycle test) nor anthropometric measurements (body weight, FM, FFM, or percent fat) to have successful regular and post-seasons.

3190 Board #11 May 29 1:30 PM - 3:00 PM
Total And Regional Body Composition Of Ncaa Division I Female Soccer Athletes Through Competitive Seasons

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(No relevant relationships reported)

Analyzing body composition and tracking changes over seasons is critical to have comprehensive insight to player performance and health as body composition is

strongly related to soccer performance. **PURPOSE:** To examine body composition of NCAA Division I female soccer players by position and season. **METHODS:** One hundred seventy-five female collegiate soccer players from 4 NCAA Division I Universities participated in this study. Athletes were categorized by positions of forward (n=47), midfielder (n=51), defender (n=57), and goalkeeper (n=20). Seasons were defined as pre-season (Aug), in-season (Sep - Oct), post-season (Nov - Dec), winter off-season (Jan), spring season (Feb - Apr), and summer off-season (May - Jul). A whole body dual X-ray absorptiometry scan assessed percent body fat (%BF), total lean muscle mass (LM), total fat mass (FM), arm and leg LM and FM, and visceral adipose tissue (VAT). Separate ANOVAs with linear mixed-effects models to account for repeated measures assessed differences across positions and seasons. **RESULTS:** Goalkeepers had significantly higher height, body mass, FM, and arm and leg LM and FM compared to all other positions ($p < 0.05$). Goalkeepers ($28.1 \pm 4.3\%$) had significantly higher %BF than defenders ($24.4 \pm 3.4\%$) and forwards ($24.5 \pm 4.0\%$; $p < 0.01$), and midfielders ($26.0 \pm 3.9\%$) had significantly higher %BF than defenders ($p < 0.01$) and forwards ($p = 0.04$). Goalkeepers had significantly greater LM (50.5 ± 4.3 kg) than all other positions, and defenders (46.2 ± 4.7 kg) had greater LM than forwards (44.2 ± 3.7 kg) and midfielders (44.3 ± 4.0 kg; $p < 0.01$). For all positions, %BF was significantly higher in winter off-season (26.7%) compared to summer off-season (25.7%) and pre-season (25.8% ; $p < 0.01$). For all positions, total LM and leg LM was significantly lower in winter off-season compared to all other seasons, and total LM was significantly higher in summer off-season than pre-season ($p < 0.01$). **CONCLUSIONS:** Goalkeepers had higher body mass and FM but also had more LM compared to the other positions. In winter off-season, %BF increased and LM decreased indicating potential undesired changes in training and/or nutrition over the holiday break. In summer off-season, LM was the highest reflecting the emphasis on resistance training and increased volume of training.

3191 Board #12 May 29 1:30 PM - 3:00 PM
Combined Anthropometry And Bioelectrical Impedance To Predicted Body Fat In Female Athletes
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PURPOSE: To determine whether combining anthropometry (skinfolds, SF) and bioelectrical impedance analysis (BIA), an indicator of hydration status, would accurately approximate the expected percentage body fat (%Fat) value and reliably predict %Fat. Accurate and reliable estimation of body composition in female athletes can be challenging since the methodological assumptions are easily violated. For example, hydration status can vary due to menstrual cycle phase, dehydration, and training, and thereby distort %Fat. We hypothesized that compared to outcomes for SF or BIA alone, %Fat using SF+BIA would not differ from our criterion method, and SF+BIA would account for a greater percent of the variance (r^2) in predicting %Fat. **METHODS:** Eighteen female athletes (D1 NCAA competitors) were recruited from the swim team and gymnastic team and measured for body density (air displacement plethysmography), total body water (D_2O dilution), and bone mineral mass (DEXA). Assessments were applied to a four-component model (4C) to determine the criterion %Fat. Skinfolds (Slaughter 2-site equation; Lange caliper), and BIA (Chumlea TBW equation; Quantum VI, RJL) were measured as the predictors. SF was used to determine body volume and BIA was used to determine TBW; these values were then applied to Siri's 3-component equation to predict %Fat (SF+BIA). One-way ANOVA with repeated measures was used to compare mean %Fat values determined for SF, BIA, and SF+BIA and 4C %Fat. Bonferroni multiple comparisons were used as the post hoc test ($p < 0.05$). Regression was used to determine r^2 SF, BIA, and SF+BIA vs 4C criterion.

RESULTS: A significant one-way ANOVA led to post hoc detection of differences in %Fat for BIA (26.6 ± 7.5) and SF+BIA (25.5 ± 7.2) vs. the 4C (22.3 ± 7.5) ($p < 0.05$). The SF estimate (24.0 ± 7.8) did not differ from the 4C value. Regression revealed the highest adjusted variance accounted for in 4C was SF+BIA ($r^2 = 0.87$) followed by BIA ($r^2 = 0.80$) and SF ($r^2 = 0.76$), all of which were statistically significant.

CONCLUSIONS: Skinfolds alone were more accurate at predicting the mean %Fat in these female athletes but combining SF and BIA might provide greater reliability for predicting percent body fat in female athletes.

3192 Board #13 May 29 1:30 PM - 3:00 PM
Increased Body Fat Negatively Impacts Aerobic Capacity Of Elite American Football Players Regardless Of Position
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 (No relevant relationships reported)

Aerobic capacity and body composition play an important role in athletic performance and health. Previous research demonstrates an association between lower body fat percentage (BF%) and enhanced aerobic as well as anaerobic capacity, while higher BF% is linked to an increased risk of chronic diseases related to obesity. The amount of research on aerobic performance in elite football players is limited, and even less research has compared maximal oxygen uptake (VO_2 peak) with body composition by position. **Purpose:** To determine the relationship between BF% and VO_2 peak in elite football players by position group. **Methods:** Elite American football players ($n = 112$, age: 25.03 ± 2.89 yrs, ht: 187.06 ± 7.62 cm, and wt: 110.89 ± 22.71 kg) were split by position into three groups. Small skill (SS) ($n=50$): running back, cornerback, safety, and wide receiver; big skill (BS) ($n=27$): tight end, linebacker, and quarterback; and linemen (LM) ($n=35$): tackle, guard, center, and defensive end. BF% was calculated using air displacement plethysmography. VO_2 peak was measured via indirect calorimetry during a treadmill test using three protocols based on position group. SS and BS ran at 7.5 or 6.5 mph (respectively) with a 2% increase of elevation every 2 minutes, and LM performed a Bruce protocol. Subjects ran until volitional fatigue. A Kruskal-Wallis test with Bonferroni post hoc was used to compare BF% and VO_2 peak values between position groups. A Spearman's rank-order correlation was used to determine the relationship between BF% and VO_2 peak. **Results:** LM (39.58 ± 5.07 ml·kg⁻¹·min⁻¹) VO_2 peak was significantly different from BS (47.75 ± 5.47 ml·kg⁻¹·min⁻¹) and SS (49.93 ± 4.31 ml·kg⁻¹·min⁻¹) ($p < .001$). There was no difference in VO_2 peak between BS and SS ($p > 0.05$). BF% was significantly different ($p \leq .002$) between all groups (SS: $12.23 \pm 4.83\%$, BS: $17.81 \pm 4.32\%$ and LM: $26.26 \pm 5.23\%$). A statistically significant ($p < 0.01$) moderate negative correlation was found between BF% and VO_2 peak overall ($r_s = -0.772$) and for each position group (SS $r_s = -0.49$, BS $r_s = -0.54$, and LM $r_s = -0.62$). **Conclusions:** Body composition differs between position groups. Lower BF% was associated with higher VO_2 peak in elite football players regardless of position group. Future research should explore the impact of these variables on player performance and risk of injury.

3193 Board #14 May 29 1:30 PM - 3:00 PM
Bioimpedance Phase Angle Reliability In Mexican College Students
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Bioimpedance (BIA) phase angle (PA) is a body composition measure related to cell structure, integrity and body cell mass. Although PA has been positively correlated to clinical outcomes, there is scarce information on ethnic differences in PA and its overall reliability. **PURPOSE:** To determine phase angle reliability in Mexican college students. **METHODS:** College students from the city of Tijuana, México, were recruited for this study. Volunteers were 26 males (Age = 22.7 ± 3.1 yr., Height = 172.8 ± 5.6 cm, Weight = 70.9 ± 11.7 kg) and 26 females (Age = 21.1 ± 2.2 yr., Height = 159.0 ± 7.1 cm, Weight = 60.8 ± 8.6 kg). Participants arrived euhydrated to the testing session (Urine specific gravity = 1.005 ± 0.003) and were measured on a multi-frequency InBody 770 BIA device in two occasions separated by five minutes of seated resting. Body weight, %fat mass, muscle mass (kg) and PA were recorded and analyzed by repeated measures 2 (gender) x 2 (measures) ANCOVA, using hydration status and age as covariates. Intraclass correlation coefficient (ICC) and 95% confidence interval were used to determine reliability between measures. **RESULTS:** Gender differences were found on PA (Males = 6.8 ± 0.1 vs. Females = 5.9 ± 0.1 , $p \leq 0.0001$), and muscle mass (Males = 31.9 ± 0.7 vs. Females = 23.2 ± 0.7 kg, $p \leq 0.0001$). Significant ($p \leq 0.0001$ for all) ICC reliability coefficients were found between pre- to post-measures of PA ($r = 0.998$, 95%CI = 0.996 to 0.999), %fat ($r = 0.999$, 95%CI = 0.998 to 1.00) and muscle mass ($r = 1.00$, 95%CI = 1.00 to 1.00). **CONCLUSION:** Young college students showed reliable BIA PA, muscle mass and %fat values following five minutes of seated resting. Mexican males showed higher muscle mass and PA than women after controlling for the influence of hydration and age.

3194 Board #15 May 29 1:30 PM - 3:00 PM

Sex Affects The Difference In Body Fat Estimation Between Body Composition Devices

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(No relevant relationships reported)

Commercially available upper-body (UB) and lower-body (LB) bioelectrical impedance analyzers (BIA) are commonly used to measure body fat percentage (%BF) and classify body composition status. Some evidence suggests that LB BIA underestimate %BF specifically in women. It is not clear if UB BIA devices also underestimate %BF in women or if LB and UB BIA devices underestimate %BF in men. **PURPOSE:** To compare %BF from air displacement plethysmography (ADP), UB BIA, LB BIA, and whole-body (WB) BIA and to determine if the %BF differences between devices are affected by sex. **METHODS:** 53 women (21±5 yrs) and 42 men (23±5 yrs) had their %BF measured via ADP, a hand-held UB BIA, a digital scale LB BIA, and a validated eight-electrode multifrequency WB BIA device following each device's recommended procedures. Paired samples t-tests were used to compare %BF between devices within each sex. Independent samples t-tests were used to compare the %BF difference between devices for each sex. **RESULTS:** In women, UB (23.8±4.3%) and LB (20.4±5.8%) BIA yielded significantly ($p<0.001$) lower %BF than ADP (28.3±7.4%) and WB BIA (28.9±5.0%). In men, UB (15.6±5.3%) and LB BIA (15.0±4.0%) also yielded significantly lower %BF values than ADP (17.6±7.7%; $p=0.012$ vs. UB BIA; $p=0.008$ vs. LB BIA) and WB BIA (19.1±6.7%; $p<0.001$ vs. UB and LB BIA). The differences in %BF between devices were greater in women compared to men: WB - UB BIA difference 5.0±2.6 vs. 3.6±3.3%, $p=0.021$ (women vs. men); WB - LB BIA difference 8.5±4.1 vs. 4.2±5.1%, $p<0.001$; ADP - UB BIA difference 4.5±5.9 vs. 2.0±5.0%, $p=0.028$; ADP - LB BIA difference 7.9±6.3 vs. 2.7±6.2%, $p<0.001$; UB - LB BIA difference 3.4±3.5 vs. 0.7±3.2%, $p<0.001$. **CONCLUSIONS:** These results suggest that commercially available UB and LB BIA devices systematically underestimate %BF in both men and women compared to a validated multifrequency WB BIA and ADP. The degree of underestimation in %BF for commercially available BIA devices is greater in women compared to men. Use of these commercially available BIA devices may cause misclassification of body composition status, especially in women.

3195 Board #16 May 29 1:30 PM - 3:00 PM

An Equation To Estimate Head Volume For Hydrostatic Weighing In Partially Immersed Subjects

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Reported Relationships: P. Papadopoulos: Other (please describe); One of the authors (Jeff C. Tesch) is the vendor of the equipment used in the study.

PURPOSE: The purpose of the study was to derive prediction equations for head volume (HV) from head girths and diameters and to use the equations for hydrostatic weighing (HW).

METHODS: HW was performed with and without head submersion of subjects using a computerized, 4 load cell weighing system. Forty-four males and 46 females comprised the experimental groups from which equations were derived to predict HV by water displacement. HW was then performed on 46 additional subjects (21 males and 25 females) to compare body density (BD) and body fat percent (BF%) for head below water (HBW) and head above water (HAW) immersion using the HV prediction equations. Subjects exhaled to residual volume and maintained the same lung volume during the HAW phase and the HBW phase of each immersion trial.

RESULTS: Head girths showed higher correlations and smaller SEEs than head diameters for the prediction of HV. Regression analysis indicated that the equations with the highest R^2 and the lowest SEE were from head girth (HG), face girth (FG) and body mass in air (MA). The equation for males was $HV = 0.1294 \cdot HG + 0.0299 \cdot FG + 0.0055 \cdot MA - 5.7506$ ($R^2 = 0.57$, $SEE = 0.26$ L). The equation for females was $HV = 0.1314 \cdot HG + 0.0504 \cdot FG + 0.0094 \cdot MA - 8.9008$ ($R^2 = 0.73$, $SEE = 0.21$ L). The validation groups showed no significant differences ($p < 0.05$) in BD between HAW immersion and HBW immersion for either males ($R^2 = 0.98$, $SEE = 0.0028$ g·ml⁻¹) or females ($R^2 = 0.90$, $SEE = 0.0054$ g·ml⁻¹). There were no significant differences ($p < 0.05$) in BF% between HAW immersion and HBW immersion for either males ($R^2 = 0.98$, $SEE = 1.16\%$) or females ($R^2 = 0.90$, $SEE = 2.24\%$). Fluctuations in weight scale readings were significantly lower ($p < 0.05$) for HAW immersion than for HBW immersion in both males ($SD_{HAW} = 0.31$ kg, $SD_{HBW} = 0.40$ kg) and females ($SD_{HAW} = 0.22$ kg, $SD_{HBW} = 0.30$ kg).

CONCLUSIONS: Weight readings are more stable and BD and BF% are not significantly different when HW is performed without head submersion using predicted HV.

3196 Board #17 May 29 1:30 PM - 3:00 PM

Test-retest Reliability Of Total Body Volume Derived From A Single 2-dimensional Digital Image

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Reported Relationships: M.V. Fedewa: Receipt of Intellectual Property Rights/Patent Holder; Provisional Patent Submitted. Dr. Fedewa developed the Intellectual Property related to this abstract as part of his research at the University of Alabama.

Simple, accurate, and cost-effective methods to estimate body composition in field settings are valuable to practitioners and clinicians. An automated smartphone- or tablet-based method of determining body composition from a single 2-dimensional (2D) digital image has recently been developed. However, the test-retest reliability has yet to be determined. **PURPOSE:** The purpose of this study was to evaluate the test-retest reliability of total body volume (BV) estimated from a single 2D digital image. **METHODS:** A convenience sample was recruited for this study ($n=30$, 21.0±3.1 yrs., 86.7% female, 24.8±3.0 kg/m²). Body mass was measured (to the nearest 0.1 kg) with a calibrated digital scale (Tanita BWB-800, Tanita Corporation, Tokyo, Japan). Standing height was measured (to the nearest 0.1 cm) with a stadiometer (SECA 213, Seca Ltd., Hamburg, Germany). Two digital images of each participant were taken from the rear/posterior view using a 12.9 inch, 64g iPad Pro. A paired sample T-test was used to examine differences between BV obtained from the images (BV₁, BV₂). An Intraclass Correlations Coefficient (ICC) assessed the strength of the association between BV₁ and BV₂. **RESULTS:** No differences were observed between BV₁ and BV₂ (71.2±12.0 L versus 71.1±11.7 L, respectively, $p=0.51$), with excellent agreement between the two measures (ICC=0.99).

CONCLUSIONS: This novel method of acquiring BV produced near-perfect reliability within our small sample. Given the excellent reliability, future research should examine the validity of acquiring body composition from a single 2D digital image using an automated smartphone- or tablet-based application.

3197 Board #18 May 29 1:30 PM - 3:00 PM

Acute Exercise And Resulting Dehydration Does Not Alter Body Composition Measures Using Fit3D

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(No relevant relationships reported)

Fit3D is a novel, camera-based system to assess anthropometric measurements and determine body composition. Little data exist on how the values generated by this system may be influenced by acute exercise and associated dehydration and fluid shifts. **PURPOSE:** To determine the effect of a prolonged bout of acute exercise on the body composition measures generated by the Fit3D. **METHODS:** 17 subjects (7 female, 10 male) underwent body composition analysis using the Fit3D before and after one hour of acute exercise. The exercise protocol consisted of a maximal treadmill exercise test to volitional fatigue followed by 40 min of continuous exercise at the estimated anaerobic threshold calculated by taking 65% of each subject's ventilatory threshold. Each subject had their vitals (heart rate, blood pressure, and scale weight) taken, provided a urine sample to measure specific gravity, and performed a Fit3D scan before and after the exercise bout. **RESULTS:** Subjects lost 2.5±1.8 lbs during exercise. This loss of body water was associated with an increase in urine specific gravity of .007±.004. These changes did not influence any of the circumference measures and only slightly influenced percent body fat measured on the Fit3D. Pre-to-post measures of body fat (24.5±6.9% vs 24.8±6.7%), trunk-to-leg volume ratio (1.45±0.59 vs 1.49±0.56), fat mass (73.4±15.7 vs 72.5±15.6kg), lean mass (54.9±9.9 vs 54.1±10.2 kg), and basal metabolic rate (1637±242 vs 1630±242 cal/day) were not statistically different ($p=0.894$, 0.876, 0.999, 0.822 and 0.930 respectively). **CONCLUSION:** Our results provide preliminary evidence that the Fit3D instrument is a consistent tool for assessment of body composition even after a bout of acute exercise resulting in the loss of body water.

3198 Board #19 May 29 1:30 PM - 3:00 PM
Body Composition And Aerobic Fitness Levels In College Freshmen
 Nicole Varone, Vipa Bernhardt. *Texas A&M University Commerce, Commerce, TX.* (Sponsor: Tony G. Babb, FACSM)
(No relevant relationships reported)

Nicole Varone & Vipa Bernhardt
Texas A&M University Commerce

Background: Research has shown that college students exhibit gains in fat mass that are up to 5.5 times greater than their peers of the same age who do not attend college (Mihalopoulos et al, 2008). Because of concerns over increasing rates of obesity, college campuses nationwide are engaging in campaigns designed to target college youth and educate them about the benefits of healthy lifestyle behaviors. In order to implement effective intervention strategies, a clear picture of current student fitness must be acquired.

Purpose: The purpose of this study was to examine objective measures of body composition and aerobic fitness levels in current first year students of a rural university.

Methods: 24 participants (17F/7M, 18±1yr, 167.5±72.0 cm, 67.9±17.1kg, 24.5±5.2kg/m² BMI) underwent dual energy x-ray absorptiometry for body fat determination and performed the Astrand submaximal bicycle ergometer test with metabolic measurements (e.g., VO₂), from which estimated VO₂max was extrapolated. The International Physical Activity Questionnaire (IPAQ) was administered to gather subjective self-evaluation of weekly exercise volume.

Results: The majority of students (13F/4M) fell into the "very poor" category for body fat percentage as defined by ACSM (34±7% in females and 24±10 in males). Five(5F/0M) were classified as "poor", 1 (0F/1M) as "fair", and 3 (1F/2M) as "good". 13 participants were classified as "good" or better on VO₂ max and 11as "fair" or worse (female: 42.5±11.2 ml/kg/min and male: 39.0±15.7 ml/kg/min). The majority (8F/7M) of participants claimed to engage in a "high" volume of physical activity per week as measured by the IPAQ, while 7 (7F/0M) scored "moderate" and 2 (2F/0M) "low" levels.

Conclusion: Although BMI average was normal, the majority of students failed to meet body fat standards. It is also interesting that all 7 males in the study scored themselves as "high" on the IPAQ, yet 6 of the 7 scored "poor" or "very poor" in the objective determination of VO₂max. Follow-up studies will investigate how these variables change within their first semester and over their entire college life.

3199 Board #20 May 29 1:30 PM - 3:00 PM
Validity Of A 3-Compartment Body Composition Model Derived From A Single 2-Dimensional Digital Image
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Reported Relationships: K. Sullivan: Receipt of Intellectual Property Rights/Patent Holder; Michael Fedewa.

Laboratory-based methods for assessing body composition often require specialized equipment, trained administrators, and relatively complex, time-consuming protocols. Simple, accurate, and cost-effective methods to assess body composition in field settings are limited. **PURPOSE:** The purpose of this study was to evaluate the validity of a digital image derived 3-compartment model estimate of body composition (IMAGE-3C) when compared to a 3-compartment skinfold estimate of body composition (SKF-3C). **METHODS:** A convenience sample of female participants was recruited for this study (n=24, 20.4±1.0 yrs., 73.1±10.3 kg). Body mass was measured (to the nearest 0.1 kg) with a calibrated digital scale (Tanita BWB-800, Tanita Corporation, Tokyo, Japan), and a standing height was measured (to the nearest 0.1 cm) with a stadiometer (SECA 213, Seca Ltd., Hamburg, Germany). Double measurements (within 2 mm of each other), of skinfold thickness were taken using calibrated skinfold calipers (Lange Skinfold Caliper, Seko, USA) across 7 standard sites on the body. A digital image of each participant was taken from the rear/posterior view using a 12.9 inch, 64g iPad Pro. A paired sample T-test was used to examine potential differences between body composition when measured via IMAGE-3C and SKF-3C. Intraclass Correlations Coefficient (ICC) was used to determine the strength of the association between the two methods. **RESULTS:** No differences in body composition were observed between IMAGE-3C and SKF-3C (17.9±5.1 versus 18.7±5.6, respectively, p=.08), with excellent agreement between methods (ICC=.96). **CONCLUSIONS:** The IMAGE-3C model appears to be a valid method of estimating body composition. The ability to evaluate body composition from a single digital image provides an accurate and efficient alternative to laboratory methods, which can be utilized by the general public. Data collection is ongoing. A larger and more diverse sample is needed to confirm these findings.

3200 Board #21 May 29 1:30 PM - 3:00 PM
COMPARISON OF BODY COMPOSITION METHODOLOGIES BETWEEN SKINFOLD AND ULTRASOUND IN ELITE CROSSFIT ATHLETES: A PILOT STUDY.

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(No relevant relationships reported)

PURPOSE: The aim of the present work was to compare body composition methodologies between skinfold and ultrasound in elite CrossFit athletes.

METHODS: The sample consisted of 8 male CrossFit athletes with practice time (mean ± standard deviation) 58.66 ± 11.13 months, age 25.33 ± 4.38 years, height 181.11 ± 6.09 cm, weight 93.8 ± 8.41 kg and participating in national competitions, and international. The athletes were evaluated through skinfold (ST) (Cescorf plicometer) and ultrasound (BodyMetrix - BX 2000) in triceps, subscapularis, biceps, middle axillary, iliac, supraspinatus, abdominal, mid thigh and middle calf. The circumferences were measured with a flexible and inelastic anthropometric tape measure. ISAK standardization was used to measure skin folds. Descriptive statistics data are expressed as mean and ± standard deviation (SD) of absolute values of skinfold thickness measured by plicometer and ultrasound. A t-test for paired measurements was used, the Shapiro-Wilk normality test. Wilcoxon for nonparametric data). The confidence interval (CI) is 95% and Cohen's d was calculated for effect size. The existence of correlation was analyzed by Pearson's test (Spearman for non-normal data).

RESULTS: The difference between the means generated by ultrasound and plicometer was statistically significant for: -1.67mm ST triceps; - 4.15mm ST Subscapular; - 1.65mm ST Axillary; - 0.21mm ST Iliac; - 3.48mm ST Thigh; - 1.61mm ST Calf. Comparing each skinfold and ultrasound result it was possible to perform a proportion, and it was noted that the triceps ST was 1.56 times higher, subscapular ST 1.95, axillary ST 1.49, iliac ST 1.67, abdominal ST 1.39, and thigh DC 1. calf 1.53, comparing plicometer with ultrasound, respectively. In addition, the variables with small correlation (r = 0 - 0.25) were: triceps (r = 0.177); subscapular (r = 0.109); axillary (r = 0.005); iliac (r = 0.222); thigh (r = 0.044); calf (r = 0.097); variables with weak correlation (r = 0.26 - 0.5) were: abdominal (r = 0.343).

CONCLUSIONS: We conclude that there is a significant reduction in the thickness of the anatomical point collected by ultrasound and the skinfold thickness collected by the plicometer. Thus, we suggest that these differences at each anatomical point be taken into account when using a predictive equation to estimate body fat.

3201 Board #22 May 29 1:30 PM - 3:00 PM
Comparison Of Waist And Hip Circumference Measures From 3-dimensional Technology And Manual Measurements

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(No relevant relationships reported)

Three-dimensional (3D) scanning technology is becoming increasingly popular to obtain quick anthropometric and body composition measurements and may be a practical alternative to manual assessment methods. **PURPOSE:** To compare waist and hip circumferences measured from a 3D scan to manual measurements in healthy adults. **METHODS:** Data was collected on 66 healthy male (n=22) and female (n=44) young adults (Mean ± SD: Age: 20.6 ± 1.1 yrs, BMI: 22.6 ± 2.0 kg/m²). Manual measurement of the waist was assessed at the narrowest part of the trunk; hip circumference was measured at the widest region of the buttocks. Circumferences were measured twice by the same researcher and averaged. Measurements corresponding to the same waist and hip regions assessed manually were automatically determined by the 3D scanner software. Paired-samples t-tests were utilized to determine differences between methods for the total sample and each sex. Manual measurements were used as the criterion to evaluate prediction error (standard error of the estimate [SEE]). **RESULTS:** For the total sample, the 3D scan significantly underestimated waist (Mean difference (3D - manual) [MD]: MD: 6.3 ± 2.2 cm; p<0.001) and hip (MD: 2.8 ± 2.3 cm; p<0.001) circumferences compared to manual assessments. For the men, the 3D scanner significantly underestimated waist (MD: 6.6 ± 2.1 cm; p<0.001) and hip (MD: 2.2 ± 1.9 cm; p<0.001) circumferences. The same trend was seen for women for the waist (MD: 6.1 ± 2.2 cm; p<0.001) and hips (MD: 3.0 ± 2.5 cm; p<0.001). Prediction error of hip circumference was greater for women (SEE=2.42 cm) compared to men (SEE=1.94 cm); waist circumference error was similar for women (SEE=2.14 cm) and men (SEE =2.05 cm). **CONCLUSIONS:** 3D technology may underestimate

waist and hip circumference estimates compared to manual techniques in normal weight adults. However, 3D technology may be useful to provide quick anthropometric measurements.

3202 Board #23 May 29 1:30 PM - 3:00 PM
Reliability Of Seca® Medical Body Composition Analyzer (mbca) In Healthy Young Adults

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PURPOSE: Bioelectrical impedance analysis (BIA) is an emerging method to measure body composition. The purpose of this study was to determine 1) baseline values of fat mass (FM), fat-free mass (FFM), skeletal muscle mass (SMM), total body water (TBW) extracellular water to total body water ratio (ECW/TBW), phase angle (PA), bioelectrical vector analysis (BIVA), and visceral adipose tissue (VAT), 2) any gender differences among measures, and 3) test-retest reliability on a newly obtained SECA® BIA device. **METHODS:** 37 young adults [22 males and 15 females; mean±SD, age 24.4±3.5; BMI 25.6±4.1 kg/m²] were measured in a single trial on the SECA® BIA machine having fasted overnight and abstaining from exercise for 12 hours. Multivariate analysis of variance was used to determine effects of gender on measures. To determine test-retest reliability, a subset of participants (26 healthy young adults) were measured 48 hours after the initial visit under the same conditions. Interclass correlation coefficients (ICC) were used to determine reliability of measures. **RESULTS:** Results: Males had higher (p<0.05) FFM, SMM, TBM, and VAT, whereas females had higher (p<0.05) FM, and ECW/TBW ratio. Correlation analysis revealed that all variables except ECW/TBW and BIVA were highly correlated between visit 1 and visit 2 (ICC>0.9) indicating reliability of measurements. **CONCLUSIONS:** Conclusion: SECA® scale measurements have high test-retest reliability. Future investigations should determine the validity of the SECA® compared to standard methods.

3203 Board #24 May 29 1:30 PM - 3:00 PM
Body Composition And Somatotype By Sex In Candidates That Apply To Dance And Theater University Degrees.

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 (No relevant relationships reported)

PURPOSE: To determine and to compare the body composition and somatotype profiles with anthropometric methods by sex in Mexican candidates that apply to dance and theater university degrees at the University of Guadalajara. **METHODS:** 264 (95 males, 169 females) Mexican candidates that applied to dance and theater university degrees were evaluated anthropometrically by certified staff by the International Society for the Advancement of Kinanthropometry (ISAK). A complete profile anthropometric evaluation according to ISAK methodology was performed for each subject. We estimated body composition by four compartments according to Kerr equations (adipose, muscle, bone, and visceral tissues), and Somatotype was determined by the Heath and Carter method (decimal equations). The sample was divided by sex. Body composition values (adipose tissue, muscle, bone) and the somatotype components were expressed as mean, standard deviation, minimum and maximum. T-test for independent samples was performed to compare variables by sex. **RESULTS:** Subject's age, weight, height, and body mass index were: 19 ± 3 and 19 ± 2 years, 67 ± 13 and 57 ± 12 kg; 172 ± 8 and 160 ± 6 cm; and 22 ± 4 and 22 ± 4 kg/m², for males and females, respectively. There were significant differences in all three compartments between males and females (percentage and mass). In the case of somatotype, we found that values of Endomorphy were lower and values of Ectomorphy were higher in males than females. Values of Mesomorphy were similar among sex. The mean value for males was Central (4-4-3), while in females was Mesomorphic Endomorph (5-4-2). **CONCLUSIONS:** In this study, we found that body composition, as well as somatotype, differs by sex. However, the sample was not divided by performing art (dance and theater), being able to find either similarities or differences with the existing literature.

Table 1. Body composition and somatotype profile of the evaluated subjects

Variable	Total (n=264)	Males (n=95)	Females (n=169)	p-value
Adipose tissue (%)	27 ± 7.4 (8-40)	20 ± 5.7 (8-32)	31 ± 4.4 (19-40)	<0.001
Adipose tissue (kg)	16 ± 6.2 (3-36)	14 ± 6.2 (3-32)	18 ± 5.7 (7-36)	<0.001
Muscle mass (%)	35 ± 5.1 (25-50)	40 ± 4.6 (29-50)	33 ± 3.4 (25-41)	<0.001
Muscle mass (kg)	21 ± 5.4 (13-43)	26 ± 4.5 (16-43)	18 ± 3.5 (13-40)	<0.001
Bone mass (%)	16 ± 2.1 (10-23)	17 ± 2.3 (10-23)	15 ± 1.8 (10-20)	<0.001
Bone mass (kg)	9 ± 1.7 (7-15)	11 ± 1.5 (7-15)	9 ± 1.1 (7-12)	<0.001
Endomorphy	4 ± 1.6 (1-8)	4 ± 1.5 (1-8)	5 ± 1.4 (2-8)	<0.001
Mesomorphy	4 ± 1.4 (1-11)	4 ± 1.3 (1-9)	4 ± 1.4 (1-11)	1.000
Ectomorphy	2 ± 1.4 (0-8)	3 ± 1.5 (0-8)	2 ± 1.4 (0-6)	<0.001

Data expressed as mean ± standard deviation (min-max)

3204 Board #25 May 29 1:30 PM - 3:00 PM
Cross-calibration Of Two Dual-energy X-ray Absorptiometry Systems For Body Composition Measurements In Young Adults

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 (No relevant relationships reported)

Dual-energy X-ray absorptiometry (DXA) is one of the most accurate methods to measure body composition, and it has been widely used in both clinical and research settings such as the Appendicular Lean Mass (ALM) in sarcopenia. The body composition results on the same client may vary depending on the manufacture, model and software version of the DXA. Therefore, it is important to compare the measurements between different systems in longitudinal research studies and clinical practice. **PURPOSE:** To properly cross calibrate the body composition measurements between the Prodigy and iDXA in young adults. **METHODS:** Thirty healthy college students, including ten males (23.7 ± 1.9 years; 171.9 ± 6.7 cm; 81.8 ± 11.4 kg) and twenty females (23.1 ± 1.9 years; 161.8 ± 6.1 cm; 64.9 ± 15.3 kg) participated in the study. Body composition was measured using two DXA systems: Prodigy and iDXA, and analyzed by enCORE version 13 and 17, respectively by the same licensed DXA technician on the same day. Paired sample t-tests and regression analyses were performed to compare the body composition variables between the two systems. **RESULTS:** No significant differences were found in total body and leg percent fat (%fat), total and leg Fat Mass (FM), and total Bone Free Lean Mass (BFLM) (p > 0.05). However, there were statistically significant differences in total body and leg Bone Mineral Content (BMC) (p = 0.000), arm %fat (p = 0.012), arm FM (p = 0.000), arm and leg BFLM (ALM, p = 0.000) between the two systems (**Table 1**). **Conclusion:** Our results suggest that calibration equations are needed for the appendicular lean mass when comparing body composition between the Prodigy and iDXA in young adults. Further study in older adults is needed for the comparison of sarcopenia assessment using the two models of DXA.

Table 1. Comparison of Regional Body Composition Between iDXA and Prodigy

Body Composition	iDXA	Prodigy	%Diff	P
Arm BFLM (lbs)	12.3 ± 5.6	12.6 ± 5.8	-2.37	0.012
Arm FM (lbs)	5.3 ± 2.3	4.3 ± 2.3	22.68	0.000
Leg BFLM (lbs)	35.6 ± 9.4	34.8 ± 9.4	2.23	0.000
Leg FM (lbs)	17.5 ± 7.9	17.6 ± 9.1	-0.34	0.83

BFLM: Bone Free Lean Mass; FM: Fat Mass

3205 Board #26 May 29 1:30 PM - 3:00 PM
The Effects Of Training Method And Experience Level On Measurement Error For Skinfold Thicknesses

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Accurate estimation of fatness from skinfolds is highly dependent on using the appropriate skinfold protocol, the methods of training and experience of the trainee. Purpose: To determine the effects of the type of training method and experience level on the accuracy of performing skinfold thickness measures at the triceps, subscapular and calf skinfold sites.

Methods: This study was designed to test the experience of the trainee using three different methods of training in a 2x3 factorial plan with a manual (M), audiovisual (AV) and in person (IP) training approach. Half of the trainees had no experience and half had some or considerable experience as judged by the number of subjects they had measured previously assessed by self report. Thirty subjects were randomly assigned to each of three methods in instruction (n=10/method). Half of the trainees were inexperienced in each training method. Three skinfolds (triceps, subscapular and calf) were measured using standardized procedures. To be trained on the skinfold measurement method, the M method group read a description of the skinfold method, the AV method group watched a training video, and the IP method group attended an IP workshop. All trainees measured the skinfolds of from 15 participants and were compared to an expert. An ANOVA was used to determine whether expert versus trainee systematic errors were different due to the method of training, experience level, or their interaction were significant.

Results: The mean systematic errors for the tricep were 1.0±0.9, 1.4±1.0, 1.0±0.6 for the M, AV and IP groups, respectively. For the calf, the mean errors were 1.4±0.7, 1.6±1.1, 0.7±0.3 for the M, AV and IP groups, respectively. For the subscapular, the mean errors were 1.1±1.0, 1.2±0.7, 0.8±0.7 for the M, AV and IP groups, respectively. There was no effect (p>0.05) of experience level or training method for all skinfolds except for the training method in the calf with the IP group trending toward the lowest error (p<0.10). The interaction between type of training and experience level was also not significant (p>0.05).

Conclusion: The systematic errors in measuring skinfolds were not influenced by experience level of the trainee or the training method however, outliers were found in every treatment group which contributed to the variability in the measures.

3206 Board #27 May 29 1:30 PM - 3:00 PM
Waist To Height Ratio: The Up To Date Method Of Predicting Chronic Disease Risk

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 (No relevant relationships reported)

Approximately 60-70% of the adult population is classified as overweight or obese, and it is estimated by 2030 adulthood obesity will increase by 33%. As obesity rates increase, there are associated increases of comorbidities such as cardiovascular disease, cancer, and type-2 diabetes. This increasing pandemic stresses the importance for healthcare professionals to efficiently and accurately measure body composition (BC), and most importantly determine chronic disease risk (CDR). Quantifiable values are important for exercise testing; however, CDR classifications may be more understandable to patients. There are many validated ways of obtaining BC and anthropometric measures (AM). Direct-segmental bioelectrical impedance analysis (DSM-BIA) directly measures both body and visceral fat (VF). AM aims to yield CDR by estimating fat, mainly in the splanchnic region. Although commonly used, inexpensive, and easy to perform, AM accuracy has been questioned. **PURPOSE:** The purpose of this study is to compare CDR between BC and AM techniques against DSM-BIA VF. **METHODS:** Males and females, 18 years and older, were recruited for a sample of 133. BC and AM were analyzed using body mass index (BMI), two waist circumference measurements: narrowest (nWC) and umbilicus (uWC), two waist-to-hip ratios: narrowest (nWHR) and umbilicus (uWHR), narrowest waist-to-height ratio (nWHtR), body fat percent (BF%) from three-site skinfold novice (nSK) and expert (eSK) trained clinicians, handheld bioelectrical impedance analysis (BIA), and DSM-BIA against DSM-BIA VF. Using consistent, numerical CDR stratification, the BC and AM values were assigned a classification. Paired sample t-tests were used to compare the CDR classifications between all measurements and DSM-BIA VF. **RESULTS:** When compared to DSM-BIA VF (1.30 ± 0.59), there was no statistical difference in CDR for nWHtR (1.37 ± 0.58), eSK (1.23 ± 0.54), and DSM-BIA BF% (1.37 ± 0.67) (p > 0.05). All other BC and AM were statistically different (p < 0.05) when compared to the DSM-BIA VF. **CONCLUSION:** VF is a key indicator of increased CDR and all-cause mortality. The DSM-BIA should be considered by clinicians due to

its accuracy in measuring both BF and VF. Our data suggests that out of all commonly used BC and AM, nWHtR, eSK, and DSM-BIA BF% predict CDR with equivalency to DSM-BIA VF.

3207 Board #28 May 29 1:30 PM - 3:00 PM
Association Between Television Viewing, Physical Fitness Markers, And Body Composition In College-Aged Adults

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 (No relevant relationships reported)

Obesity and sedentary behavior are major concerns in the United States. It has been observed that Americans who watch more television are at greater risk of becoming obese and have lower health-related fitness markers. Most literature, however, has not focused on college-aged adults. **PURPOSE:** The purpose of this study was to examine the association between daily screen time viewing (proxy of sedentary behavior) and health-related fitness markers in college-aged adults. **METHODS:** A total of one hundred and forty one college-aged subjects (mean age ± SD= 22.9 ± 2.6 years; percent body fat= 22.9 ± 10.3%) were separated into four groups in accordance to reported screen time (very low viewing time, low viewing time, moderate viewing time, and high viewing time) and participated in two data collection (screening & exercise) sessions. In the screening session, subjects completed an informed consent form, inclusion criteria form, screen time survey, and body composition assessment through a bioelectrical impedance analysis device. Seven days later, participants returned to complete a countermovement jump assessment of lower body anaerobic power and an aerobic capacity PACER test to assess cardiorespiratory fitness. **RESULTS:** Spearman rank-order correlation coefficient tests showed a significant positive correlation (p = 0.032, r = 0.352) between daily time spent watching television and vertical jump displacement for the very low viewing time group. A significant positive correlation (p = 0.022, r=0.402) between daily time spent watching television and PACER laps was found in the very low viewing time group as well as a significant negative correlation (p = 0.49, r = -0.340) in the high viewing group. However, there were no statistically significant associations between daily time spent watching television and percent body fat. A one-way ANOVA showed a statistically significant difference (p < 0.05) for viewing time groups. A Tukey post hoc analysis showed statistically significant differences (p < 0.001) between all viewing time groups. **CONCLUSION:** Lower amounts of daily television viewing in college-aged adults was associated with greater lower body power production and greater cardiorespiratory fitness. Higher amounts of daily television viewing were associated with decreased cardiorespiratory fitness.

3208 Board #29 May 29 1:30 PM - 3:00 PM
Three Methods Of Assessing Percent Body Fat In Healthy Older Adults

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PURPOSE: We compared body fat using three different body fat percent methods that can be performed in 60 seconds or less. One hundred healthy older adults between 60 and 88 years old (mean: 72.28) served as subjects. **METHODS:** The three methods used to assess body fat were the following: skinfold calipers using regressive equations developed from seven skinfold sites; tape measure using regression equations developed from waist, abdominal, and hip circumference measurements and age, height, and weight; and body mass index (BMI), using regression equations developed from BMI, age, and gender. **RESULTS:** Significant differences were found in the calculation of percent body fat between the three methods (F = 143.30825, p<.01). **CONCLUSION:** While excessive body fat is correlated with several diseases in older adults such as cardiovascular disease, diabetes, and stroke and is an important aspect of all health/wellness programs, assessing body fat can be very expensive and time consuming. The three quick and inexpensive methods of calculating percentage body fat however produced significantly varied calculations of percentage body fat. More research is needed to compare these three methods to the gold standard of measuring percent body fat such as hydrostatic weighing and Dual-Energy X-Ray Absorptiometry (DEXA).

3209 Board #30 May 29 1:30 PM - 3:00 PM

SOMATOTYPING IN COLLEGE TRACK & FIELD ATHLETES: EVALUATING CHANGE ACROSS A COMPETITIVE SEASON

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(No relevant relationships reported)

Coaches may find value in following track and field athletes' anthropometrics as the extended competitive season requires a unique balance of peak and maintained preparation. Somatotyping may offer a more holistic metric compared with BMI, mass, or body fat percentage alone when tracking changes across competition mesocycles. **PURPOSE:** The purpose of this study was to record track and field athletes' somatotype scores to elucidate potential changes across the competitive season according to sex and/or age. **METHODS:** Division II track and field athletes ($n=47$) were tested at the start and end of the outdoor season. Somatotype data were collected according to the Heath-Carter manual (skinfolds, girths, breadths, stature & mass). Raw data were converted to mesomorph, endomorph, and ectomorph scores. One-way RM ANOVAs with between subject variables (sex & age) were used to evaluate change in endomorphy, mesomorphy, and ectomorphy scores across the season. **RESULTS:** Scores for endomorphy ($F(1,45)=117.9, p<.001, \eta^2=.072$, males (M)= +3.2%, females (F)= -0.1%) and mesomorphy ($F(1,45)=10.1, p=.003, \eta^2=.018$, M = -3.4%, F = +4.6%) differed across time by sex, but not ectomorphy ($F(1,52)=0.03, p=.86, \eta^2=.001, M$ = -6.2%, F = -6.3%). Age did not influence somatotype scores across the season. **CONCLUSIONS:** The rigors of a competitive season may influence only certain sex-somatotype combinations. Influencing factors for the divergent changes in somatotype presently found should be identified to optimize training approaches.

3210 Board #31 May 29 1:30 PM - 3:00 PM

Relationships Between Sport Nutrition Knowledge, Body Composition And Body Weight Goal In Female Soccer Players.

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(No relevant relationships reported)

Sport nutrition knowledge may impact the quality of an athlete's dietary intake. It is currently unknown how sport nutrition knowledge (SNK) influences body composition and what factors may contribute to an athlete's body weight goal.

PURPOSE: To examine relationships between SNK and body composition and identify predictors of body weight goal in female collegiate soccer players.

METHODS: Twenty-six Division III female soccer athletes (height: 1.61 ± 0.30 m; body mass: 66.7 ± 7.5 kg; fat-free mass: 50.3 ± 6.5 kg; body fat %: 25.6 ± 5.1 %) participated in the current study. All players had body composition assessed using air displacement plethysmography and completed a validated questionnaire designed to assess sport nutrition knowledge. Athletes were also asked questions about perceived dietary requirements and body weight goal. Pearson correlation coefficients were assessed to examine relationships between SNK and body fat percentage (BF %), fat-free mass, fat-mass, body mass (BM), body mass index (BMI), and perceived dietary requirements. Multinomial logistic regression was used to identify predictors of body weight goal. Paired sample t -tests were used to compare differences between calculated and perceived dietary needs.

RESULTS: The mean number of questions answered correctly on the SNK questionnaire was 44.5 ± 11.2 %. An inverse relationship was observed between BF % and SNK ($r = -0.391; p=0.044$). Body mass, BMI and BF % were all significant predictors of body weight goal ($p<0.05$). For every 1% increase in BF % and 1 kg increase in BM, athletes were 1.3 times more likely to want to lose weight. For every 1 unit increase in BMI, athletes were 2.7 times more likely to want to lose weight. All players significantly underestimated daily energy (-578 ± 104.9 kcal/d, $p<0.001$) and carbohydrate (-283.7 ± 141.8 g/d, $p<0.001$) requirements when compared to their calculated required daily intakes.

CONCLUSIONS: Division III female collegiate soccer players have a low sport nutrition knowledge base which was associated with a higher BF %. Players who had a higher BM, BF % and BMI were more likely to have weight loss as a body weight goal. Players also significantly underestimated their energy and carbohydrate requirements based on the demands of their sport. Players could likely benefit from a sport nutrition education intervention.

3211 Board #32 May 29 1:30 PM - 3:00 PM

Body Composition Values Of Division 1 Men's Lacrosse Players Derived From Dual Energy X-ray Absorptiometry

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(No relevant relationships reported)

Total and regional body compositions are key components of sport performance. Dual energy X-ray absorptiometry (DXA) allows for precise measurements of body composition parameters between athletes who experience different competitive demands. Yet, accurate interpretation of DXA data is dependent on the availability of reference values. Despite the widespread use of DXA to measure body composition in collegiate athletes, positional reference values for men's lacrosse do not exist.

PURPOSE: To generate descriptive data for total and regional body composition in men's collegiate lacrosse players using DXA, and examine differences between positions. **METHODS:** Members of an NCAA Division 1 Men's Lacrosse team underwent DXA scanning and were categorized according to position. Descriptive statistics were calculated for total and regional body composition measures and differences between positions were examined using a one-way ANOVA or a Kruskal-Wallis test. **RESULTS:** A total of 98 players (age: 19.2 ± 1.0 yrs; height: 181.1 ± 7.0 cm; total mass: 82.4 ± 9.2 kg) completed the study (Attack; $n=24$, Midfield; $n=44$, Defense; $n=25$, Goalkeeper; $n=6$). The mean total body fat percentage (BF%) was 18.9 ± 3.4 % (range: 11.0 - 27.6). No differences in BF% between positions were identified (Attack= 18.9 ± 3.9 %, Midfield= 18.8 ± 4.2 %, Defense= 18.9 ± 3.7 %, GK= 20.5 ± 2.9 %; $p=0.79$). For the android region, no differences between positions were identified for fat mass (Attack= 1.0 ± 0.5 kg, Midfield= 1.0 ± 0.5 kg, Defense= 0.9 ± 0.4 kg, GK= 1.1 ± 0.5 kg; $p=0.9$), or lean mass (Attack= 4.3 ± 0.5 kg, Midfield= 4.3 ± 0.4 kg, Defense= 4.4 ± 0.3 kg, GK= 4.4 ± 0.8 kg; $p=0.7$). For the gynoid region, no differences between positions were noted for fat mass (Attack= 2.6 ± 0.8 kg, Midfield= 2.5 ± 0.9 kg, Defense= 2.7 ± 0.8 kg, GK= 0.3 ± 1.1 kg; $p=0.48$), or lean mass (Attack= 10.3 ± 1.6 kg, Midfield= 10.4 ± 1.0 kg, Defense= 10.5 ± 0.7 kg, GK= 10.4 ± 1.4 kg; $p=0.79$). **CONCLUSION:** Total and regional body composition measures did not vary across positions in a group of men's collegiate lacrosse players. These data suggest that the athletic demands across positions of men's collegiate lacrosse are not related to differences in body composition. Therefore, training programs tailored to specific positions may not be needed in order to achieve athletic success.

3212 Board #33 May 29 1:30 PM - 3:00 PM

Somatotype Of Female And Male Field Athletes: Comparing Between Sexes And Among Select Events

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(No relevant relationships reported)

Anthropometrics (e.g. BMI, mass, limb lengths) have their place in the discussion of sports performance, but their unidimensional view prevents whole-athlete evaluation. Classical somatotyping categorizes the human build into ectomorph (ECTO), mesomorph (MESO), and endomorph (ENDO) according to stature and mass distribution. Somatotyping may offer clues as to desirable physique when investigating human performance in a diverse athletic group like field athletes. **PURPOSE:** The aim was to compare the somatotype of Division II field athletes between sexes and among select events. **METHODS:** Somatotyping data were collected on competitive female ($n=9$, age: 20.0 ± 0.7 yrs., ht.: 173.4 ± 6.5 cm, body fat: 18.8 ± 5.2 %) and male ($n=16$, age: 19.9 ± 1.1 yrs., ht.: 183.4 ± 3.4 cm, body fat: 9.0 ± 2.8 %) field athletes nearing the conference championship; an assumption was made that athletes were in peak form. Raw data included stature (cm), mass (kg), skinfolds (mm), girths (cm), and breadths (cm) and were converted into ECTO, MESO, and ENDO scores. Independent t -tests were used to test significance. Data are represented as means and standard deviations. **RESULTS:** Data for female athletes were: ECTO= 2.76 ± 1.30 , MESO= 3.32 ± 1.64 , and ENDO= 8.02 ± 1.04 and for males were: ECTO= 2.78 ± 0.74 , MESO= 4.48 ± 0.75 , and ENDO= 5.00 ± 0.96 . Between the sexes, there was a difference for ECTO ($t(23)=7.33, p<.000$), but not MESO ($t(23)=-.05, p=.958$) or ENDO (equal variance not assumed; $t(9.91)=-2.01, p=.073$) scores. Among the multi-field athletes (female heptathletes= 3 and male decathletes= 5) there were not any differences for ECTO (2.99 ± 1.56 vs. $3.08 \pm 0.54, p=.907$) or MESO (2.91 ± 1.43 vs. $4.13 \pm 0.73, p=.153$) scores, but there was a difference for ENDO (7.81 ± 1.10 vs. $4.79 \pm 0.71, p=.003$) scores. The jumpers (long, high, and triple; females= 3 and males= 7) were not different on ECTO (3.27 ± 0.65 vs. $2.81 \pm 0.76, p=.396$), but they differed on both MESO (2.77 ± 0.94 vs. $4.54 \pm 0.72, p=.011$) and ENDO (7.00 ± 0.42 vs. $5.28 \pm 0.96, p=.020$) scores. **CONCLUSIONS:** Evidence regarding somatotype among competitive athletes is interesting but

ambiguous. Investigating scores between multi-field athletes and uni-field athletes and aligning somatotype with performance data to ascertain potential predictive relationships are the next steps in this inquiry.

3213 Board #34 May 29 1:30 PM - 3:00 PM
Somatotyping Male And Female Sprinters And Endurance Sprinters

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Coaches and athletes plan for peak physical condition to occur at specified times during the competitive season (e.g. conference championship). Depending upon the event, athletes may or may not have similar somatotypes (endomorph=Endo, ectomorph=Ecto, and mesomorph=Meso). It is currently unclear whether competitive, Division II sprinters and endurance sprinters differ in somatotype. **PURPOSE:** The aim was to calculate somatotype of male and female collegiate sprinters and endurance sprinters preceding their outdoor conference championship. **METHODS:** Athletes ($n=18$) were tested near the end of their outdoor season. Somatotype data were calculated, for sprinters ($n=10$; 100m and 200m) and endurance sprinters ($n=8$; 400m), according to the Heath-Carter manual [breadths (cm), girths (cm), stature (cm), mass (kg), and skinfolds (mm)]. Comparisons were made by independent t-tests. Means and standard deviations are presented. **RESULTS:** Male sprinters ($n=5$, age: $19.8 \pm .5$ yrs., ht.: 180.3 ± 10.5 cm, wt.: 73.2 ± 10.2 kg, body fat: $6.1 \pm .9\%$) displayed as Endo= $4.74 \pm .69$, Ecto= $3.09 \pm .92$, and Meso= 3.71 ± 1.03 and endurance sprinters ($n=4$, age: $19.5 \pm .6$ yrs., ht.: 181.9 ± 3.9 cm, wt.: 73.2 ± 4.2 kg, body fat: $6.2 \pm 1.6\%$) displayed as Endo= $4.40 \pm .46$, Ecto= $3.31 \pm .26$, and Meso= $3.84 \pm .70$. Male sprinters and endurance sprinters were not significantly different on Endo ($t(7)=.85$, $p=.424$), Ecto (equal variance not assumed; $t(4.79)=-.52$, $p=.628$), or Meso ($t(7)=-.22$, $p=.830$) scores. Female sprinters ($n=5$, age: 19.2 ± 1.3 yrs., ht.: 166.4 ± 5.4 cm, wt.: 60.8 ± 4.6 kg, body fat: $15.5 \pm 5.3\%$) displayed as Endo= 7.45 ± 1.21 , Ecto= $2.50 \pm .75$, and Meso= $3.21 \pm .94$ and endurance sprinters ($n=4$, age: 19.8 ± 1.7 yrs., ht.: 167.9 ± 5.0 cm, wt.: 58.6 ± 2.7 kg, body fat: $15.8 \pm 5.5\%$) displayed as Endo= 7.39 ± 1.37 , Ecto= $3.13 \pm .74$, and Meso= $2.70 \pm .67$. Female sprinters and endurance sprinters were not significantly different on Endo ($t(7)=.08$, $p=.942$), Ecto ($t(7)=-1.27$, $p=.245$), or Meso ($t(7)=.91$, $p=.393$) scores. **CONCLUSIONS:** There was no difference in the somatotype of male and female sprinters and endurance sprinters. Further research should be conducted to analyze the relationships between early season somatotype, late season somatotype, and performance season long.

3214 Board #35 May 29 1:30 PM - 3:00 PM
The Relation Of Body Composition Methodologies Between Sports In Division 1 Collegiate Athletes.

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Body composition has a significant impact on athletic performance, as well as overall health and wellbeing. Athletes and coaches often attempt to optimize performance by changing body composition without sport specific guidelines. Several techniques for measuring body composition exist, but the validity compared to the DXA has not been fully elucidated in athletic populations in various sports. **PURPOSE:** The aim of this study is to examine the relationship of surrogate body composition methodologies in Division 1 NCAA men's and women's sports. **METHODS:** Student athletes from men's (baseball, swim and dive, track, and tennis) and women's (softball, soccer, basketball, swim and dive, track and, tennis) sports volunteered to participate in 3 measures of body composition including Dual Energy X-ray Absorptiometry (DEXA), Bioimpedance Analysis (BIA), and 3D body imaging (FIT-3D). **RESULTS:** 106 assessments were completed (age 19.7 ± 1.4 y, mean \pm SD) with 84 athletes (61 Female, 17 African American athletes). The average weight, lean mass (LM), and % body fat (%BF) by DXA for men were 79.8 ± 9.0 kg, 67.7 ± 8.1 kg, and $15.9 \pm 1.5\%$ and women were 69.6 ± 9.5 kg, 54.5 ± 7.3 kg; and $25.5 \pm 3.9\%$, resp. Matched pairs analysis showed that compared to DXA, BIA underestimated LM and overestimated %BF in women ($-1.9 \pm .3$ kg; $P<0.0001$; $0.8 \pm .4\%$; $P=0.04$), but missed statistical significance in men (-1.2 ± 1.1 kg; $P=0.3$; $1.5 \pm .7\%$; $P=<0.07$), resp. Likewise, the FIT-3D over estimated LM and underestimated %BF in women ($0.4 \pm .4$ kg; $P=0.3$; $-2.4 \pm .3\%$; $P<.0001$), but not men (0.8 ± 1.2 kg; $P=0.6$; $-0.8 \pm .5\%$; $P=0.2$), resp. compared to DXA LM and %BF. Linear regression analysis from the Bland-Altman analysis shows a significant bias for male BF% from the FIT-3D to DXA ($r=0.61$; $P=0.009$), as well as BIA to DXA ($r=0.80$; $P<0.0001$). **DISCUSSION:** This is an ongoing longitudinal study of which this cross-sectional data was used to examine the relationship between body composition methodologies. Understanding the sex specific mean differences and bias between

body composition methodologies may assist in the development of algorithms to improve the correlation between the criterion standard measure (DXA) and surrogate measures.

3215 Board #36 May 29 1:30 PM - 3:00 PM
Evaluating Fat Free Mass Index For Sport Specific Performance Goals In Female Collegiate Athletes

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(No relevant relationships reported)

Fat free mass index (FFMI) in an athletic female population is computed as (bone mineral content + lean mass / height²). It has been associated with performance and training status in their relevant sport, collegiate female athletes need to optimize bone mineral density (BMD), and lean mass as multiple factors impact their levels, including: the type of sport, nutrition, menstrual cycle, training program variation, lifestyle habits, and genetics. **PURPOSE** To compare FFMI and lower body BMD across female collegiate athletes and sedentary control considering their desired sport-specific performance and training. **METHODS** A sample of 68 women (Mean \pm SD; Age: 20.89 ± 1.91 yrs, Height: 1.65 ± 0.07 m, and Weight: 62.25 ± 10.11 kg) including 43 females collegiate athletes ($n=23$ hockey players, $n=20$ synchronize swimmers) and 25 sedentary university students received a scan using dual-energy x-ray absorptiometry (DEXA). ANOVA was used to evaluate differences in: FFMI, and regional BMD in the spine and the femur. **RESULTS** The FFMI of hockey players (18.11 ± 1.33 kg/m²), was significantly ($p<.05$) higher than both the synchronized swimmers (15.43 ± 1.25 kg/m²) and the controls (14.99 ± 1.45 kg/m²). Hockey players, compared to synchronized swimmers and the control group, have a higher BMD of the spine, $F(2, 65) = 13.391$, $p<.05$, FFMI, $F(2, 66) = 37.06$, $p<.05$. BMD of the total femur in the hockey players was great than the controls, $F(2, 65) = 4.06$, $p<.05$. Total lean mass of synchronized swimmers (40.77 ± 3.67 kg.) was greater ($p<.05$) than the control group (36.65 ± 5.30 kg). **CONCLUSION** BMD and FFMI of the control group compared to female athletes show how sports' demands influence bone's health in a female collegiate population. BMD and FFMI of hockey players compared to synchronized swimmers may demonstrate the importance of percussive activities for bone health in female athletes. Differences in FFMI between female hockey players and synchronize swimmers suggest that establishing sport-specific norms in this new measure may help coaches and strength specialists better tailor training programs to optimize performance and bone health in varsity athletes.

3216 Board #37 May 29 1:30 PM - 3:00 PM
Validity Of The Portable Ultrasound Device To Estimate Body Fat Percentage.

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Many studies have performed to examine the validity of those tools to measure body composition, including DEXA (Dual-energy X-ray absorptiometry), underwater weighing (UWW), Skin-fold thickness (SFT), and Bioelectrical impedance analysis (BIA). Technological advances now permit the use of the portable ultrasound device for the field measures. But no information is available regarding the validity of the device in collegiate students. **Purpose:** The purpose of the present study was to examine the validity of Body Metrix™ ultrasound device for estimating percent body fat in normal and obese college-aged male participants, compared to DEXA. **Methods:** In total, ninety-eight (73 Normal, 25 Obese, 20.11 ± 2.13 years, 175.15 ± 6.00 cm, 73.63 ± 13.92 kg) male collegiate students volunteered for this study. Height and weight were measured and participants' percent body fat was measured twice; 1) the DEXA (Dual-energy X-ray absorptiometry; GE Lunar, Madison, WI, USA) and 2) the BodyMetrix BX2000 (IntelaMetrix, Livermore, CA, USA) using Pollock three site technique (P3). For data processing, the average and standard deviation of the data were calculated by using SPSS 25.0 program and MedCalc program. Correlation analysis (r) and Bland & Altman were performed to examine the validity of the portable ultrasound device. Mean absolute percentage errors (MAPEs) were calculated as measurement errors. **Results:** There was a strong correlation between DEXA and Body Metrix™ ultrasound device (Normal, $r = 0.84$, $p = 0.001$); Obese, $r = 0.80$, $p = 0.001$). Bland-Altman analysis identified that 95% relative limits of agreement for the portable ultrasound device were again clinically acceptable in participants with BMI <25 and BMI ≥ 25 (-1.90% to 7.70% and 5.20% to 16.58% , respectively). MAPEs were 20.3% and 36.3 for normal BMI and Obese participants, respectively. **Conclusion:** We found that the Body Metrix™ ultrasound device appears to be an

alternative measurement to estimate percent body fat. However, relatively large MAPEs indicated that Body Metrix™ ultrasound device requires careful interpretation to estimate percent body fat in clinically obese collegiate participants.

3217 Board #38 May 29 1:30 PM - 3:00 PM
Effects Of Blood Flow Restriction And Neuromuscular Electrical Stimulation On Muscle And Adipose Tissue Thickness Of The Calves

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Accelerated muscle atrophy is an important factor to consider in several different environments such as spaceflight, paralysis, immobilization, and aging. Understanding optimal exercise countermeasures in such environments is therefore necessary to examine. **PURPOSE:** To assess muscle and adipose tissue thickness in the calves while using the unconventional training methods of blood flow restriction (BFR) and neuromuscular electrical stimulation (NMES). **METHODS:** Six sedentary participants (4 males and 2 females; 20.5 ± 1.4 yrs, 73.5 ± 13.8 kg) underwent 6 weeks of calf training with each leg randomly assigned to one of three conditions: 1) BFR (n=4), 2) NMES (n=3), and 3) combined BFR+NMES (n=5). A control group of seven sedentary participants (4 males and 3 females; 23.1 ± 4.3 yrs, 75.1 ± 12.2 kg) were also used. Adipose tissue thickness was measured via ultrasound and skinfolds while muscle thickness of the gastrocnemius and soleus was assessed via ultrasound. Comparisons were made using separate two-way ANOVA's for each variable. **RESULTS:** A significant main effect of time was found for ultrasound measurements of the lateral ($p = 0.0021$) and medial ($p = 0.0467$) adipose tissue. A significant interaction effect was found for medial adipose tissue ($p = 0.0282$) with post-hoc comparisons revealing a significant increase in medial adipose tissue thickness with the BFR ($p = 0.0176$). No differences were found in muscle thickness for both the medial and lateral gastrocnemius, however, there was a significant main effect of time ($p = 0.0025$) and interaction ($p = 0.0013$) for soleus muscle thickness. Post-hoc comparisons showed a significant increase in soleus muscle thickness with the BFR+NMES condition ($p = 0.0029$) only. **CONCLUSION:** These results suggest that a combined BFR+NMES training condition may be a feasible method for increasing soleus muscle thickness with 6 weeks of training. Additional research is warranted to elucidate the potential use of BFR and NMES for stimulating positive physiological change in the calves. Supported by National Institute of Health grants UL1GM118979; TL4GM118980; RL5GM118978.

3218 Board #39 May 29 1:30 PM - 3:00 PM
Development And Cross-validation Of A Bmi-based Equation For Percent Fat In Children With Intellectual Disability

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Children with intellectual disability (ID) have higher rates of obesity than children without ID, and the management of obesity might be facilitated through simple and accurate methods for estimating percent body fat (%BF) in children with ID. **PURPOSE:** To develop and cross-validate an equation for estimating %BF from Body Mass Index (BMI), age, sex and other independent variables in children with ID. **METHODS:** Participants were 107 children (aged 6-15 years) with ID allocated to development (N = 81; 50 boys; age 12 ± 3 years) and cross-validation (N = 26; 13 boys; age 12 ± 3 years) samples. Dual-Energy X-Ray Absorptiometry (DXA) served as the criterion method for %BF determination. Candidate predictor variables for estimation of DXA-determined %BF were BMI, age, sex, disability status, ID level, ethnicity, and presence of diseases. Using the data from the development sample, we derived a %BF prediction equation with hierarchical linear regression. The performance of the equation was assessed in the cross-validation sample by comparing the actual (DXA-determined %BF) and predicted (Equation-determined %BF) values with paired-samples t-test, Pearson's correlation coefficient, mean absolute and root mean square errors, and Bland-Altman plot. **RESULTS:** BMI, age, and sex (0=boy; 1=girl) were significant predictors of %BF ($p < 0.001$; $R^2 = 0.66$; SEE = 5.95% BF). Disability, ID level, ethnicity, and presence of diseases did not significantly contribute to the model ($p > 0.05$). The equation was: $\%BF = 15.269 + (1.412 \times BMI) - (1.350 \times age) + (5.362 \times sex)$. The equation had high accuracy during cross-validation as indicated by: (i) strong correlation between actual and predicted %BF ($r = 0.80$; $p < 0.001$); (ii) non-significant difference between

actual and predicted %BF ($30.2 \pm 7.1\%$ and $28.6 \pm 9.6\%$, respectively; $p > 0.05$); (iii) mean absolute and root mean square error of $4.4 \pm 4.1\%$ and 5.6% , respectively; and (iv) small mean overestimation of DXA-determined %BF but somewhat wide limits of agreement in the Bland-Altman plot (mean error: -1.53% ; 95% CI: 10.2% , -13.3%). **CONCLUSIONS:** BMI, age and sex significantly predicted %BF in children with ID. The developed equation was cross-validated for estimating %BF in children with ID. Supported by FAPESP Grants 2019/07103-6, 2018/02795-4, 2018/02677-1, and 2017/13071-4

3219 Board #40 May 29 1:30 PM - 3:00 PM
Development Of A Dxa-derived Body Volume Equation In Hispanic Adults For Administering In 4-compartment Models

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PURPOSE: The purpose of the current study was two-fold: 1) to develop a new dual energy X-ray absorptiometry (DXA)-derived body volume (BV) equation with the GE-Lunar Prodigy while utilizing underwater weighing (UWW) as a criterion and 2) cross-validate 4-compartment(4C) models when utilizing the new DXA-derived BV equation (4C-DXA_{NICKERSON}), Wilson DXA-derived BV equation (4C-DXA_{WILSON}), and air displacement plethysmography (ADP)-derived BV (4C-ADP) in Hispanic adults. **METHODS:** 191 Hispanic adults (18-45yrs) participated in the current study. The development sample consisted of 60 females and 60 males whereas the cross-validation sample comprised of 41 females and 30 males. Criterion body fat percentage (BF%) and fat-free mass (FFM) were determined using a 4C model with UWW as a criterion for BV (4C-UWW). The new DXA-derived BV equation (Nickerson) was developed by linearly regressing UWW-derived BV with DXA fat mass (FM), lean mass (LM), and bone mineral content (BMC). 4C-DXA_{NICKERSON}, 4C-DXA_{WILSON} and 4C-ADP were compared against 4C-UWW in the cross-validation sample. **RESULTS:** The new DXA-derived BV equation (L) was generated in the development sample as follows: $(FM/0.91) + (LM/1.06) + (BMC/16.95) + 0.268$. 4C-DXA_{NICKERSON}, 4C-DXA_{WILSON}, and 4C-ADP all produced similar mean values (BF%=21.04±5.99, 22.23±6.93, and 20.62±6.26%, respectively) when compared to 4C-UWW (21.29±6.14%) in Hispanic males (all $p > 0.05$). 4C-DXA_{NICKERSON} also yielded similar BF% and FFM values as 4C-UWW when evaluating the constant error (CE) in Hispanic females (CE=-0.79% and 0.38kg; $p=0.060$ and 0.174 , respectively). However, 4C-DXA_{WILSON} produced significantly different BF% and FFM values (CE=3.22% and -2.20kg, respectively; both $p < 0.001$). Additionally, 4C-DXA_{WILSON} yielded significant proportional bias when estimating BF% (coefficient=0.226; $p < 0.001$) whereas 4C-ADP produced significant proportional bias for BF% and FFM (coefficient=0.188 and -0.084; both $p < 0.05$) when evaluated in Hispanic females. **CONCLUSIONS:** Current study findings demonstrate that 4C-DXA_{NICKERSON} is a valid measure of BV in Hispanics and is recommended for use in clinics where DXA is the main body composition assessment technique.

3220 Board #41 May 29 1:30 PM - 3:00 PM
Physiological And Anthropometric Predictors Of Discrepancies Between Bioelectrical Impedance Analysis And Dual-energy X-ray Absorptiometry

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 (No relevant relationships reported)

Assessment methods such as dual-energy x-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA) are commonly used to determine molecular-level body composition estimates in both healthy and clinical populations. Though discrepancies in body composition estimates between BIA and DXA have been previously reported, virtually no investigations have explored potential predictor variables that may explain the disagreement between these methods. **PURPOSE:** To explore the physiological and anthropometric predictors of discrepancies between DXA and BIA total body composition estimates. **METHODS:** During a single visit, 103 female participants (Mean ± SD; 33.4 ± 15.9 years; 65.6 ± 12.1 kg; 165.5 ± 6.3 cm; 32.2 ± 7.4 DXA body fat percentage [BF%]) and 76 male participants (33.8 ± 14.5 years; 83.9 ± 15.1 kg; 178.8 ± 6.6 cm; 22.9 ± 8.0 DXA BF%) underwent body composition assessment via DXA and 8-point single-frequency BIA. Potential predictors of the discrepancies between DXA and BIA body composition estimates were obtained during the same visit using air displacement plethysmography,

bioimpedance spectroscopy, and 3-dimensional optical scanning. Select DXA variables were also utilized as predictors. Ordinary least squares regression was conducted to predict the differences in total fat mass (FM) and total lean soft tissue (LST) between DXA and BIA. Standardized model coefficients (β), p-values for coefficients, and R^2 values were generated. **RESULTS:** For FM estimates, significant predictors ($p \leq 0.01$) of the differences between DXA and BIA were hydration of LST (TBW:LST; $\beta = -0.82$), height ($\beta = -0.78$), percentage of TBW as extracellular fluid (%ECF; $\beta = -0.36$), and the male sex ($\beta = 0.26$). For LST, significant predictors of the errors between DXA and BIA were TBW:LST ($\beta = 0.85$), height ($\beta = 0.77$), %ECF ($\beta = 0.40$), the male sex ($\beta = -0.22$), and racial identification as Black ($\beta = -0.09$). The R^2 values for regression models predicting differences between DXA and BIA were 0.80 to 0.86 for FM and 0.73 to 0.87 for LST. **CONCLUSION:** Hydration variables and height are primary predictors of discrepancies between DXA and BIA total body composition estimates.

3221 Board #42 May 29 1:30 PM - 3:00 PM
Explaining Segmental Lean Soft Tissue Discrepancies Between Bioelectrical Impedance Analysis And Dual-Energy X-Ray Absorptiometry
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 (No relevant relationships reported)

Interest in evaluating the composition of specific anatomical regions has become commonplace in a variety of settings. Appendicular lean soft tissue (A_{LST}) estimates are considered in the diagnosis of sarcopenia. While dual-energy x-ray absorptiometry (DXA) is viewed as a reference method for regional assessments, its availability is limited. Thus, explaining discrepancies in regional body composition estimates between DXA and the more accessible bioelectrical impedance analysis (BIA) is of utmost importance. **PURPOSE:** To assess the anthropometric and physiological predictors of variations between BIA and DXA segmental lean soft tissue (LST) estimates. **METHODS:** During a single visit, 179 participants (103 females, 76 males; Mean \pm SD: 33.6 \pm 15.3 years; 73.4 \pm 16.2 kg; 171.2 \pm 9.2 cm; 28.2 \pm 8.9% DXA body fat %) underwent body composition assessments via DXA and 8-point single-frequency BIA. Potential predictors of discrepancies between DXA and BIA LST estimates were obtained from these methods and additional laboratory techniques. Specifically, air displacement plethysmography, 3-dimensional optical scanning, and bioimpedance spectroscopy were used to estimate body volume, anthropometrics, and hydration variables, respectively. Significant predictors ($p \leq 0.05$) of the mean difference between DXA and BIA estimates of trunk LST (T_{LST}) and A_{LST} were established using ordinary least squares regression. Standardized model coefficients, p-values for coefficients, and R^2 values were generated. **RESULTS:** For both T_{LST} and A_{LST} , extracellular fluid percentage, LST hydration, height, total LST mass, the male sex, and racial identification as Black significantly predicted discrepancies between DXA and BIA. Additional predictors for T_{LST} discrepancies were DXA total fat mass (FM) to LST ratio and DXA T_{LST} , while additional predictors of A_{LST} discrepancies included DXA A_{LST} , DXA FM to LST ratio of the legs, DXA appendicular FM, and DXA-derived volume of the arms and legs. Regression models including these significant predictor variables produced R^2 values of 0.92 and 0.95 for T_{LST} and A_{LST} , respectively. **CONCLUSIONS:** Hydration variables, the quantity of LST in the region of interest, and height were the most influential predictor variables for discrepancies between DXA and BIA segmental LST estimates.

3222 Board #43 May 29 1:30 PM - 3:00 PM
Abstract Withdrawn

F-54 Free Communication/Poster - Training
 Friday, May 29, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

3223 Board #44 May 29 1:30 PM - 3:00 PM
Effects Of Training With Blood Flow Restriction On Muscular Strength: Meta-analysis
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Blood flow restriction (BFR) training has been a breakthrough in both practice and equipment used in the field of exercise science and rehabilitation. However, previous literature showed inconsistent findings regarding the effects of BFR training on muscle strength. **PURPOSE:** The purpose of this study was to analyze how different types of BFR training influence muscular strength by means of a meta-analysis. **METHODS:** The review was conducted according to the Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines. The following databases were used to conduct the research: Academic Search Complete, Medline, Web of Science, SPORT-Discus, HealthSource: Consumer, and HealthSource: Nursing. Search words used included "blood flow restriction" * AND strength*. The following search limited to full text articles, peer-reviewed academic journals, and published in the English language. Out of 327 articles, 25 were eligible to be included where 47 ESs were calculated. Comprehensive meta-analysis v.3 software was used to examine a random effect model and moderator analysis of the collected data. **RESULTS:** The results showed that BFR training had positive effects on skeletal muscle strength. The overall effect size (Cohen's d) was .558 (95% CI=.385, .731) which yielded a medium effect. The moderator analysis identified a group difference in workload (15-60% (ES=.423, SE=.090), >60% (ES=1.004, SE=.181), Qbetween=9.008, df=2, p=.011. However, gender, intervention length, mode (upper body, lower body) and cuff type/pressure did not affect the muscular strength. **CONCLUSION:** This study confirmed that BFR training has a moderate impact on increase of skeletal muscle strength. Also, the study identified that more than 60% of workloads in exercise result in greater strength gain compared to 15 to 60% workloads. The results of this meta-analysis can help design optimal exercise interventions to maximize increases in muscle strength through BFR training.

3224 Board #45 May 29 1:30 PM - 3:00 PM
Effects Of Blood Flow Restriction And Neuromuscular Electrical Stimulation On Strength Of The Plantar Flexors
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 (No relevant relationships reported)

Exposure to a microgravity environment removes the frequent loading of postural, or antigravity muscles, such as those found in the calf. Due to this reduced stimulation, muscle mass and strength are greatly reduced. Blood flow restriction (BFR) and neuromuscular electrical stimulation (NMES) are unconventional training methods that have been shown to elicit growth in thigh and wrist musculature. However, the effects of these methods on the calves are unknown. **PURPOSE:** The purpose of this study was to explore the effectiveness of BFR and NMES individually and in combination for increasing calf strength. **METHODS:** Thirteen participants (9 males and 4 females; 20.15 \pm 1.72 yr, 69.95 \pm 11.45 kg) were recruited from California State University, Long Beach with each leg being randomized to one of three training conditions: 1) BFR only, 2) NMES only, or 3) BFR and NMES, for six weeks of training. Calf strength was measured using an isokinetic dynamometer to assess peak and average torque during maximal plantar flexion contractions through a range of velocities (0-210 deg/s). Comparisons were made using separate two-way ANOVA's for each variable. **RESULTS:** Average isometric torque during five second maximal plantar flexion contractions increased in the NMES (P=0.019) and BFRNMES groups (P=0.01), while peak isometric torque only increased in the NMES group (P=0.031). Peak torque at 30 deg/sec and 90 deg/sec increased only with BFRNMES (P=0.001 and P=0.008, respectively). A significant main effect for time was found at 60 deg/sec (P=0.014) and 210 deg/sec (P=0.019), with no differences found during post-hoc comparisons. No significant differences were found at the other velocities. **CONCLUSION:** NMES and BFRNMES conditions may have potential for increasing strength of the plantar flexors at slower velocities (≤ 90 deg/sec). This study adds to the literature regarding the feasibility of these methods as alternative exercise countermeasures for promoting favorable adaptations in the calf musculature.

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3225 Board #46 May 29 1:30 PM - 3:00 PM
Discomfort And Ratings Of Perceived Exertion To Practical Vs. Traditional Blood Flow Restriction Resistance Exercise

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 (No relevant relationships reported)

Elastic knee wraps are used to produce blood flow restriction (BFR) but it is unclear how discomfort and perceived exertion may compare to more traditional ways of producing BFR such as nylon cuffs where the pressure is known. **PURPOSE:** To investigate how elastic knee wraps (practical) compare in ratings of perceived exertion (RPE) and discomfort after exercising to failure when compared to nylon cuffs (traditional) or low and high loads without BFR.

METHODS: Nine participants (male=7, female=2) completed this study. The average age and body mass index were 22 (4) years and 25.4 (1.5) kg/m². Each participant completed six conditions, in a randomized order, of unilateral knee extension exercise to failure for four sets. Two conditions (30% one-repetition maximum, 1-RM) included elastic knee wraps that were either stretched by two inches from resting length (Practical-Low) or they were stretched to a new length that was 85% of the thigh circumference (Practical-High). Two more conditions (30%-1RM) used nylon cuffs that were inflated to either 80% (BFR-High) or 40% (BFR-Low) of arterial occlusion pressure. The last two conditions had no restriction stimulus and were 30% 1-RM (LL) or 70% 1-RM (HL). Discomfort (0-10) and RPE (6-20) were measured before exercise and at the end of the four sets. The change scores from before exercise to the end of set 4 were used for analysis. Friedman's test and Conover's post hoc test were used to determine if there was a difference in discomfort and RPE between conditions. Statistical significance was set at p<0.05. **RESULTS:** Practical-High had larger changes in discomfort compared to HL (8 vs 6, p=0.007) and LL (8 vs 6, p=0.018). Practical-Low had a smaller change in discomfort compared to BFR-High (7 vs. 9, p=0.028) but it was not different from BFR-Low (7 vs. 7, p=0.450). No differences were found between Practical-High vs. BFR-High (8 vs. 9, p=0.211) or Practical-High vs. BFR-Low (8 vs 7, p=0.316). Practical-Low had smaller changes in RPE compared to BFR-High (12 vs 11, p=0.024) but there was no difference in RPE between Practical-High and the other conditions (p>0.05).

CONCLUSIONS: When exercising to failure, both discomfort and RPE are impacted by the pressure used and elastic knee wraps can produce changes in discomfort and RPE levels that are comparable to high pressure BFR.

3226 Board #47 May 29 1:30 PM - 3:00 PM
Training-induced Changes In The Control Of Heart Rate Throughout A Competitive Season In Collegiate Female Swimmers.

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In competitive swimming, overload training is often used to elicit transient states of overreaching in the hopes that subsequent periods of taper will lead to performance supercompensation. However, if the overload stress is too great relative to the level of recovery, fatigue will accumulate and cause both a greater risk of injury and more prolonged decrements in performance. Measures of vagal control of the heart rate (HR) have been shown to reflect the balance between training-induced fatigue and recovery, and so those measures can provide valuable feedback to help guide coaches as they develop and revise training plans. **PURPOSE:** The purpose of the present study was to use three different indicators of vagal control of HR to investigate the impact of overload training and tapering in collegiate female swimmers. Those indicators were the resting logarithm of the root mean square of successive R-R intervals (lnRMSSD_{rest}), HR responses to forced breathing (HR_{diff}), and HR responses to one minute of sustained handgrip exercise (HR_{hg}). **METHODS:** Thirteen female Division-I swimmers performed lnRMSSD_{rest}, HR_{diff}, HR_{hg} assessments three times throughout their competitive season: 1. at the beginning of the season (BL), 2. eleven weeks later during a period of intense overload training (OL), and 3. another eleven weeks later and following a taper (TP). Differences in the cardiovascular variables during BL, OL, and TP were determined using repeated measures ANOVAs. **RESULTS:** Very large decreases in lnRMSSD_{rest} (p<0.01) and increases in HR_{hg} (p<0.05) occurred during OL, but those values then returned to BL levels during TP (p<0.05 and p<0.01, respectively). By contrast, HR_{diff} values fell progressively throughout the season, and there was a large difference between the BL and TP measurements (p<0.05). **CONCLUSION:** Changes in all three variables demonstrated that OL impaired vagal

stimulation of the heart, and the bulk of evidence indicated that vagal stimulation was fully restored during TP. This was one of only a few longitudinal studies that have investigated the control of HR over the course of an entire competitive swim season, and it was the first study to demonstrate that overload training and taper can alter HR responses to both forced breathing and sustained handgrip exercise.

3227 Board #48 May 29 1:30 PM - 3:00 PM
Peripheral Heart Action Training: A Metabolic Profile With Between Sex Comparison

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ABSTRACT

Peripheral heart action (PHA) is a time-efficient and under-researched style of circuit training that alternates upper and lower body exercises with minimal rest between sets. **Purpose:** To compare the metabolic profile of PHA to traditional (TRAD) resistance training (RT) and report sex-specific responses during each. **Methods:** In a repeated measures design, twenty resistance-trained individuals underwent two bouts of volume-matched RT: PHA and TRAD. For PHA, subjects executed 6 consecutive lifts (75% 10-RM, 12-15 repetitions) in circuit fashion with little rest between them. Four rounds were performed, and one minute of rest was allotted between rounds. Volume-load and intensity were matched for the subsequent bout of TRAD, during which straight-sets were performed and 90 seconds of rest was allotted between every set. Oxygen uptake (VO₂), heart rate (HR), blood lactate concentration [La], rating of perceived exertion (RPE), and excess post-exercise oxygen consumption (EPOC) were measured. **Summary of Results:** PHA elicited significantly greater %VO₂Max (45±7.1 vs. 28±4.3%, p<0.0001), %HRmax (80±4.0 vs. 61±9.1% p<0.0001), RPE (16±1.8 vs. 12±2.0, p<0.0001), and EPOC (9.6±2.4 vs. 7.1±1.4 ml/kg/min, p<0.0001) compared to TRAD. PHA was also completed in less time (20±3.2 vs. 46±3.8 min, p<0.0001). Compared to TRAD, [La] was significantly higher at mid-exercise (8.1±1.5 vs. 5.6 ±1.9 mmol/L, p<0.0001), post-exercise (10.5±2.8 vs. 5.2±1.8 mmol/L, p<0.0001), and 5-min post-exercise (10.3±3.0 vs. 4.5±1.9 mmol/L, p<0.0001) during PHA. There were no between sex differences for [La] at any time-point for TRAD. During PHA, [La] was significantly higher for males at mid-exercise (9.6±2.0 vs. 6.6±2.4 mmol/L, p = 0.008), post-exercise (12.1±2.0 vs. 8.9±2.5 mmol/L, p = .006), and 5-min post-exercise (12.2±2.1 vs. 8.4±2.4 mmol/L, p = .002). No between sex differences were detected for HR, VO₂, or RPE for either style of RT. **Conclusion:** PHA is a time-effective and metabolically demanding circuit that may be employed to stimulate musculoskeletal and cardiorespiratory adaptations. Males produced more lactate than females during PHA, and one may speculate this was caused by discrepancies in total-body lean-mass, cross-sectional area per muscle fiber, or Type I fiber distribution.

3228 Board #49 May 29 1:30 PM - 3:00 PM
Neuromuscular Training Intervention Developed To Combat The Effects Of Acute Fatigue In Collegiate Pivoting Athletes

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Purpose: A large body of evidence has mounted supporting the efficacy of neuromuscular training (NMT) for prevention of anterior cruciate ligament (ACL) injury. Incorporation of NMT with athletes has been shown to improve biomechanics during dynamic pivoting movements. However, there is a lack of literature to date examining the influence of NMT on biomechanical measures during dynamic movements in a state of acute fatigue. This study examined strength, dynamic balance, and lower quarter biomechanics while performing functional movements succeeding a short-term fatigue protocol in collegiate soccer athletes before and after an eight-week NMT intervention. **Methods:** 28 Division II NCAA male and female soccer players ages 18-23 participated in the study. Hip strength was measured with hand dynamometry and single-leg stance modified balance (SLS^M) was measured with eyes shut and in static heel rise. The Noraxon MyoMotion system assessed peak hip and knee excursion in three dimensions during select movement assessments following execution of the functional agility short-term fatigue protocol. Training consisted of 16 NMT sessions, performed over eight weeks, following which the tests were repeated. **Results:** Improvements post-intervention were found in hip abduction strength L (p=0.015), hip extension strength R (p=0.031) and L (p=0.013); SLS^M with eyes-closed on R (p=0.000) and L (p=0.000); SLS^M with heel rise bilaterally (p=0.000); peak ROM for L hip abduction (p=.025), R knee flexion (p=0.002), and L knee flexion (p=0.006) during single-leg squat; peak ROM for R hip flexion (p=0.033) during bilateral squat; peak ROM for L hip flexion (p=0.045) and L knee flexion (p=0.000) during single-leg jump assessment and peak ROM for R knee flexion

($p=0.029$) and L knee flexion ($p=0.045$) during bilateral jump. **Conclusions:** Following the NMT intervention, proximal hip strength, dynamic balance, and functional loading capacity significantly improved, illustrating positive neuromuscular adaptations in the lower quarter and nervous system. Enhanced kinematics during select sport-specific movement assessments were evident by the MyoMotion system following a fatigue protocol, defending the hypothesis that NMT can improve lower extremity biomechanics of collegiate pivoting athletes while acutely fatigued.

3229 Board #50 May 29 1:30 PM - 3:00 PM

The Effects Of Vertical And Horizontal Training On Sprint Ability In Athletes: a Systematic Review And Meta- Analysis

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Plyometrics exercises are characterized by rapid stretch- shortening cycle (SSC) muscle actions. While studies have proved the effectiveness of plyometrics training on improving athletes' sprint ability, limited information is available on which specific method is more effective to athletes improve their sprint ability. **PURPOSE:** To examine the effect of vertical training (VT) and horizontal training (HT) on sprint ability in athletes. **METHODS:** Searched databases (MEDLINE, PubMed, websites of science core database) till Oct.1, 2019. Search keywords included: Vertical, horizontal, countermovement jumps (CMJ), sprint, and speed. The screening conditions were as follows: (a) Randomized controlled trials; (b) Participants were athletes, (c) VT or HT were the training method and there are at least 8 training lessons; (d) The study design consisted of an intervention group and a control group, or a vertical group and a horizontal group. (multiple training methods were excluded); (e) Other training courses (e.g. warm-up, technical, tactical, and strength training, volume, intensity); and (f) The final results of the study should include sprint ability test, and CMJ. **RESULTS:** A total of 340 articles were screened out and then removing the papers with duplicate titles and abstracts; as a result, 252 articles remained; additional 35 papers were removed after excluding the reviews and reading the abstracts; thereafter, 26 articles were read in full text according to the screening criteria; finally, 7 articles were included in the meta-analysis. The risk of bias was evaluated using the Cochrane collaboration's tools. Compared with VT, HT is more effective in improving athletes' sprint ability [0.84(95%CI =0.06,1.62), $Z=2.10$ ($P=0.04$)], but there is no difference between VT and HT in improving CMJ [0.45 (95% = -0.05,0.94), $Z=1.78$ ($P=0.08$)]. Through subgroup analysis of 10-M sprint time, the large number of training lessons (≥ 20) had a significant effect; age (under 17 yr. old) and project soccer player (Others include basketball and handball) were no statistically significant. **CONCLUSION:** HT is more helpful to improve the sprint ability, but HT and VT were about the same in improving CMJ.

3230 Board #51 May 29 1:30 PM - 3:00 PM

Eight-week Aerobic Exercise Training Using Swiss-ball Improves Postural Stability Compared With Bicycle Ergometer Training.

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PURPOSE: To compare the effect of aerobic training using Swiss-ball (SB) and aerobic training using bicycle on postural stability. **METHODS:** Sixteen healthy adults allocated into two group randomly: SB training group performed two-month aerobic training using SB and bicycle training group (Bike group) performed two-month aerobic training using bicycle ergometer. Subjects were asked to do the training for 30minute in a day and three days in a week. In each group, baseline and post intervention postural stability and peak oxygen consumption were measured. Postural stability was measured using stabilometric platform. During the assessment of stability, subjects were asked to close eyes and stay as still as possible for 30 seconds. Fundamental parameters obtained are: position of the body center of gravity, area and shape of sway density curve and velocity variables. **RESULTS:** All results show mean (SD). There was no main effect on peak oxygen consumption and no difference between training group (SB group: 33.1(5.0) ml/kg/min to 32.9(5.4) ml/kg/min, Bike Group: 32.2(7.6) ml/kg/min to 35.5(8.0) ml/kg/min). On the other hand, significantly interaction was found on some postural stability measurement: area in which the center of gravity (SB group: 2.3(0.4) cm² to 3.0(1.3) cm², Bike Group: 1.9(1.0) cm² to 2.4(1.4) cm²: no significantly interaction), total length of center of gravity displacement ((SB group: 55.3(9.9) cm to 46.4(8.4) cm, Bike Group: 39.9(11.6) cm to 43.3(13.1) cm: interaction $p<0.05$), velocity of center

of pressure ((SB group: 1.8(0.3) cm/sec to 1.6(0.3) cm/sec, Bike Group: 1.3(0.4) cm/sec to 1.4(0.4) cm/sec: interaction $p<0.05$). **CONCLUSIONS:** SB training shows no significantly effect on peak oxygen consumption. On the other hand, SB training improved postural stability compared with bicycle ergometer training.

3231 Board #52 May 29 1:30 PM - 3:00 PM

Effects Of A 10-week Physical Activity Intervention Among Seminary Students

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(No relevant relationships reported)

PURPOSE: While the number of overweight and obese Americans increases, fewer people meet recommended physical activity levels. Among Americans, 32 - 56% of Christian clergy have obesity and associated chronic diseases. Seminararians are an optimal group to introduce interventions to decrease the prevalence of obesity, as they have the power to improve both their own health as well as the health of those in their congregation. This study aims to determine whether a physical activity intervention in a seminary population is an effective way to improve physical fitness and body composition, in an effort to decrease obesity and related diseases. **METHODS:** 59 male seminary students (age range 22 - 66 years; mean age 30.12 years) participated in a 10-week physical activity intervention, attending two trainer-led exercise sessions per week for 10 weeks, which including cardiorespiratory and resistance training components. Pre- and post-intervention anthropometric measures included weight, BMI, waist-to-hip ratio, and body fat (%). Physical fitness assessments included the Rockport Walk test, cardiorespiratory endurance, and flexibility. Blood panels included a lipid and glucose panel. **RESULTS:** Results are shown in Table 1 (not all data shown). Body weight, BMI, triglycerides and LDL cholesterol did not change as a result of the intervention. Mean waist circumference decreased 3 cm ($p < 0.001$). Significant improvements were observed in all physical fitness assessments (all $p < 0.05$). Mean total cholesterol increased 8.7 mg/dL, HDL cholesterol increased 5 mg/dL, and blood glucose decreased 10 mg/dL (all $p < 0.05$). **CONCLUSIONS:** The results of this study show that a 10-week physical activity intervention in seminary students was effective in improving body composition, physical fitness and blood cholesterol and glucose measures. Results of this study suggest that seminararians may be an optimal group for future interventions to improve overall health and fitness.

Table 1. Pre- and post-intervention anthropometric, fitness and blood panel outcomes

Variable	n	Pre-Pre-TestMean (±SD)	Post-TestMean (±SD)	p-value
Anthropometrics				
Weight (kg)	51	89.7 (±17.9)	89.2 (±17.8)	0.161
Waist Circumference (cm)	51	94.5(±13.1)	91.5 (±11.3)	0.000
Hip Circumference (cm)	50	106.2 (±8.9)	104.9 (±8.7)	0.041
Physical Fitness Tests				
Push-up Test (n)	51	20.1 (±12.0)	23.9 (±11.1)	0.000
Curl-up Test (n)	51	33.9 (±19.5)	47.1 (±22.6)	0.000
Trunk Flexion (cm)	51	25.4 (±9.9)	28.6 (±10.6)	0.000
Blood Panel				
Glucose (mg/dL)	43	94.7 (±31.1)	84.7 (±13.2)	0.005
Total Cholesterol (mg/dL)	44	175.9 (±32.2)	184.6 (±29.3)	0.018
HDL (mg/dL)	44	48.1 (±13.1)	53.2 (±14.5)	0.000
LDL (mg/dL)	44	105.7 (±25.9)	110.3 (±24.2)	0.109

3232 Board #53 May 29 1:30 PM - 3:00 PM

Acute Response Of Biochemical And Hematological Markers After A Crossfit® Training Session.

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Crossfit® is a strength and conditioning program recognized as one of the most popular and practiced types of high-intensity functional training today. The goal of participants is to optimize physical conditions in some fitness domains: strength, flexibility, power, cardiovascular or respiratory endurance, coordination, and agility. The exercises are executed quickly, repetitively in a high intensity with little or no recovery time between sets. **PURPOSE:** This study aimed to verify muscle damage and immune markers parameters in the response of the Crossfit® training session. **METHODS:** Sixteen male recreational Crossfit® practitioners (Mean± SD: 29.4 ± 5.3 years old) performed a single session of AMRAP (means as many rounds as possible) for 12 minutes. This session followed a sequence of 12 box jumps, 6 thrusters and 6 burpees facing bar. After the rest of 3 minutes, participants were instructed to complete a Wingate test on a cycle ergometer in the fastest time possible. Blood samples were collected immediately before the session of AMRAP (PRE) and after Wingate test (POST). Were analyzed white blood cells and platelet count in EDTA samples. Creatine kinase, C-reactive protein and uric acid were quantified in serum samples. The paired t test was applied to verify PRE and POST statistical differences. Values of $P < 0.05$ were considered significant. **RESULTS:** The data are presented as mean and SE. There was significant increases in leukocytes (PRE 7.6 ± 0.4 and POST 15.0 ± 0.8x10⁹/L, $p < 0.001$); neutrophils (PRE 4.3 ± 0.4 and POST 6.2 ± 0.6x10⁹/L, $p < 0.001$); lymphocytes (PRE 2.5 ± 0.1 and POST 6.9 ± 0.4 10⁹/L, $p < 0.001$) and platelets counts (PRE 271 ± 6 and POST 344 ± 12 x10⁹/L, $p < 0.001$); Creatine Kinase (PRE 363 ± 94 and POST 452 ± 114 U/L, $p < 0.001$) and C-reactive Protein (PRE 7.1 ± 0.9 and POST 8.0 ± 1.1 mg/L, $p < 0.001$). Uric acid concentrations were not different (PRE 4.7 ± 0.3 and POS 5.0 ± 0.2 mg/L, $p 0.184$). **CONCLUSION:** In conclusion, these results indicate that the AMRAP session associated with the Wingate test elicits an acute immune response, including neutrophils, lymphocytes, and platelets. Besides, this protocol acutely increase muscle damage and inflammatory markers. These blood parameters could be analyzed in the recovery strategies in Crossfit® practitioners.

3233 Board #54 May 29 1:30 PM - 3:00 PM

A Comparison Of Functional Movement Between CrossFit Trained, Recreationally Trained And Sedentary Individuals

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(No relevant relationships reported)

CrossFit programs focus on performance of aerobic and strengthening exercises which incorporate multi-joint, functional movements. These variables combine to enhance athletic performance and improve an individual's ability to perform daily functional movement. A limited amount of research has compared CrossFit with other training groups regarding aerobic capacity, muscular strength, and body composition. A smaller percentage of research has compared functional movement variables. **PURPOSE:** Current research supports that CrossFit athletes demonstrate high symmetry of functional movement patterns. The primary aim of this study was to determine if CrossFit training was more beneficial to functional movement as compared to a standard exercise regimen. **METHODS:** This investigation was an exploratory cross-sectional study. Sixty (28 males, 32 females) healthy adults (age, 25±5 yr; ht, 170.5±10.3 cm; wt, 79.2±20.0 kg; BIA 23.10±8.44%) participated. Participants were recruited from the community and assigned to three groups based on their reported exercise lifestyle: CrossFit trained (CF), recreationally trained (RT), and sedentary (SD). The 60 participants underwent a series of tests including a functional movement assessment (FMS components), a maximal strength test (Deadlift 1-Rep Max assessment; kg deadlift/kg body wt), and an estimated aerobic capacity assessment (Astrand-Rhyming Cycle Ergometer Test; LO₂/min). Exclusion criteria, anthropometric data and vital signs were assessed in all patients. **RESULTS:** The CF group (6.97±1.13) was significantly higher than the sedentary group (5.73±1.41) in the FMS components score. The CF group deadlift score (1.90±0.40) was significantly higher than both the SD (1.18±0.36) and RT groups (1.47±0.51). For aerobic capacity, both the CF (3.09±1.00) and RT (2.84±0.67) groups were significantly higher than the SD group (1.96±1.17). All testing significance was set at $p \leq 0.05$. **CONCLUSION:** CrossFit training provided improved fitness and functional performance parameters as compared to sedentary counterparts. For muscular strength, CrossFit was associated

with higher scores as compared to recreationally trained individuals. CrossFit and recreationally trained groups scored evenly for aerobic fitness and components of functional movement patterns.

3234 Board #55 May 29 1:30 PM - 3:00 PM
Stretching Training Can Change Shoulder And Neck Function In Middle-aged Women With Upper Crossed Syndrome

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(No relevant relationships reported)

PURPOSE: Upper Crossed Syndrome (UCS) is a syndrome of abnormal movement patterns of the upper limbs. To judge the improvement of shoulder and neck function, the changes in shoulder joint function and shoulder cervical spine angle after 8 weeks of stretching training was observed in middle-aged women with.

METHODS:

12 middle-aged women (Table 1) were selected for a detailed assessment of upper crossover syndrome included in Acromion height test, the distance from the medial margin of the inferior angle of scapula to the spine, measurement of range of motion of shoulder joint, cervical the vertebra and stretching training program.

RESULTS:

1. The angles related to the range of motion of the cervical vertebrae were measured and the results were shown in Table 2. It was found that the average range of movement of the cervical spine after training was significantly higher than that before training, and the difference was significant before and after training.
2. The angle related to the range of motion of the shoulder was measured, and the results shown in Table 3. It found that the average amplitudes of shoulder flexion, extension, abduction, adduction, and abduction and horizontal abduction in patients with superior crossover syndrome after training was significantly higher than those before training, and there was a significant difference before and after training ($P < 0.05$).
3. The height of the acromion and the distance between the inferior angle of the scapula and the spine before and after training was compared (Table 4), and the results were shown in Table 3.

CONCLUSION: A long-term sedentary lifestyle may lead to muscle imbalance, weakening the primary motor function of the body, and increasing the risk of soft tissue injury. Stretching training has a significant effect on the shoulder and neck function of patients with UCS. The right joint function sequence can reduce the asymmetry of the body, prevent and reduce bone and joint wear.

Table 1. Subject characteristics

Subject	Age (y)	Height (cm)	Weight (kg)
12	45.17±7.83	157.83±2.23	55.57±2.23

Table 2. Comparison of ROM of cervical before and after training

Cervical ROM		Pre	Post
Flexion		32.33±6.71	42.67±2.73*
Extension		31.83±1.47	41.50±2.51*
Lateroflexion	L	31.83±2.93	38.83±3.43*
	R	32.83±6.01	40.83±2.14*
Rotation	L	43.83±8.30	54.50±3.21*
	R	44.50±6.22	56.50±2.07*

Data are presented as means ± SD. *Significant difference

Table 3. Comparison of ROM of shoulder joint before and after training

ROM	L		R	
	Pre	Post	Pre	Post
Flexion	150.17±11.70	163.33±7.34*	150.50±3.94	162.33±3.83*
Extension	30.00±7.24	44.67±10.91*	26.00±5.37	42.00±9.19*
Adduction	34.17±6.94	39.00±2.45	30.17±8.98	37.00±7.80
Abduction	129.33±31.78	164.67±13.06*	142.67±18.04	169.50±6.16*
Adduction and internal	51.50±8.92	53.00±6.00	53.67±5.82	53.67±4.84
Adduction and external	54.83±11.86	65.50±10.52*	61.33±10.65Δ	70.00±9.07*
Horizontal abduction	25.67±3.67	35.67±4.13*	24.00±7.10	36.50±4.09*

Data are presented as means ± SD. *Significant difference. Δ standard compression left and right P<0.05; ▲standard compression ipsilateral P<0.05.

Table 4. Comparison of acromial height and distance from the inferior angle of the scapula to the spine before and after training

	L		R	
	Pre	Post	Pre	Post
Acromial height (cm)	10.15±0.95	7.03±0.47*	11.12±0.87	7.48±0.77*
Distance from the inferior angle of the scapula to the spine (cm)	8.55±0.67	7.10±0.66*	9.37±0.89	7.70±0.81*

Data are presented as means ± SD. *Significant difference.

3235 Board #58 May 29 1:30 PM - 3:00 PM
Physiological Adaptations To A Concurrent Exercise Training Program In Physically Inactive Women
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PURPOSE: To assess the effect of a 10-week, high-intensity concurrent exercise training program on body composition, bone density and muscular strength in physically inactive aging women.
METHODS: 53 inactive women (age 40-64) were randomized into two sprint interval training (SIT) programs, 0% incline (age 51.9 ± 6.6) and 6% incline (age 53.4 ± 7.6). SIT was performed to achieve 95% of each participant's age-predicted maximal heart rate for 40 seconds followed by 20 seconds of passive recovery for approximately 15 minutes. Additional, each group performed a resistance training protocol, alternating between two programs: back squat, bent over row, bench press; and squat jumps, weighted lunges, standing press, back extensions. Participants attended 30 workouts over the course of 10 weeks. DXA scans assessed body composition and bone density of the femoral neck. IRM was performed to assess muscular strength changes in bench press and back squat. A repeated measure ANOVA examined group (0% incline and 6% incline) by time interactions.
RESULTS: There was no significant effect of group (p>.05). Significant decreases in fat mass (p = .02), visceral adipose tissue (p = .048) and significant increases in muscular strength for both bench press (p<.0001) and back squat (p<.0001) occurred for both groups. No significant differences were found for lean body mass (p=.872) and bone density of the femoral neck (p=.092).
CONCLUSIONS: A SIT and resistance training program is an effective strategy to improve fat mass and muscular strength in inactive, aging women. Muscular strength improvements resulting from this intervention are particularly important as muscular strength losses are strong predictors of morbidity and mortality.

3236 Board #57 May 29 1:30 PM - 3:00 PM
Comparison Of Upper-Body Strength Changes With Different Training Modalities Among Women Of Different Body Builds

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Previous investigation has noted that neither body build nor initial strength level appear to influence upper-body strength gains resulting from a short-term resistance training (RT) program in young men. Such information is lacking in young women. With increasing interest of women in RT, it would be beneficial to determine if the same outcome as noted in men is operating in women. **PURPOSE:** To determine the influence of body build on changes in upper-body strength resulting from different modes of RT in college women.
METHODS: College women (n = 708, age = 19.0 ± 0.9 yrs, Ht = 165.0 ± 6.0 cm, Wt = 62.6 ± 10.7 kg) self-selected to train with free weights or machine weights during 12 weeks of periodized RT 3 days/week. 1RM press was measured with free weights (FW, n = 170), supine vertical machine weight (SVP, n = 284), and seated horizontal machine weight (n = 232) before and after training. Fat mass (FM) and fat-free mass (FFM) were determined from a gender-specific skinfold %fat equation. Body build was determined by regressing FFM/Ht² on FM/Ht². Body build was partitioned into thirds as slender (SL, n = 231), average (AV, n = 239), and solid (SO, n = 232) groups.
RESULTS: The SVP group had a significantly greater initial 1RM (37.8 ± 8.5 kg) than the FW (35.6 ± 7.8 kg) and SHP (35.6 ± 7.8 kg) groups. SO body type (36.6 ± 8.3 kg) had a greater initial 1RM than SL (35.8 ± 8.0 kg) and AV (35.1 ± 8.4 kg) body types. Mode x body type ANOVA indicated that SVP (9.5 ± 6.2 kg) and SHP (8.8 ± 5.1 kg) made significantly greater 1RM gains than FW (4.9 ± 3.9 kg), while SO (9.3 ± 6.2 kg) and AV (8.8 ± 5.1 kg) body types made significantly greater gains than SL (6.9 ± 5.0 kg), with no significant interaction. Absolute strength gains had low correlations with initial strength in all modes (r = -0.08 to -0.26), accounting for no more than 7% of the common variance. Body type also had low correlations with absolute strength gains (r = 0.11 to 0.25). **CONCLUSIONS:** Young women appear to make slightly better initial strength gains using machine weights compared to FW. Body type does not appear to influence training potential to gain strength in women from RT using either mode. Thus, when beginning RT, young women of any body size or initial strength level can make significant gains using either free weights or machine weights.

3237 Board #58 May 29 1:30 PM - 3:00 PM
Use Of Pool Bottom Mirror In Coaching Front Crawl Stroke Correction

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PURPOSE: The mirror can provide visual information about the learner's body movement instantaneously and allow immediate error detection followed by appropriate correction. This study analyzed whether coaching recreational swimmers using pool bottom mirror for correcting front crawl stroke is effective in achieving an intended stroke. **METHODS:** Thirty adults who enrolled swimming lessons for more than 1 year participated and were randomly divided into two groups; mirror group (MG: 12 men; 32.3±8.2 yrs, 175.0±5.5 cm, 70.9±9.2kg; 3 women; 37.6±13.7 yrs, 160.0±3.4 cm, 55.6±3.5 kg) and control group (CG: 7 men; 28.7±6.1 yrs, 176.2±3.7 cm, 72.4±14.4 kg; 8 women; 38.8±14.6 yrs, 162.1±4.4 cm, 54.1±7.3 kg). They performed front crawl twice in a swimming flume (2.43 × 4.57 × 1.37 meter) at their chosen speed (pace of 87.9±4.2 for men, 102.7±4.7 sec/100 meter for women). Their stroke was video recorded by an underwater camera (xnb-6001, Samsung, Korea) and dry land camera (gnd-6020R, Samsung, Korea). After their first trial and recording, individual stroke was evaluated and verbal feedback was given for correction targeting full arm range stroking. During second trial, MG had a mirror (81 × 151 cm) installed under the bottom of flume so that they could check their stroke. CG did not use mirror during second trial. An image analyzer (Dartfish, Swiss) was used to analyze the distance between reference point (RP: where fingertip was reached over Vastus lateralis during standing till on land) and fingertip as well as stroke time (time between left hand immersion cycle). Stroke frequency was counted cycles of both arms. Two trials were compared. **RESULTS:** The distance between RP and fingertip was 7.7±3.3 and 2.5±3.5 cm in MG in 1st and 2nd trial, respectively (p<0.001) while it was 6.0±4.0 and 5.1±3.8 cm in CG. The stroke frequency was 60.7±7.3 in MG and 57.7±6.8 freq/min in CG at 1st trial. It was decreased to 53.7±5.4 in MG (p<0.001), but not in CG (56.3±6.6 freq/min). The stroke time was increased from 2.1±0.3 to 2.4±0.3 sec in MG (p<0.01), but it was not changed in CG (2.1±0.2 vs. 2.2±0.3 sec). **CONCLUSION:** The results

suggest that a pool bottom mirror is an effective tool in coaching for correction of front crawl stroke. Both verbal and visual instruction is valuable in correcting stroke of recreational swimmers and it can be achieved by the mirror.

3238 Board #59 May 29 1:30 PM - 3:00 PM
Effects Of Unilateral Resistance Training On Muscular Strength, Power, And Measures Of Core Stability In Trained Individuals

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PURPOSE: This study examined the effects of unilateral resistance training on lower body muscular strength and power, and measures of core stability in resistance-trained college students.

METHODS: Participants (N=22) underwent either 10 sessions of lower body unilateral (URT) or bilateral (BRT) resistance training on three non-consecutive days per week for three weeks. Training sessions consisted of three sets of five repetitions of 80% 1-RM for each exercise. BRT exercises included the barbell back squat, deadlift, and weighted jump squat. URT exercises included the Bulgarian split squat, single leg of Romanian deadlift, and single leg weighted jump squat. Outcome measures were a one repetition maximum (1-RM) leg press for lower body strength, standing vertical jump (VJ) for lower body power, and double leg lowering (DLL), hip abduction isometric strength (HAIS), and Sorensen (SOR) tests for core stability.

RESULTS: Training elicited a positive main effect of time for all variables ($p < 0.05$). Both groups improved pre to post training in 1-RM (297 ± 95.4 to 373 ± 114 kg), VJ (56.5 ± 15.0 to 62.2 ± 10.8 cm), DLL (33.9 ± 14.9 to 43.6 ± 13.2 deg), HAIS (29.6 ± 8.86 to 32.6 ± 10.1 kg), and SOR (91.4 ± 33.1 to 112 ± 36.7 sec). The magnitude of change was similar between groups for all variables except HAIS, in which the UL group demonstrated significantly ($p=0.0155$) greater improvement (14.3% vs. 5.3%). However, the effect size was larger in UL for all variables except VJ (Cohen's $d = 0.86$ vs. 0.61 for 1-RM, 0.92 vs. 0.55 for DLL, 0.64 vs. 0.19 for HAIS, 0.90 vs. 0.36 for SOR).

CONCLUSIONS: Relative to bilateral training, unilateral resistance training produced similar improvements in measures of lower body strength and power in trained subjects. Additionally, these data suggest that unilateral training may potentially offer the benefit of enhanced core stability.

3239 Board #60 May 29 1:30 PM - 3:00 PM
Effect Of Core Strength Exercise On Colon Transit Time In Female University Students

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PURPOSE: To evaluate the benefit of core strength exercise (CSE) on colonic transit time (CTT) for female university students. **METHODS:** Eighty women were enrolled and randomly assigned to participate in a 12-week instructor-led group CSE program (exercise group; $n = 40$) or to maintain their ordinary daily activities (control group; $n = 40$). The final groups were composed of 27 participants (age: 22.9 years) in the exercise group and 21 participants (age: 22.9 years) in the control group (CG). The CSE program consisted of 60 minute sessions, two days a week for 12 weeks. Each session included a 10-minute warm-up, 40-minute core strengthening exercises, and 10-minute cool-down. Body composition, Trunk muscle power and endurance, physical fitness and CTT were measured twice before and twice after the exercise program. CTT was measured using a multiple marker technique with a radio-opaque marker. Data were analyzed with a 2-way, repeated measures ANOVA. **RESULTS:** After the 12-wk core exercise intervention, decreased intestinal transit time was observed in segment CTT of the exercise group, including the right CTT (exercise: 9.0 ± 1.8 vs 6.4 ± 1.5 , control: 5.3 ± 1.3 vs 6.5 ± 1.5), left CTT (exercise: 10.9 ± 2.0 vs 6.9 ± 1.8 , control: 10.6 ± 2.3 vs 8.7 ± 1.5), recto-sigmoid CTT (exercise: 17.4 ± 2.9 vs 12.1 ± 2.0 , control: 8.7 ± 2.3 vs 11.9 ± 2.8), and total colonic transit time (TCTT) (exercise: 37.5 ± 4.4 vs 25.5 ± 3.8 , control: 24.7 ± 4.8 vs 27.2 ± 4.8). After the 12-wk core exercise period, LCTT (mean difference, -3.7 h; 95% confidence interval [CI], -6.9 to -0.6 h; $P=0.02$) and TCTT (mean difference, -9.4 h; 95% CI, -16.4 to -2.4 h; $P=0.01$) was significantly shortened within the exercise group in mean changes from baseline to 12wk follow-up. **CONCLUSIONS:** The CTT was reduced due to increased physical activity via a 12-wk CSE program. In addition to eating habits, water intake, and fiber intake, the increased physical activity level as a result of the 12-wk CSE reduced the CTT. Further prospective studies will need to study the effects on CTT according to dose-response, type of exercise, and intensity.

3240 Board #61 May 29 1:30 PM - 3:00 PM
Chronic Influence Of Inspiratory Muscle Training At Different Intensities On The Serum Metabolome

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 (No relevant relationships reported)

PURPOSE: To investigate the chronic effect of inspiratory muscle training (IMT) on the human serum metabolome in healthy male recreational cyclists. **METHODS:** This study employed a randomized, parallel group design. Recreational male cyclists ($n=23$, 20-40 y, BMI < 30 kg/m²) were randomized to three IMT groups: low intensity (6 cm H₂O) (LI, $n=7$); moderate intensity or 60% of maximal inspiratory pressure (MI, $n=10$) and high intensity, the critical inspiratory pressure ($\approx 85-90\%$ of maximal inspiratory pressure) (HI, $n=11$). The IMT was performed for 11 weeks, 3 times per week (3 sets of 15 minutes/session). Another group of participants under the same conditions, who did not perform the IMT but participated in all assessments and procedures, was included as controls (CG, $N=6$). Blood samples were collected one week before and one week after 11 weeks of IMT and analyzed using 1H NMR spectroscopy. Statistical analysis included a 4 (group) x 2 (time) repeated measures ANOVA using the general linear model (GLM), and multivariate Principal Component Analysis (PCA). **RESULTS:** The targeted metabolomics analysis of serum samples identified 23 metabolites, including amino acids, lipids, and tricarboxylic acid cycle intermediates. No significant interaction effects from GLM were found for the 23 metabolites, and this was confirmed by PCA. **CONCLUSION:** These data indicate that IMT at three intensity levels did not alter the serum metabolome relative to the control group. These results are consistent with other exercise training studies showing negligible alterations in the serum metabolome compared to the large but transient perturbations linked to prolonged and intensive exercise.

3241 Board #62 May 29 1:30 PM - 3:00 PM
Cardiorespiratory And Metabolic Responses Of High Intensity Yoga-surya Namaskar Session

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The recent global rise in obesity appears to be a threat to public health as it is connected with various cardiovascular and metabolic diseases. Surya Namaskar (SN), a component of Vinyasa yoga, consisted of a specific sequence of 12 yoga postures performed with controlled breath, is often used as an alternative of a typical fitness program to improve overall health, including body weight management. However, research data studying high intensity SN (HSN) are limited. **PURPOSE:** The aim of the present study was to assess cardiorespiratory and metabolic demands of HSN performed with 3 s/pose. **METHODS:** Heart rate (HR) response of twenty-four moderately trained subjects (12 males and 12 females; mean \pm sd age: 39 ± 7.33 years, body stature: 167.38 ± 9.32 cm, body mass: 66.60 ± 14.07 kg, % body fat: 23.30 ± 5.86 ; $\dot{V}O_{2peak}$: 45.48 ± 7.12 ml.kg⁻¹.min⁻¹ and HRmax: 183.54 ± 10.13 bpm) was recorded during two-15 min sessions HSN practice 7 days apart. Maximal oxygen uptake ($\dot{V}O_{2peak}$) and maximum HR (HRmax) had been estimated earlier, after an incremental test to exhaustion. $\dot{V}O_2$ during HSN was estimated from individual regression equations using the relationship of $\dot{V}O_2$ and HR values derived from $\dot{V}O_{2peak}$ test, while the metabolic rate (kcal.min⁻¹) was calculated from the relationship of HR and kcal.min⁻¹. Total HSN energy consumption was the average value of the two-15 min sessions. **RESULTS:** Mean \pm sd values of the %HRmax, % $\dot{V}O_{2max}$ and rate of energy expenditure during HSN were $71.7 \pm 7.5\%$, 59.9 ± 10.3 and 8.9 ± 3.3 kcal.min⁻¹ (7.9 ± 2.0 METs) respectively. Total session energy expenditure was 133.04 ± 50.14 kcal. **CONCLUSIONS:** The results of the present study confirm that an HSN session may produce a sufficient training stimulus to promote cardiorespiratory fitness and favor weight loss in moderate trained adults.

3242 Board #63 May 29 1:30 PM - 3:00 PM
**Low Volume Bodyweight Interval Training Improves
 Cardiorespiratory Fitness: A Contemporary Application
 Of The 5BX Approach**

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Brief vigorous exercise training can improve cardiorespiratory fitness. Few studies, however, have examined the efficacy of basic bodyweight exercises that can be performed in a small space, without the need for specialized equipment. Practical, time-efficient approaches of this sort have been advocated for decades, including the 11-minute "Five Basic Exercises" (5BX) program developed by the Canadian government in the 1960s. **PURPOSE:** We determined the effect of a 5BX-style program on peak oxygen uptake (VO_{2peak}) in inactive but healthy young men and women (20 ± 1 y; body mass index: 20 ± 5 kg/m²; mean \pm SD). **METHODS:** Participants were randomized to a training group that performed 18 sessions over six weeks (n=9), or a non-training control group (n=10). Each session involved a 1-minute warm-up (jumping jacks), followed by 1-minute bouts of five exercises (burpees, high knees, split squat jumps, high knees, squat jumps), each interspersed with 1-minute of active recovery (walking around the room). Participants were instructed to complete as many repetitions per bout as possible, at a self-determined "challenging" pace. All sessions were supervised and compliance was 100%. **RESULTS:** Mean intensity during training was $82 \pm 5\%$ of maximal heart rate. Borg Scale ratings of perceived exertion for the five exercises ranged from 12 ± 2 to 15 ± 3 out of 20. ANCOVA revealed a significant difference between groups after the intervention, such that VO_{2peak} was higher in the training group compared to control (34.2 ± 6.4 vs 30.3 ± 11.1 ml/kg/min; $P=0.03$). Peak power output during the VO_{2peak} test was also higher after training compared to control (211 ± 43 vs 191 ± 50 W, $p=0.004$). There were no changes in leg muscular endurance, handgrip strength or vertical jump height in either group. **CONCLUSIONS:** A simple bodyweight interval training program, requiring 11 minutes per session, increased cardiorespiratory fitness in previously sedentary young adults when performed three times per week for six weeks. Supported by NSERC.

3243 Board #64 May 29 1:30 PM - 3:00 PM
Biomechanics And Energetics Of Curved Treadmills

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PURPOSE: This study aims to examine the biomechanical and energetic differences between the non-motorized curved treadmill and the motorized flat (i.e., traditional) treadmill (TM). We hypothesize that, when compared to TM, CT will result in significantly higher EE, percentage of VO_2 max and trunk flexion under all testing conditions.

METHODS: Data collection included two sessions. In session one, participants filled out an informed consent, health questionnaire, and anthropometric data was collected. After, the participants underwent a 20-minute resting energy expenditure test to gather baseline metabolic data and the session concluded with a Bruce VO_2 max test. In session two, participants were connected to a metabolic cart to measure metabolic costs and outfitted with reflective markers to capture 3D kinematic data.)

RESULTS: There was not a significant increase in the amount of trunk flexion under any of the conditions between treadmills. There was a significant increase in the amount of EE from the TM to the CT across all six speeds. At 15% above their self-selected jogging (SSJ) speed, EE was 10.00 ± 1.32 kcal/min and 8.74 ± 1.34 kcal/min for the CT and TM, respectively ($p=.002$). At 15% slower than SSJ speed, participants' EE was 8.44 ± 1.16 kcal/min and 7.36 ± 1.05 kcal/min ($p=.005$) for the CT and TM, respectively. At SSJ speeds, participants EE was 8.94 ± 1.17 kcal/min and 7.47 ± 1.13 kcal/min for the CT and TM, respectively ($p<0.001$). At 15% above participants' self-selected walking (SSW) speed, EE was 5.35 ± 1.18 kcal/min and 3.38 ± 0.68 kcal/min on the CT and TM, respectively ($p<0.001$). At 15% slower than SSW, participants EE was 4.34 ± 0.92 kcal/min and $2.93 \pm .47$ kcal/min on the CT and TM, respectively ($p<0.001$). At SSW speeds, participants EE was 4.66 ± 1.00 kcal/min and 3.18 ± 0.62 kcal/min on the CT and TM, respectively ($p<0.001$).

CONCLUSIONS: Our findings suggest that female athletes may benefit from using CTs over TMs because of the increased EE utilization but further research needs to be conducted to assess the viability of CTs as a safe option with respect to musculoskeletal structures.

3244 Board #65 May 29 1:30 PM - 3:00 PM
**Aerobic Fitness Changes In Trained And Untrained
 Subjects Following A Three Week Cycling Course**

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The health and fitness related benefits of endurance training are numerous and well documented. As training progresses, however, the window for training-specific improvement narrows, making continued performance gains challenging. **Purpose:** The purpose of this study was to compare changes in aerobic fitness between endurance-trained athletes (ET), power-trained athletes (PT), and non-athletes (NON) before and after completing a 3 week college cycling course. It was hypothesized that improvement in aerobic fitness would be greatest for NON and least for ET. **Methods:** 19 subjects (12 male, 7 female; mean age 20 ± 0.5 yr.) enrolled in a cycling course at Alma College participated in the study. Participants were categorized into 3 groups (ET, PT, or NON) based on their sport-specific training prior to taking the course. Training for this study consisted of cycling an average of 5 days/week for 18-44 miles/day for 3 weeks, with mileage and course difficulty increasing throughout the training. Participants performed a 5-mile time trial pre- and post-training utilizing a standardized cycle trainer and road bike. Time to completion and average power (Watts) were recorded for each participant and utilized to compare fitness changes among groups. One-way ANOVAs were used to compare the change in time to completion and power pre-to-post training among groups (ET, PT, NON), and paired t-tests were used to compare pre-training to post-training. **Results:** There was no significant difference in time to completion ($p=0.81$) or average power ($p=0.43$) on the 5-mile time trial among groups, although all groups decreased time to completion by 0.98 ± 0.92 minutes ($p<0.01$) and increased average power by 13.5 ± 20.9 Watts ($p=0.01$). **Conclusions:** An intensive, 3-week cycling training program elicited similar improvements in aerobic fitness in a sample of college students, regardless of prior training status.

3245 Board #66 May 29 1:30 PM - 3:00 PM
**Psychological Responses To Acute Exercise: A
 Comparison Of Lower Body Positive Pressure
 Treadmill And Cycling**

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Acute aerobic exercise has been shown to improve mood and affect in active adults. Lower body positive pressure treadmills (LBPTT) have been utilized to reduce loading on the musculoskeletal system and to provide an alternative to running and cross-training. While the biomechanical and physiological responses to the LBPTT have been well-researched, little is known about psychological responses and how this compares to other forms of exercise. **PURPOSE:** To investigate mood, affect, and self-efficacy, following an acute, hard-intensity exercise session and compare these responses between three modalities: cycling, LBPTT running and treadmill running (NT). **METHODS:** 10 active adults (average age = 30 years, SD = 10.4 years) completed a 30min, high-intensity exercise session on each of three modalities in a randomized order: bike, LBPTT, and NT. Intensity was determined as 85% age-predicted maximum heart rate. Before and after each session, feeling, arousal, affect and self-efficacy were determined using the Feeling and Arousal scale (FAS), Activation-Deactivation Adjective Checklist (ADACL), and Generalized Self-efficacy survey (GSE). **RESULTS:** From baseline to post-exercise, there was a significant increase in feeling (2.4 ± 0.31 vs. 3.33 ± 0.29 , $p=0.021$), arousal (3.23 ± 0.23 vs. 4.07 ± 0.31 , $p=0.006$), and self-efficacy (31.83 ± 0.83 vs. 33.97 ± 1.16 , $p=0.013$) across all three modalities. However, when compared among the three modalities, there was no observed significant change in self-efficacy values from baseline to post-exercise ($p=0.708$). For affect (ADACL), there was an observed significant increase in energetic arousal (25.9 ± 1.12 vs. 29.43 ± 1.36 , $p=0.023$) and a decrease in state anxiety (20.93 ± 1.73 vs. 17.367 ± 1.08 , $p=0.041$) from baseline to post-exercise across all modalities, however, this did not significantly differ among the modalities. There were no other significant changes in affect observed. **CONCLUSION:** Self-efficacy, feeling, energetic arousal, and anxiety improves following acute, hard intensity exercise sessions; however, these changes do not differ based on exercise modality. Psychological responses to acute exercise differs between runners and non-runners. Future research should investigate how these responses may differ between the two groups based on modality.

3246 Board #67 May 29 1:30 PM - 3:00 PM
Interlimb Asymmetries With High And Low External Training Loads In Male Collegiate Basketball Athletes

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Tracking and monitoring bilateral limb asymmetries is an increasingly common practice to provide information associated with athlete performance, injury risk, as well as guiding return-to-play or return-to-performance protocols following injury. It is speculated external training loads (eTL) during sport specific practice may influence subsequent changes in inter-limb asymmetries. **PURPOSE:** Therefore, the purpose of the present study was to evaluate acute differences in lower inter-limb asymmetries during a bilateral countermovement jump (CMJ) immediately following high versus low eTL basketball practices in a group of NCAA men's collegiate basketball players. **METHODS:** Twelve NCAA Division I collegiate men's basketball players performed three CMJs on dual cell force platforms immediately prior to and immediately following basketball practices of high and low eTL. A dependent T-test was used to determine mean differences in practice intensities. A 2-way (condition x time) repeated measures analysis of variance (ANOVA) was performed to examine differences in Concentric Impulse (ConcImp), Concentric Peak Force (ConcPF), Eccentric Peak Force (EccPF), Takeoff Peak force (TakeoffPF), and Peak Landing Force (PeakLandF) captured during the CMJ between conditions and across time, with significance set at $p \leq 0.05$. **RESULTS:** There was a significant difference in practice intensities (High: PlayerLoad/min = 5.3 ± 0.9 , Low: PlayerLoad/min = 4.7 ± 1.4 ; $p \leq 0.001$). There were no significant condition or time main effects ($p > 0.05$), and there were no significant condition by time interactions for ConcImp, ConcPF, EccPF, TakeoffPF, and PeakLandF ($p > 0.05$). **CONCLUSION:** Although there were significant differences experienced in eTL intensities between practices (PL/min), these differences did not result in alteration of acute lower inter-limb asymmetries during the bilateral CMJ.

3247 Board #68 May 29 1:30 PM - 3:00 PM
Use Of Plyometric Training To Offset Fatigue In Division I Collegiate Female Volleyball Players

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Volleyball is a demanding sport consisting of multiple passages of play with a high priority on jumping, including attacking, blocking, jump serving and setting. Heavy resistance training and plyometric training have been shown to increase vertical jump in volleyball players, as well as high intensity interval training to increase conditioning, however, there is a lack of information on the use of plyometric training to decrease indexes of fatigue. **PURPOSE:** To determine if plyometric training can decrease repeated jump fatigue in NCAA Division I female college volleyball players. **METHODS:** 8 female collegiate volleyball players (Age: 18.4 ± 0.7 , height: 179.7 ± 9.2 cm, weight: 71.8 ± 10.0 kg), cleared of injuries completed a vertical jump test, squat jump test, repeat squat jump, and repeat block jump test while wearing velocity and height measuring devices. Participants were split into a control group (CON) and a plyometric group (PLYO), which completed a 3 day a week/ 8 week program consisting of dot drill and box drop jump exercise variations. After 8 weeks, participants were retested. Fatigue Index for the repeat tests were analyzed for statistical significance, $[(\text{Initial Jump-Final Jump})/\text{Initial Jump}] \times 100$. **RESULTS:** Significant differences were seen in the PLYO group in the repeat squat jump test at posttest compared to the CON (10.98 ± 4.69 vs -5.41 ± 4.65 $p < .015$), and in the repeat block jump test compared to pretesting values within the PLYO group (6.41 ± 8.47 vs -4.24 ± 14.77 , $p < .042$). **CONCLUSIONS:** Utilization of plyometric training may help offset fatigue as seen in multiple jump bouts in volleyball players, potentially attributing to increased athletic performance.

3248 Board #69 May 29 1:30 PM - 3:00 PM
Study On Kayak Sprint Specific Core Instability Training

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PURPOSE: In this study, Surface Electromyography (sEMG) and Saturation of Muscle Oxygen (SmO_2) indexes were used to explore the influence of the introduction of special core instability training in kayak training on the special sports ability.

METHODS: Using 14 elite kayak athletes as subjects, performed an 8-week specific core instability training intervention. Before and after 8-weeks training, data of sEMG, SmO_2 , paddle power, velocity, stroke distance, and heart rate(HR), blood lactate(Bla), max stroke frequency (Max SPM) of relevant muscles in the process of full paddling were collected for comparative analysis. Combined with the change of special performance on water, the influence of adding special core training on technical movements and special performance was explained.

RESULTS: After 8-weeks special core instability training intervention, we found that during Max SPM paddling test, both side of Rectus Femoris (RF)'s iEMG decreased ($L: 9.92 \pm 0.33$ vs. 6.66 ± 5.87 , $P < 0.05$; $R: 8.49 \pm 0.73$ vs. 5.67 ± 0.7 , $P < 0.05$), both Erector Spinae(ES)'s iEMG significantly enhanced ($L: 4.04 \pm 0.71$ vs. 5.81 ± 0.7 , $P < 0.05$; $R: 3.13 \pm 0.52$ vs. 5.51 ± 1.13 , $P < 0.05$). Meanwhile, SmO_2 of left Triceps Brachii(TB) decreased (42.54 ± 1.83 vs. 28.06 ± 5.18 , $P < 0.001$), right TB decreased (48.76 ± 8.33 vs. 31.77 ± 4.24 , $P < 0.01$), left Latissimus Dorsi (LD) decreased (40.19 ± 5.58 vs. 32.56 ± 3.68 , $P < 0.01$), right LD decreased (35.38 ± 4.19 vs. 28.39 ± 3.55 , $p < 0.05$). Both side paddle power enhanced ($L: 196.17 \pm 11.63$ vs. 294.38 ± 15.58 , $P < 0.01$; $R: 210 \pm 19.13$ vs. 319.83 ± 15.15 , $P < 0.01$), velocity enhanced ($L: 4.43 \pm 0.06$ vs. 5.64 ± 0.14 , $p < 0.01$; $R: 4.22 \pm 0.07$ vs. 5.68 ± 0.13 , $p < 0.01$), paddle distance increased ($L: 2.86 \pm 0.16$ vs. 4.08 ± 0.16 , $p < 0.001$; $R: 2.77 \pm 0.4$ vs. 4.12 ± 0.38 , $p < 0.001$), with higher BLA (7.133 ± 2.014 vs. 8.769 ± 2.359 , $P < 0.05$), also reached a higher Max SPM (141.14 ± 11.06 vs. 149.14 ± 6.248 , $P < 0.05$).

CONCLUSION: 1) Kayak special core instability training enhance the capacity of maintain balance by trunk, which create stable condition for power force of movement, and allow athletes increase their arm muscles force during paddle movement on an instable plane, and enhance symmetry of power force from both side of body efficiently. 2) 8-weeks specific core instability training produced a positive effect on kayaking performance.

3249 Board #70 May 29 1:30 PM - 3:00 PM
Abstract Withdrawn

3250 Board #71 May 29 1:30 PM - 3:00 PM
Anthropometric Characteristics And Training Behaviors In Advanced And Elite Rock Climbers

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PURPOSE: The purpose of this study was to quantify training volumes and modalities in a sample of advanced and elite climbers. **METHODS:** An online survey was distributed through various climbing-related social media platforms. Questions included demographics, climbing ability and style, training modalities used, and weekly volumes of training. **RESULTS:** Of 595 initial participants, 92 boulderers (B) (63 men, 29 women) and 71 sport-lead (SL) climbers (49 men, 22 women) were identified as advanced or elite (A/E) using the IRCRA (International Rock Climbing Research Association) Red Point Scale of which 69% had entered at least one competition. Among A/E women and men SL climbers there was a moderate inverse relationship between BMI and SL climbing ability ($r = -0.56$ and $r = -0.39$, respectively), this was not observed among women B and diminished in men B ($r = 0.12$ and $r = -0.25$). Anthropometric and training data is reported in Table 1. Mean exercise volume among A/E was 470 ± 263 min/week, with 333 ± 202 min/week as climbing specific training. Women SL climbers reported spending more time each week training specifically for climbing compared to women B ($p < 0.05$) but total training time did not differ between groups or genders ($p > 0.05$). 70% and 35% of A/E climbers reported weekly aerobic and resistance exercise, respectively, with no differences between genders or SL and B. **CONCLUSION:** To our knowledge, this was the first study to quantify training volume and modalities in A/E climbers. *Table 1.* Characteristics of advanced/elite (A/E) women and men boulderers (B) compared to A/E women and men sport lead (SL) climbers (mean \pm standard deviation).

Characteristic	A/E B n=29(w); n=63(m)	A/E SL n=23(w); n=49(m)
Age (years)	28.8 ± 7.1*; 29.5 ± 7.1**	37.6 ± 8.3; 35.6 ± 8.8
Height (cm)	165.9 ± 6.7*; 178 ± 5.8	160.8 ± 6.1; 179 ± 6.3
Weight (kg)	57.9 ± 7.4*; 69.9 ± 9.3	52.7 ± 5.9; 69.3 ± 6.2
BMI (kg/m ²)	21.0 ± 2.2; 22 ± 2.3	20.3 ± 1.6; 21.5 ± 1.1
Years climbing	6.9 ± 5.8*; 10.1 ± 8.9**	12.1 ± 7.9; 14.1 ± 8.8
IRCRA boulder ability	20.1 ± 2.6; 23.2 ± 2.3	20.7 ± 3.4; 23 ± 2.5
IRCRA sport-lead ability	14.8 ± 5.4*; 19.5 ± 4.3**	22.0 ± 3.2; 24 ± 1.9
Climbing volume (min p/ week)	278 ± 187*; 305 ± 201	378 ± 220; 376 ± 198
Indoor climbing (% total climbing) Total exercise volume	80% ± 19%*; 74% ± 25%** 421 ± 251; 438 ± 269	50% ± 27%; 37% ± 31% 504 ± 237; 523 ± 268
% Participating in aerobic exercise	69%; 70%	64%; 75%
% Participating in anaerobic exercise	17%; 24%	32%; 31%
% Participating in resistance exercise	41%; 33%	36%; 31%

BMI, body mass index; IRCRA B and IRCRA SL, bouldering and sport lead climbing ability, respectively, based on International Rock Climbing Research Association conversion scale.* Significant difference between groups within females; ** significant differences between groups within males p<0.05.

3251 Board #72 May 29 1:30 PM - 3:00 PM

The Immediate Effects Of Abdominal And Core Exercise On Balance For College-age Dancers

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(No relevant relationships reported)

Balance is defined as the ability to maintain a stable position while remaining steady. Balance is extremely important to dancers to help prevent injury and to maximize aesthetic and athletic performance. While other studies support the improvement of balance among dancers following a core exercise training program, the effects immediately following one core exercise session are less clear. **PURPOSE:** The purpose of this study was to examine the immediate effects of a core and abdominal exercise program on balance for dancers, with the hypothesis that a core exercise program would cause an immediate improvement in balance for college-aged dancers. **METHODS:** Eighteen female collegiate dancers (19.83 ± 1.58 years, 7-18 years of dance experience) completed two sets of eight exercises, engaging the upper and lower abdominal, obliques, gluteals, and erector spinae muscles. Two static balance tests, the Balance Error Scoring System (BESS) test and the Stork Balance Standing test, and two dynamic balance tests, the Y Balance test and the Pirouette test, were conducted prior to and after the core exercises. **RESULTS:** The core exercise program significantly improved balance results for the Y Balance Test composite score (86.0 ± 6.3% pre vs 88.4 ± 5.3% post, p<0.05) and the BESS Test (22.7 ± 8.0 errors pre vs 16.1 ± 7.0 errors post, p<0.05). There were no significant differences between pre and post intervention scores of the Stork Balance Standing test or the Pirouette test. **CONCLUSIONS:** Including core exercises in a dancer's warm-up before practices and performances may have an acute positive effect on balance for dancers, which could translate to improvements in performance. It is unclear if a core exercise program can acutely improve dance skill-specific balance, such as during pirouettes.

3252 Board #73 May 29 1:30 PM - 3:00 PM

Weighting The Swing: The Mechanical Changes That Emerge When Loads Are Applied To Baseball Bats

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(No relevant relationships reported)

Success in baseball batting relies on a union of swing power and accuracy. Off the field, training commonly employs weighted loads replicating hitting mechanics. On the field, immediately prior to a plate appearance, batters sometimes place a weighted ring on the bat to warm up their swing. Although common, these traditional training methods lack investigation. **PURPOSE:** To observe differences of baseball swing characteristics in response to applied bat resistance. **METHODS:** We tested 14 NCAA baseball athletes using Proteus technology (Proteus Motion, USA). Participants completed 5 sets of 6 swings at increasing loads of magnetic resistance. Each set

increased in weight by 2 lbs, ranging from 1-9 lbs. Measurements computed by Proteus were peak power, peak force development rate (PFDR), braking, consistency, endurance, velocity, and range of motion (ROM). Paired-samples t-tests compared swing characteristics of the 1 lb resistance to the mean of 3, 5, 7, and 9 lb. MANOVA with repeated measures observed the differences of swing variables in response to resistance increases. Linear regression tested the effect of different loads on performance parameters. **RESULTS:** The 1 lb resistance differed from the mean resistance in peak power (p<0.001), PFDR (p<0.001), braking (p<0.001), ROM (p=0.017), and velocity (p=0.063), but not in consistency (p=0.110) or endurance (p=0.375). The mean values of consistency (p=0.985) and endurance (p=0.530) could not predict outcomes for 1 lb performance, but did predict ROM (p=0.002) and braking, power, PFDR, and velocity (p<0.001). As resistance levels increased, there were significant differences in swing power (F=317.297, p<0.001), PFDR (F=141.797, p<0.001), braking (F=91.011, p<0.001), ROM (F=6.067, p=0.013), and velocity (F=2.5122, p=0.039), but not measurements of consistency (F=0.911, p=0.480) or endurance (F=2.156, p=0.070). **CONCLUSIONS:** As bat resistance increased, players made acute responses that compromised recruitment characteristics (consistency and endurance). Training and warm-up techniques that employ loaded swings may alter mechanics accordingly.

F-55 Free Communication/Poster - Blood Flow Restriction

Friday, May 29, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

3253 Board #74 May 29 2:30 PM - 4:00 PM

The Acute Effects Of Volume-Matched Resistance Exercise With Blood Flow Restriction Versus Traditional Exercise On Arterial Elasticity And Hemodynamic Variables

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PURPOSE: To investigate the acute effects of varying intensities of volume-matched lower body resistance exercise sessions with and without blood flow restriction (BFR) on hemodynamic variables and arterial compliance. **METHODS:** Seventeen males and fifteen females completed six separate volume-matched sessions of lower body resistance exercise of 4 sets of leg curl and leg extension at 40 (T40), 60 (T60), and 80% (T80) of 1RM without BFR and 25 (BFR25), 35 (BFR35), and 50% (BFR50) with BFR. Blood pressure, arterial elasticity, and hemodynamic variables (mean arterial pressure (MAP), stroke volume (SV), stroke volume index (SVI), cardiac output (CO), cardiac index (CI), large arterial elasticity (LAE), small arterial elasticity (SAE), systemic vascular resistance (SVR), total vascular impedance (TVI) and cardiac ejection time (CET)) were measured at baseline, immediately postexercise, 10 min, 20 min, and 30 min-post exercise using a oscillometric blood pressure module and a piezoelectric pressure sensor. **RESULTS:** One-way ANOVA found no significant differences between group means at baseline resting values. Repeated measures ANOVA found significant condition main effects (p<0.05) for HR, LAE, SAE, and TVI post exercise. Post-hoc pairwise comparisons found that BFR25 caused significantly greater HR than BFR50 (p<0.04) at 10 min-post exercise and T80 at 0 and 10 min-post exercise (p<0.02). BFR25 also resulted in significantly greater (p<0.03) LAE compared to BFR50 at 10 min-post exercise (20.8 ± 1.7 vs. 16.4 ± 0.7 ml/mmHg × 10). SAE was significantly lower (p<0.05) following BFR50 (8.4 ± 0.4 ml/mmHg × 10) compared to T40 (10.7 ± 0.7 ml/mmHg × 10). TVI was found to be significantly lower in BFR25 than BFR50 (p<0.01) and BFR35 (p<0.02) at 10 min-post exercise (87.2 ± 5.9 vs. 111.2 ± 5.8 and 103.7 ± 5.8 dyne·sec·cm⁻⁵, respectively). **CONCLUSIONS:** The current results indicate that higher intensity BFR groups may not be favorable for acute post exercise arterial elasticity. The changes in hemodynamic and arterial elasticity responses to volume-matched lower load exercise during the BFR25 session demonstrate the possibility of improving cardiovascular health and function. Future studies should determine the effects of BFR and non-BFR training methodologies on chronic adaptations in cardiovascular system.

3254 Board #75 May 29 2:30 PM - 4:00 PM
Cardiovascular Response To Unilateral, Bilateral, And Alternating Exercises With Blood Flow Restriction

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The cardiovascular response induced by resistance exercise with blood flow restriction (BFR) seems to be lower or comparable to traditional exercise in healthy individuals. However, the potential for BFR to be used for at risk populations highlights a need to further attenuate the cardiovascular response, potentially via the modality of exercise. **PURPOSE:** To compare the cardiovascular response to unilateral (UN), bilateral (BI), and alternating (AL) BFR exercise. **METHODS:** 13 males and 7 females performed four sets (30 seconds rest) of UN, BI, and AL knee-extensions to failure with 30% one-repetition maximum and 40% arterial occlusion pressure. Pulse wave analysis was measured before and after exercise. Data, presented as mean (SD), were analyzed using Bayesian RMANOVA. **RESULTS:** AL caused greater changes in: aortic systolic [Δ mmHg: AL=21 (8); UN=13 (10); BI=15 (7); BF₁₀=29.63], diastolic [Δ mmHg: AL=13 (8); UN=7 (10); BI=8 (7); BF₁₀=5.13], and mean arterial [Δ mmHg: AL=19 (8); UN=11 (10); BI=13 (7); BF₁₀=48.39] blood pressures. Brachial [Δ mmHg*bpm: AL=4945 (2340); UN=3218 (1412); BI=3461 (1430); BF₁₀=31.74] and aortic [Δ mmHg*bpm: AL=6134 (2479); UN=4200 (1722); BI=4525 (1664); BF₁₀=114.83] rate pressure product as well as heart rate [Δ bpm: AL=26 (14); UN=18 (8); BI=19 (11); BF₁₀=5.82] were also greatest with AL. Augmentation pressure [Δ mmHg: UN=-3 (5); BI=-2 (6); AL=-1 (6); BF₁₀=0.19], pulse pressure [Δ mmHg: UN=6 (6); BI=7 (7); AL=8 (5); BF₁₀=0.27], augmentation index [Δ %: UN=-6 (12); BI=-7 (11); AL=-6 (16); BF₁₀=0.16], wave reflection magnitude [Δ %: UN=-5 (8); BI=-5 (7); AL=-4 (7); BF₁₀=0.15], forward wave height [Δ mmHg: UN=8 (6); BI=8 (6); AL=8 (4); BF₁₀=0.15], and reflected wave height [Δ mmHg: UN=1 (3); BI=2 (4); AL=3 (3); BF₁₀=0.31] were not different between conditions. Exercise volume was greater in AL [kg: AL=1835 (1725); UN=915 (312); BI=893 (313); BF₁₀=29.17]. Ratings of perceived exertion (BF₁₀=3.99e+144) and discomfort (BF₁₀=2.0e+73) increased with sets. AL had an elevated discomfort (BF₁₀=5548.97). **CONCLUSION:** The greater cardiovascular response following alternating BFR exercise in healthy individuals, suggests those at risk of a cardiovascular event should choose unilateral or bilateral BFR exercise until further work determines the degree to which this modality can be tolerated.

3255 Board #76 May 29 2:30 PM - 4:00 PM
Effect Of Aerobic Exercise With Blood Flow Restriction On Substrate Utilization And Energy Expenditure

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Blood flow restriction (BFR) added to aerobic exercise has the potential to elicit physiological adaptations. However, the acute effects of BFR on substrate utilization and energy expenditure (EE) remains unclear. **PURPOSE:** The purpose of this study was to examine the effects of intermittent BFR compared to low- (LIIE) and high-intensity interval exercise (HIIE) on EE and substrate utilization during exercise and recovery. **METHODS:** Participants randomly performed 3 interval (INT) exercise protocols: BFR, LIIE and HIIE. BFR and LIIE consisted of 10 INTs of 2-min of work at 70% of ventilatory threshold (VT) and 1-min of recovery (20 watts; W). During BFR, the cuffs were inflated to 80% of limb occlusion pressure (154 ± 17 mmHg) during each work INT and deflated during each recovery INT. HIIE consisted of 5 INTs at 140% of VT and 1-min of recovery (20 W). Breath by breath pulmonary oxygen uptake (VO₂) and carbon dioxide production (VCO₂) were recorded during a 15-min seated rest, exercise, and a 180-min seated recovery. Excess post exercise oxygen consumption (EPOC) magnitude was calculated as area under the curve from netVO₂ (VO₂ - VO₂ at rest) during the first 90 minutes post-exercise. EE was calculated from VO₂ during exercise and recovery. Fat oxidation (FatOx) and carbohydrate oxidation (CarbOx) rates were calculated from VO₂ and VCO₂ at rest, 1, 2 and 3 hrs post-exercise. Enjoyment was assessed post-exercise using the physical activity enjoyment scale (PACES). **RESULTS:** EPOC magnitude was similar among trials (LIIE = 4.87 ± 2.60 L*min⁻¹, BFR = 6.59 ± 2.33 L*min⁻¹, HIIE = 6.56 ± 2.01 L*min⁻¹; p = 0.06). Total EE was different between BFR (321.6 ± 30.1 kcal), HIIE (254.5 ± 33.5 kcal), and LIIE (287.1 ± 25.5 kcal) (p<0.05). FatOx in BFR (1hr = 0.14 ± 0.01 g*min⁻¹, 3hr = 0.11 ± 0.01 g*min⁻¹) was greater than LIIE (1hr = 0.08 ± 0.02 g*min⁻¹, 3hr = 0.9 ± 0.02 g*min⁻¹), but not different from HIIE (1hr = 0.12 ± 0.02 g*min⁻¹, 3hr = 0.09 ± 0.01 g*min⁻¹) (main effect of trial; p<0.05). CarbOx during BFR (3hr = 0.16 ± 0.03 g*min⁻¹) was less than LIIE (3hr = 0.19 ± 0.03 g*min⁻¹) and HIIE (3hr = 0.23 ± 0.05 g*min⁻¹) (main effect of trial). There were no differences in PACES scores.

CONCLUSIONS: This study suggests that the addition of intermittent BFR to LIIE may result in greater EE but similar substrate utilization and enjoyment as HIIE, albeit at a lower work rate.

3256 Board #77 May 29 2:30 PM - 4:00 PM
Physiological Responses To Intermittent Blood Flow Restriction During Cycling Exercise

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Aerobic exercise with the addition of blood flow restriction (BFR) has the potential to elicit physiological adaptations. However, the acute physiological and perceptual responses during aerobic exercise with intermittent BFR remains unclear. **PURPOSE:** The purpose of this investigation was to examine the physiological and perceptual responses to intermittent BFR compared to low- (LIIE) and high-intensity interval exercise (HIIE). **METHODS:** Participants randomly performed 3 interval (INT) exercise protocols: BFR, LIIE and HIIE. BFR and LIIE consisted of 10 INTs of 2-min of work at 70% of ventilatory threshold (VT) and 1-min of recovery (20 W). During BFR, the cuffs were inflated to 80% of limb occlusion pressure (154 ± 17 mmHg) during each work INT and deflated during recovery INTs. HIIE consisted of 5 INTs at 140% of VT and 1-min of recovery (20 W). Pulmonary VO₂ and respiratory exchange ratio (RER) were recorded and tissue oxygen saturation (StO₂) was assessed by near-infrared spectroscopy. The level of perceived exertion (RPE) was assessed at the end of each INT. INTs 2, 4, 6, 8, and 10 during BFR and LIIE were used for comparison with INTs 1-5 during HIIE. The last 30 seconds of each INT were used for analysis. StO₂ during each condition is expressed as change from baseline cycling (20W) (arbitrary units; AU). Two-way (INT x trial) ANOVAs analyzed differences. Significance was established if p<0.05. **RESULTS:** There was a main effect of trial for VO₂ and RER. VO₂ was greater in HIIE (INT 5 = 2.12 ± 0.56 L*min⁻¹) than BFR (INT 10 = 1.41 ± 0.21 L*min⁻¹) and LIIE (INT 10 = 1.28 ± 0.27 L*min⁻¹). RER was lower in LIIE (INT 10 = 0.93 ± 0.01) compared to BFR (INT 10 = 0.94 ± 0.06) and HIIE (INT 5 = 0.99 ± 0.03). At all points, HR was lower in LIIE (INT 10 = 110 ± 10 bpm) than BFR (INT 10 = 155 ± 24 bpm) and HIIE (INT 5 = 154 ± 14 bpm). There were no differences in HR between BFR and HIIE. Delta StO₂ was greater during BFR (INT 10 = -37.5 ± 15.6 AU) and HIIE (INT 5 = -34.2 ± 6.5 AU) compared to LIIE (INT 10 = -14.6 ± 8.67 AU). During all points, RPE was greater in BFR (INT 10 = 15.0 ± 2.4) and HIIE (INT 5 = 14.3 ± 1.3) compared to LIIE (INT 10 = 9.3 ± 0.4). **CONCLUSIONS:** This study suggests that cycling with the addition of intermittent BFR at an intensity equivalent to 70% of VT may provide similar cardiovascular and local physiological stress to traditional HIIE, albeit at a lower work rate.

3257 Board #78 May 29 2:30 PM - 4:00 PM
MEASURING LIMB OCCLUSION PRESSURE USING DIFFERENT VASCULAR DOPPLERS

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PURPOSE: Blood flow restriction (BFR) in physical therapy settings requires personalized restriction pressures in order to remain a safe rehabilitation modality. Measuring limb occlusion pressure (LOP) is one method of setting the pressure relative to each patient and is performed with a vascular doppler and inflatable cuff. Several dopplers are available, but have not been compared. This study was performed to compare the Hokanson MD6 and the Edan SonoTrax vascular dopplers in measuring LOP.

METHODS: In a randomized crossover design, 20 participants (women=10, men=10) visited the laboratory once. Arm and thigh circumferences were measured. After 10min of rest, LOP was measured in the arm and leg with 5cm and 10cm wide inelastic cuffs, respectively. Measurements were repeated every 5min until LOP was measured in both limbs with both dopplers. Bland-Altman analyses (MD6 - SonoTrax) were performed and limits of agreement (LOA) calculated. Two one-sided tests of equivalence with lower and upper equivalence bounds of -5 mmHg to 5 mmHg were calculated. Results are reported as mean (95%CI) for Bland-Altman analyses and mean (90%CI) for equivalence testing.

RESULTS: Arm LOP measurement showed a mean bias of 0.6 (-1.3 - 2.4) mmHg, with upper and lower LOA of 8.4 (5.1 - 11.7) mmHg and -7.3 (-10.6 - -4.0) mmHg, respectively. Thigh LOP measurements showed a mean bias of -1.5 (-4.4 - 1.4) mmHg with upper and lower LOA of 10.5 (5.5 - 15.5) mmHg and -13.5 (-18.5 - -8.5) mmHg, respectively. Equivalence testing determined that both doppler measurements were equivalent in the arm (0.55 (-0.99 - 2.1) mmHg, p = .547) and leg (-1.5 (-3.87 - 0.87) mmHg, p = .288).

CONCLUSIONS: The SonoTrax measured LOP equivalently to the MD6. Physical therapists wanting to use BFR therapy should feel comfortable using either vascular doppler in their clinic.

3258 Board #79 May 29 2:30 PM - 4:00 PM
Endothelial-dependent Cutaneous Vasodilatory Responses To Single Bout Of Remote Ischemic Preconditioning

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Endothelial-Dependent Cutaneous Vasodilatory Responses to a Single Bout of Remote Ischemic Preconditioning

Jahyun Kim, Sydney E. Barlow, Warren D. Franke FACSM, and James A Lang Iowa State University, Ames, IA, 50010
 Remote ischemic preconditioning (RIPC) induces protective effects from endothelial ischemic reperfusion injury in two phases. Initial protection occurs in the first 1-2 hrs post-RIPC and disappears after 4 hrs. Delayed protection occurs ~24 hours after RIPC and lasts for 2-3 days in human conduit arteries. The extent to which this timeline occurs in human cutaneous microvasculature is not clear. **Purpose:** To assess the timeline of skin microvascular functional changes after a single bout of RIPC. **Methods:** Sixteen participants (23-4 yrs; 7 males, 9 females) underwent a single bout of RIPC. Using laser speckle contrast imaging, acetylcholine (Ach)-mediated skin blood flow responses were assessed immediately prior to RIPC as well as 24 hr, 48 hr, 72 hr, and a week afterwards. RIPC consisted of 4 repetitions of 5 min of arm blood flow occlusion interspersed by 5 min reperfusion. Ach was prepared with saline solution (2% Ach) and administered by iontophoresis (20 µA for 200 s). Skin blood flow was expressed as cutaneous vascular conductance (CVC; perfusion units/mean arterial pressure, PU·mmHg⁻¹). Ach-induced CVC changes throughout this timeline were analyzed by one-way repeated ANOVA and post hoc tests were conducted by the SNK method to locate significant differences. **Results:** Ach-mediated CVC increased during the time line (p<0.05). However, CVC was significantly increased only 48 hours after the single bout of RIPC (0.71±0.07 vs. 0.94±0.12 PU·mmHg⁻¹, p<0.05, pre-RIPC vs. 48 hrs), returning to baseline levels after a week (0.61±0.10 PU·mmHg⁻¹, p>0.7). **Conclusion:** Responses to Ach infusion are an indicator of global endothelial cell function and reflects endothelial dependent vasodilation. These data suggest that a single bout of RIPC induces a response to Ach-induced endothelial dependent-cutaneous vasodilation that peaks at 48 hours post-RIPC. This response to a single bout of RIPC does not persist a week afterwards. Thus, a single bout of RIPC elicits a delayed window response of endothelial dependent vasodilation in human skin microvasculature.

3259 Board #80 May 29 2:30 PM - 4:00 PM
Feasibility And Effectiveness Of High-intensity Interval Training With Blood Flow Restriction In Heart Failure

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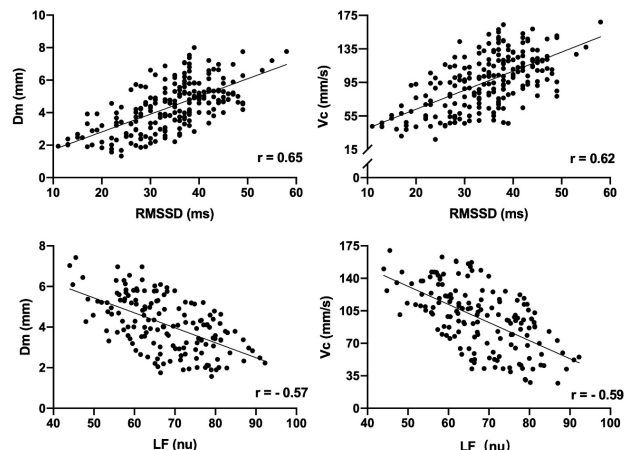
Reduced aerobic capacity ($\dot{V}O_{2peak}$) is a key characteristic of heart failure with reduced ejection fraction (HFrEF). Peripheral vascular dysfunction, the result of an imbalance between endothelial damage and endogenous repair mechanisms, is both a precursor to and a consequence of HFrEF. This may contribute to the reduction in $\dot{V}O_{2peak}$ by increasing peripheral vascular resistance, impairing blood flow distribution and reducing O₂ delivery to locomotor muscles. High-intensity interval training (HIIT) can ameliorate vascular dysfunction and increase $\dot{V}O_{2peak}$ in HFrEF. Whether the effectiveness of HIIT can be increased by combining it with leg blood flow restriction (BFR), a novel technique that alters peripheral vascular shear stress and augments the intramuscular metabolic stress of a given exercise protocol, is unknown. **Purpose:** To investigate the feasibility and effectiveness of HIIT vs. HIIT with BFR to improve CD34+/KDR+ progenitor cell number (marker of vascular repair), exercise tolerance and $\dot{V}O_{2peak}$ in HFrEF. **Methods:** 13 males with HFrEF (72 ± 11 y; LVEF 35 ± 9 %) completed HIIT (5 x 2 min cycling bouts at 80 % ramp-incremental peak power, separated by 2 min recovery) twice per week for 4 weeks, either with BFR (HIIT+BFR; n = 7; thigh cuff pressure 100 mmHg) or without BFR (HIIT; n = 6; thigh cuff pressure 10 mmHg). CD34+/KDR+ number (flow cytometry), exercise tolerance and $\dot{V}O_{2peak}$ (ramp-incremental exercise test), and quality of life (QoL) were measured pre- and post-training. **Results:** All HIIT+BFR participants tolerated 100 mmHg cuff pressure. There was a pre- to post training increase in CD34+/KDR+ number (HIIT: 78 ± 11 vs. 88 ± 28 per 10⁶ total events; HIIT+BFR: 67 ± 21 vs. 102 ± 44 per 10⁶ total events; time effect,

P < 0.05) and ramp-incremental exercise tolerance (HIIT: 494 ± 160 vs. 537 ± 162 s; HIIT+BFR: 469 ± 136 vs. 529 ± 108 s; time effect, P < 0.05). However, the effect of training was not different for HIIT vs. HIIT+BFR. $\dot{V}O_{2peak}$ was unchanged with training (HIIT: 16.7 ± 8.5 vs. 18.7 ± 9.8 ml/min/kg; HIIT+BFR: 17.0 ± 3.8 vs. 16.4 ± 3.7 ml/min/kg; time effect, P > 0.05). QoL was also unchanged with training. **CONCLUSIONS:** HIIT+BFR is feasible in HFrEF. However, the increases in CD34+/KDR+ progenitor cell number and exercise tolerance following HIIT+BFR are not greater than the increases conferred by HIIT alone in HFrEF.

3260 Board #81 May 29 2:30 PM - 4:00 PM
Effects Of Exercise Under Different Levels Of Blood-flow Restriction On Autonomic Modulation And Muscular Fatigue

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Purpose: To assess the acute cardiac autonomic and peripheral muscular responses to eccentric exercise combined with different levels of blood flow restriction (BFR) in young women. **Methods:** Twenty-five women (21.22±0.61 year) performed 4 sets of leg extension (30 + 15 + 15 + 15 repetitions) at 20 % one repetition maximum, with four different BFR conditions (0, 40, 60, and 80 %). Restrictive pressures were calculated based on blood-flow measurements taken at rest on each subject. Heart rate variability (HRV) and muscle fatigue were recorded at rest and during 24 hour of recovery by calculating time (RMSSD) and frequency domain (LF nu, HF nu, LF/HF) indices and analyzing muscle displacement (Dm) and contraction velocity (Vc) values, respectively. **Results:** All parameters in CON (0%BFR) did not significant change (P>0.05). In BFR_{40%} there was a slight reduction in RMSSD (18.51%) and HF nu (12.19%) compared to CON (P<0.05). In BFR_{60%}, RMSSD and HF nu decreased 27.91% and 13.98% while LF nu increased 13.77% compared to CON (P<0.05), and LF/HF recovered within 30min post exercise (P>0.05). In BFR_{80%}, LF nu increased 16.43% while RMSSD, HF nu, Dm and Vc dramatically declined 39.92%, 15.41%, 37.34% and 48.85% respectively when compared to CON (P<0.01), so it took longer time to restore LF/HF balance (within 24 hours). Correlation analysis showed that RMSSD was positively correlated with Dm (r = 0.65) and Vc (r = 0.62), respectively (P<0.05), while LF nu was negatively correlated with Dm (r = - 0.57) and Vc (r = - 0.59) (P<0.05). **CONCLUSION:** On the basis of low load resistance exercise, 40% BFR can withdraw vagal regulation, but sympathetic activity and sympathetic/parasympathetic balance can be enhanced when the restriction increased to 60%BFR. Peripheral muscular fatigue can just be obviously evoked in 80% BFR, and this fatigue is highly related to cardiac autonomic modulation. Therefore, we do not recommend 80% BFR for women with cardiovascular risk.



3261 Board #82 May 29 2:30 PM - 4:00 PM
Femoral Blood Flow During Blood Flow Restriction In Males And Females

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 (No relevant relationships reported)

Use of blood flow restriction (BFR) during strength training results in an increase in muscle strength and mass when using light loads (20-30% of 1 RM). Only a few studies have reported actual arterial blood flow characteristics during BFR. In addition,

research reporting blood flow characteristics in the dominant and non-dominant limb in both males and females is lacking. **PURPOSE:** This study compared femoral artery occlusion pressure (AOP) and femoral artery blood flow characteristics at different percentages of AOP between both legs in males and females. **METHODS:** Participants in this study included 31 physically active and healthy males (n=18) and females (n=13) years of age. Blood flow in the superficial femoral artery (SFA) was measured using Doppler ultrasound and BFR was controlled using a Hokanson E20 Rapid Cuff Inflator with a 10 cm cuff placed on the upper thigh. After measuring the AOP of the SFA, blood flow was measured in a random order at 0%, 20%, 40%, 60%, 80%, and 100% of AOP. This was repeated in the opposite leg. Blood flow was recorded in absolute (mL/min) and relative terms (% unoccluded bloodflow). **RESULTS:** There was significant difference ($p<0.008$) in the AOP in the dominant leg (234 vs 188 mmHg) and nondominant leg (206 vs 177 mmHg) between males and females, respectively. After accounting for differences in leg circumference ($p<0.001$), sex remained a significant ($p=0.0001$) factor in accounting for differences in AOP. The difference in AOP between the dominant and nondominant leg in males (234 vs 206 mmHg) and females (188 vs 177) were not significant ($p=0.123$). At each of the occlusion pressures (0%, 20%, 40%, 60%, 80%, 100% of AOP), there were no differences in absolute or relative blood flow between males and females. The relationship between SFA blood flow at occlusion pressures between 0 and 100% of the AOP was curvilinear in both males and females. Blood flow at occlusion pressures between 40% and 80% of AOP was relatively constant. **CONCLUSIONS:** Significant differences in AOP in males and females can be attributed, in part to differences in leg circumference and sex. The curvilinear relationship between blood flow and occlusion pressure indicates that BFR during exercise can be equally effective a lower pressures (40% AOP) as at higher pressures (80% AOP).

F-56 Free Communication/Poster - Vascular Function II

Friday, May 29, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

3262 Board #83 May 29 2:30 PM - 4:00 PM
The Effect Of The Somatosensory Afferent On Hemodynamic Transmission From The Aorta To The Brain
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(No relevant relationships reported)

PURPOSE: This study aimed to reveal whether the somatosensory input from lower extremities can affect hemodynamic transmission from the aorta to the brain during orthostatic stimulation.

METHODS: Thirteen young adults (5 women, mean age 25±5 yrs.) underwent two consecutive 6-min orthostatic stimulations with lower body negative pressure (LBNP) (-30 mmHg and -50 mmHg) under following two conditions in random order: (1) placing feet on the wood board with slight knee flexion (RESISTED) and (2) feet untouched using a harness (FREE) inside the LBNP chamber. Heart rate (HR), aortic pressure, stroke volume (SV), cardiac output (CO), and cerebral blood flow velocity (CBFV) from the middle cerebral artery were continuously recorded. Hemodynamic transmission (i.e., admittance) from the aorta to the brain was evaluated by transfer function analysis.

RESULTS: HR was significantly higher, and SV and CO were significantly lower during -50 mmHg LBNP stimulation than baseline values irrespective of foot conditions. Aortic mean pressure and mean CBFV were not affected by the leg-condition. In contrast, aortic pulse pressure and pulsatile CBFV were significantly reduced during -50 mmHg LBNP with the degree of reduction (from baseline to -50 mmHg LBNP) smaller in the RESISTED condition than in the FREE condition (aortic pulse pressure: -17 % vs. -35 %, $P=0.047$; CBFV: -15 % vs. -26 % vs. $P=0.09$, respectively). Transfer function gain at the first harmonic from the aortic pressure to the CBFV was not affected significantly by LBNP stimulation or the somatosensory input. The transfer function normalized gain by mean CBFV was significantly increased with LBNP ($1.3±0.1$ vs. $1.5±0.1$ cm/s/mmHg, $P=0.048$) but did not differ by the somatosensory input.

CONCLUSIONS: These results suggest that the aorta-brain admittance at the first harmonic is augmented with the LBNP stimulation but not altered by the somatosensory input from the lower limbs.

3263 Board #84 May 29 2:30 PM - 4:00 PM
Arduino-based Impedance Spectroscopy: An Open-source Platform For Physiological Impedance Spectroscopy Measurements In Rats

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(No relevant relationships reported)

Assessment of body water and compartmentalization is an important experimental outcome in many studies. Whole-body impedance spectroscopy permits assessment of body water and composition; however the expense of commercially available systems can be prohibitive. **PURPOSE:** The purpose of this project was to develop an affordable, open-source, and precise system to perform whole-body impedance spectroscopy in rats. **METHODS:** Commercially validated circuit components, as described in the literature, were evaluated and compiled. An impedance spectroscopy system was designed using KiCad. Simulation and modeling of the circuit and instrumentation output was performed using LTSpice. The software was developed using Python, Arduino IDE. The system includes an internal per measurement calibration system and a constant current supply. The system was tested using serially-diluted KCl cells and an equivalent thorax circuit (RRC circuit). Validation studies were performed in anesthetized rats (2% isoflurane in 95% O₂, 5% CO₂) rats *in-vivo* (n=4, ~350 g). **RESULTS:** The impedance spectroscopy system was based on a built-in Arduino-Mega and AD5933 integrated circuit (Analog Devices) using open-source software. The system includes an internal per measurement calibration and constant current supply, and was able to stably iterate through excitation frequencies from 1 to 300 kHz. Admittance data obtained from rats were plotted in a complex plane. After least-squared semicircular regression analysis, there were consistent correlations within rats (triplicate) and among individual rats (n=4) on consecutive days. Total costs of the system was less than \$250. **CONCLUSION:** We developed an affordable (open-source platform that precisely and repeatably provides whole-body impedance spectroscopy measurements in rats. The rat impedance results were qualitatively consistent with published data. This system can also be reprogrammed and reconfigured for use in other physiologic applications.

3264 Board #85 May 29 2:30 PM - 4:00 PM
Water Immersion Skin Wrinkling: The Influence Of Age, Sex, And Adiposity
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From the evolutionary perspective, water immersion skin wrinkling (WISW) is the perceived water drainage to enhance grip in wet conditions. In modern medicine, it is a noninvasive test of limb sympathetic function and can be used to assess peripheral neuropathy. WISW occurs as sympathetically-mediated contraction of subcutaneous glomus bodies after perturbation of ion concentration in palmar sweat glands. This phenomenon has not been studied well and it is not clear if common demographic variations (e.g. age, sex, and adiposity) that impact overall cardio-autonomic health status also affect WISW. **Purpose** The purpose of the present study is to determine if peak WISW is modulated by age, sex, and body adiposity, additionally, we addressed if this phenomenon is associated with osmotic reactions or edema. **Methods** So far 12 apparently healthy adults (5 females) aged 34.5±17.6 years were studied. Participants hands were submerged in 40°C water for 30 minutes with degree of wrinkling being assessed via 5-point scale (0 to 4) at 10-minute intervals. Final ratings for digits 2-5 were summed and used to determine peak WISW with a score of 16 being the highest and 0 being the lowest possible scores. Additionally, hand and forearm volume were measured via water displacement before and after submersion to quantify hand volume expansion. **Results** Peak WISW ranged from 5 to 16 with the mean (±SEM) score of 13.2±1.3. Peak WISW was moderately correlated with age ($r=-0.54$), BMI ($r=-0.39$), body fat percentage ($r=-0.51$). Males demonstrated a greater degree of WISW with a mean rating of 16 compared with females with a mean rating of 9 ($p<0.01$). Hand and forearm volume did not change with water immersion (497±29 vs. 500±30 ml). Changes in hand and forearm volume were not associated with peak WISW ($r=-0.03$). **Conclusion** The preliminary results indicate that water immersion skin wrinkling varies widely with age, sex, and body adiposity and is not associated with edema or osmotic reactions.

3265 Board #88 May 29 2:30 PM - 4:00 PM
An Assessment Of The Potential For Standardizing Various Measures Of Arterial Stiffness
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 (No relevant relationships reported)

Arterial stiffness is an independent risk factor for cardiovascular disease. Different measures of arterial stiffness have been used to assess the impacts of exercise training interventions. One of the primary problems faced by investigators conducting systematic reviews and meta-analyses is the lack of standardized methodology to evaluate and compare efficacies of the existing and newly conducted exercise interventions on arterial stiffness. The reference standard measure of arterial stiffness is pulse wave velocity (PWV) while other commonly-used methodologies are ultrasound-derived arterial compliance and distensibility. **PURPOSE:** To describe standardized equations to convert common ultrasound-based measures of arterial stiffness (arterial compliance, distensibility, β -stiffness index, elastic modulus) to local PWV. **METHODS:** We first conducted a literature search to derive conversion equations. For measures of arterial stiffness that conversion equations cannot be used, we generated regression equations using the accumulated dataset available in the laboratory. Subsequently, these equations were cross-validated in a well-controlled laboratory-based study, in which all measures of arterial stiffness were collected in 49 apparently healthy participants. **RESULTS:** The literature search revealed that some measures of arterial stiffness such as distensibility coefficient (DC) can be converted to local PWV using the Bramwell-Hill model ($PWV = [pDC]^{1/2}$) with an assumption of $p=1059 \text{ kg/m}^3$. Ultrasound-based measures of arterial stiffness were strongly and significantly associated with local PWV with Pearson r ranging from 0.74 to 0.99 ($p < 0.01$). Converted local PWV using regression models were correlated with each other ($r=0.73$ to 0.99 , $p < 0.01$). The correlations between converted local PWV and directly measured carotid-femoral PWV ranged from weak to moderate correlations with the range of r from 0.08 to 0.41. **CONCLUSION:** Our findings indicate that commonly-used measures of ultrasound-based arterial stiffness can be converted to local PWV and can be compared with a reference standard measure. These conversions can be used in systematic reviews and meta-analyses to synthesize evidence across studies to detect effects.

3266 Board #87 May 29 2:30 PM - 4:00 PM
Interrupting Prolonged Sitting With Different Walking Intensities And Durations: Effects On Resting Blood Pressure
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 (No relevant relationships reported)

BACKGROUND: Greater time spent in sedentary behaviour is associated with an increased risk of cardiovascular disease, type-2 diabetes, and mortality. Regularly interrupting prolonged sitting with 2-min light-intensity and 2-min moderate-intensity walking every 20 minutes without matching for energy expenditure has been shown to reduce resting blood pressure. However, little is known whether interrupting prolonged sitting with 3-min light-intensity walking and 1.5-min brisk walking every 30 min when the energy expenditure of these trials is matched provides similar benefits on resting blood pressure. **PURPOSES:** To compare the effects of 1.5-min moderate-intensity walking every 30 minutes and 3-min light-intensity walking every 30 minutes on resting blood pressure in young men with central obesity when the energy expenditure of these trials is matched. **METHODS:** Sixteen East-Asian men with central obesity (mean age: 22.3 ± 4.2 years; body mass index: $29.9 \pm 1.7 \text{ kg}\cdot\text{m}^{-2}$; waist circumference: 100.3 ± 5.9 cm) completed three, 7-h laboratory-based conditions in a randomised order: 1) prolonged sitting (SIT), 2) 3-min (at 20 - 39% of $\dot{V}O_2$ reserve) and 3) 1.5-min (at 40 - 59% of $\dot{V}O_2$ reserve). Each trial was separated by a 6-day washout period. Resting blood pressure was measured hourly using automated sphygmomanometer in a seated position (mean of two recordings, ≥ 15 -min post-activity). Generalised Estimating Equations were used to examine differences among the three conditions. **RESULTS:** Resting systolic blood pressure (SBP) reduced in the 3-min condition (mean \pm SEM; 119 ± 2 mmHg) but not in 1.5-min condition (120 ± 2 mmHg) when compared with SIT condition (123 ± 3 mmHg, $P = 0.028$). Resting diastolic blood pressure (DBP) reduced in both 3-min (75 ± 2 mmHg) and 1.5-min (75 ± 2 mmHg) conditions compared with SIT condition (76 ± 2 mmHg, $P = 0.024$ and $P = 0.001$, respectively). **CONCLUSIONS:** Interrupting prolonged sitting with 3-min of light-intensity walking every 30 minutes is more effective on reducing resting blood pressure when compared to the trial with 1.5-min of moderate-intensity walking every 30 minutes in young East-Asian men with central obesity.

3267 Board #88 May 29 2:30 PM - 4:00 PM
Seasonal Variation In Sunlight Exposure, Nitric Oxide Metabolites, And Blood Pressure
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A reduced exposure to ultraviolet (UV) radiation in winter can decrease 25-hydroxyvitamin D (25(OH)D) levels, increase cardiovascular risk factors, and inhibit athletic performance. Exposing skin to UV-A light in the laboratory has also been shown to release nitric oxide (NO) metabolites into the circulation; molecules known to regulate multiple cardiovascular and metabolic processes. However, it is presently unclear whether NO availability is influenced by the seasonal variation in UV exposure. **PURPOSE:** To compare UV exposure, serum 25(OH)D, plasma nitrate and nitrite, and blood pressure between the summer and winter months. **METHODS:** Thirty-four healthy adults (21 males) residing in Scotland ($\sim 55.8^\circ \text{N}$, 4.1°W) were monitored for 7 days in the summer (June - August) and winter (December - February) in a randomised order. Participants wore a personal UV monitor on the wrist throughout each monitoring phase before visiting the laboratory to provide a venous blood sample and to have blood pressure measured. Serum levels of 25(OH)D were measured using an enzyme-linked immunosorbent assay and plasma nitrate and nitrite analysed using gas-phase chemiluminescence. **RESULTS:** Total UV-A exposure was higher in summer ($17 \pm 21 \text{ J}\cdot\text{cm}^{-2}$) compared to winter ($2.5 \pm 3.0 \text{ J}\cdot\text{cm}^{-2}$, $P < 0.001$). Plasma nitrate did not differ between seasons ($P=0.57$) but nitrite ($137 \pm 31 \text{ nM}$) and serum 25(OH)D ($22 \pm 8 \text{ ng/ml}$) were lower (both $P < 0.001$) in the winter compared to summer ($200 \pm 56 \text{ nM}$ and $35 \pm 13 \text{ ng/ml}$, respectively). Blood pressure was higher in winter (systolic 126 ± 13 mmHg; diastolic 76 ± 9 mmHg) than in summer (systolic 119 ± 11 mmHg; diastolic 67 ± 8 mmHg; both $P < 0.001$). UV-A exposure was positively associated with plasma nitrite ($R=0.41$, $P < 0.01$) and 25(OH)D ($R=0.43$, $P < 0.01$). Plasma nitrite was negatively associated with systolic ($R=-0.5$, $P < 0.01$) and diastolic blood pressure ($R=-0.4$, $P < 0.01$). **CONCLUSIONS:** In a similar fashion to 25(OH)D, circulating levels of plasma nitrite, a marker of NO bioavailability, appear to be influenced by seasonal variations in UV exposure. The negative association between nitrite and blood pressure suggest that a reduced level of NO may increase cardiovascular risk factors in the winter months.

3268 Board #89 May 29 2:30 PM - 4:00 PM
Abstract Withdrawn

3269 Board #90 May 29 2:30 PM - 4:00 PM
Sex And Fiber-type Differences: Vascular ATP-sensitive K⁺ (K_{ATP}) Channels Support Critical Speed And Interstitial PO₂
 Trenton D. Colburn, Ramona E. Weber, Kiana M. Schulze, K. Sue Hageman, Timothy I. Musch, FACSM, David C. Poole, FACSM. *Kansas State University, Manhattan, KS.* (Sponsor: David C. Poole, FACSM)
 (No relevant relationships reported)

Glibenclamide (GLI), prescribed to Type II diabetes patients, enhances insulin release by inhibiting pancreatic K_{ATP} channels. K_{ATP} channels support maximal aerobic capacity ($\dot{V}O_{2\text{max}}$) and blood flow during treadmill running in male rats. Whether high-intensity exercise tolerance (i.e. critical speed, CS) and muscle O₂ delivery-utilization matching (interstitial PO₂, PO_{2is}) is impaired, and whether sex differences exist in K_{ATP} function, are unknown. **PURPOSE** We hypothesized that systemic inhibition of K_{ATP} channels via GLI would decrease $\dot{V}O_{2\text{max}}$ and CS, while local inhibition would decrease contracting PO_{2is} and blood flow within fast-twitch oxidative (mixed gastrocnemius (MG)) and slow-twitch oxidative (soleus (SOL)) muscles with females (F and F+OVX) expressing the greatest reduction. **METHODS:** Male (n=12), female (n=10, proestrus) and ovariectomized female (F+OVX; n=12) Sprague-Dawley rats with and without GLI (10 mg kg⁻¹ in DMSO i.p.). $\dot{V}O_{2\text{max}}$ and CS were assessed using state-of-the-art techniques on a motorized treadmill. PO_{2is} was determined, before and after GLI superfusion (5 mg kg⁻¹), via phosphorescence quenching (G4) in the exposed MG and SOL muscles during electrically-induced contractions and blood flow by fluorescent-labeled microspheres (15 μm). **RESULTS:** GLI decreased $\dot{V}O_{2\text{max}}$ in female (71.5 ± 1.0 vs 67.9 ± 1.5) and F+OVX (76.8 ± 1.4 vs 74.4 ± 1.4 ; $p < 0.05$ for both) but not males (81.5 ± 2.0 vs $80.8 \pm 2.0 \text{ mL O}_2 \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$; $p > 0.05$). CS was reduced equivalently in all groups (8-11%; $p < 0.05$). GLI reduced MG blood flow (female: 49 ± 9 vs 34 ± 5 ; male: 50 ± 5 vs 35 ± 4) and PO_{2is} (female: 7.3 ± 0.5 vs 6.1 ± 0.5 ; male: 8.9 ± 1.1 vs 7.2 ± 0.5), but not SOL, of female and male rats ($p < 0.05$). Conversely, in F+OVX, PO_{2is} was reduced in the SOL (14.5 ± 1.5 vs 10.2

± 1.1 ; $p < 0.05$), but not MG. **CONCLUSION:** These data support the role of vascular K_{ATP} channels in exercise tolerance (i.e. CS) by matching O_2 delivery-utilization with ovariectomy shifting K_{ATP} channel effects from fast- to slow-twitch muscles. Supported by NIH Grants: HL108328 and F31HL145981

3270 Board #91 May 29 2:30 PM - 4:00 PM

Dose-response Impact Of Resistance Training Frequency On Arterial Stiffness

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(No relevant relationships reported)

Arterial stiffness (AS) has been shown to underpin the development and progression of many cardiovascular diseases. Regular exercise promotes favorable changes in arterial health; however, investigations on the impact of resistance training (RT) alone on AS have shown mixed results. Moreover, the frequency design in which an RT program is completed on a weekly basis (i.e., the 'weekend warrior' approach) may impact overall changes to arterial health.

PURPOSE: We sought to examine the dose response impact of RT frequency over a 4-week period on arterial stiffness and blood pressure in college-aged resistance trained individuals. **METHODS:** Twenty-seven resistance trained males ($n=16$) and females ($n=11$) were randomized into three training groups differing in weekly RT frequency: a) 1-day (1D) per week ($n=8$), b) 2-days (2D) per week ($n=9$), or c) 3-days (3D) per week ($n=9$). Resistance training exercises included: dumbbell chest press, seated cable row, leg press, calf raise, lateral pulldown, seated shoulder press, seated leg extension, and prone leg curl. Exercises were completed either two (3D), three (2D), or six (1D) sets of 10 repetitions at 65% 1-repetition max, depending on group. Arterial stiffness indices (augmentation index (AIx75), pulse pressure (PP), and augmentation pressure (AP)) were measured at baseline, midpoint, and after completing the 4-weeks using the SphygmoCor XCEL. A two-way (group x time) ANOVA with repeated measures was employed to examine differences in AS indices between groups. **RESULTS:** Total weekly load volumes were similar ($p = 0.996$) across groups. There were no differences between 1D, 2D, and 3D for AIx75 ($p = 0.429$), PP ($p = 0.646$), and AP ($p = 0.247$). **CONCLUSION:** Given no differences between groups, a total weekly load volume of RT can be completed in a single weekly session or across multiple sessions without any negative or favorable impact on AS.

3271 Board #92 May 29 2:30 PM - 4:00 PM

Pulse Wave Velocity And Pulmonary Function Testing As Markers Of Cardiovascular Disease In Females

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(No relevant relationships reported)

PURPOSE: To assess the association of dynamic lung function, namely forced vital capacity (FVC) and forced expiratory volume in 1 sec (FEV_1) and diffusing capacity for carbon monoxide with markers of cardiovascular disease in a cohort of asymptomatic female smokers. Cardiovascular disease is a major health problem worldwide, poor lung function has been associated with increased mortality in cardiovascular disease patients. Both are linked to smoking. Poor scores in arterial stiffness have been linked to restrictive pattern on spirometry. Relatively little is known about the association of other pulmonary function test scores to arterial stiffness. **METHODS:** 35 female participants, age 51 ± 9 yrs, VO_{2peak} 22.5 ± 4.7 ml/kg/min, FEV_1/FVC : 0.78 ± 0.08 , $FEV_1\%pred$ 88.9 ± 17.85 , $DLC0\%pred$ 79.05 ± 14.43 were recruited as part of a North East Inner City Dublin City Council 'Change for Life' exercise programme. Patients performed spirometry, and diffusing capacity for carbon monoxide (DLCO) was assessed. Body mass index (BMI) and waist:hip (W:H) ratio were calculated. EC was assessed via cardiopulmonary exercise test (CPET) upper body strength via handgrip dynamometer (HG) and lower body strength via 30 sec sit to stand test (30STS). Carotid-Femoral (caPWV) and Brachial-Ankle (baPWV) pulse wave velocity were assessed with the Vicorder unit. Continuous data are presented as mean \pm SD. Associations between continuous variables were scored using Pearson's r. **RESULTS:** Significant negative correlations were observed between caPWV and baPWV and FEV_1/FVC , $r = -.55$ and $r = -.51$. EC showed positive correlations with FEV_1 , $r = .35$, and FVC = $.44$, and negative correlations with baPWV, $r = -.35$. No association was seen between arterial stiffness measures and DLCO.

CONCLUSIONS: Female patients with significant smoking history and preserved pulmonary function may display signs of cardiovascular disease as evidenced by increased arterial stiffness.

3272 Board #93 May 29 2:30 PM - 4:00 PM

EXERCISE TRAINING AMELIORATES CEREBROVASCULAR DYSFUNCTION IN ALZHEIMER'S DISEASE; A ROLE OF P2Y2 RECEPTOR AND ENDOPLASMIC RETICULUM STRESS

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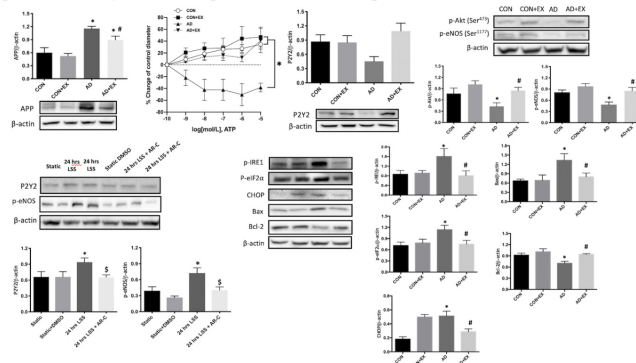
(No relevant relationships reported)

PURPOSE: To determine the protective effect of exercise training on P2Y2 receptor-mediated and ER stress-associated cerebrovascular dysfunction in AD.

METHODS: We used the control mice (CON; C57BL/6), CON with exercise training (CON+EX), AD mice (AD; APP/PS1) and AD with EX (AD+EX). At 7 to 9 months of age, CON+EX and AD+EX mice underwent 10-12 weeks of aerobic exercise training on the treadmill, running for an hour at 15m/min at a 5% grade for 5 days a week. To test the purinergic receptor-dependent vasoreactivity, a posterior cerebral artery (PCA) was isolated and pressurized, and then ATP (2-MeS-ATP, 1 nmol/L to 10 μ mol/L)-induced dose-dependent vasoreactivities were determined at 10-12 months of age. Human brain micro endothelial cells (HBMECs) were exposed to laminar shear stress (LSS) at 20 dyne/cm² for 30 mins, 2 hrs, and 24 hrs. Western blotting was utilized to analyze the expression of P2Y2 receptors, endothelial nitric oxide synthesis (eNOS), and ER stress signaling to define the effect of exercise training on cerebrovascular dysfunction.

RESULTS: ATP-induced vasodilation in PCA from CON mice, but it caused vasoconstriction in PCA from AD mice. Notably, exercise training reversed ATP-induced vasoconstriction in PCA from AD mice to vasodilation (AD+EX) comparable to CON mice. Exercise training reduced the elevation of APP expression and increased P2Y2 receptor and Akt/eNOS expression in AD mice brain. Also, LSS increased the expression of P2Y2 receptor and eNOS in HBMECs, but these increases were blunted by P2Y2 receptor inhibitor (AR-C) in HBMECs. Exercise training normalized the abnormal expression of ER stress markers; p-IRE1, p/t-eIF2 α , CHOP, and ER stress-associated apoptosis; Bax and Bcl-2 in AD mice brain.

CONCLUSION: Exercise training improves the cerebrovascular dysfunction in AD possibly through P2Y2 receptor-and ER stress-dependent endothelial dysfunction.



3273 Board #94 May 29 2:30 PM - 4:00 PM

Dietary Nitrate Intake Improves Vascular Function And Walking Capacity In Patients With Peripheral Artery Disease

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(No relevant relationships reported)

Peripheral artery disease (PAD) is the manifestation of atherosclerosis in the arteries of the legs, which reduces blood flow to the lower extremities and impairs walking capacity. Dietary nitrate has been used to reduce blood pressure (BP) and increase exercise tolerance in PAD. However, a standard dose, body mass normalized nitrate, for PAD has yet to be determined.

PURPOSE: To elucidate the impacts of a body mass-normalized dose of nitrate (0.11 mmol nitrate/kg) in the form of beetroot juice on resting heart rate (RHR), central and peripheral BP, vascular function, and exercise tolerance in patients with PAD.

METHODS: In a randomized crossover design, 10 patients with PAD (stage II-III) received either the nitrate supplement or placebo. At each visit, measures of RHR, central and peripheral BP, brachial and popliteal artery endothelial function (flow-

mediated dilation, FMD), arterial stiffness (pulse-wave velocity, PWV), augmentation index (AIx)), maximal walking capacity, and time to claudication (COT) were measured before and after nitrate and placebo.

RESULTS: There were significant group by time interactions ($p < 0.05$) for systolic BP, endothelial function, and maximal walking distance. Systolic BP was significantly reduced ($p < 0.05$) while popliteal FMD, brachial FMD, and maximal walking time significantly increased ($p < 0.05$). Nitrate intake reduced central systolic BP and increased maximal walking time ($p < 0.05$). There were trends for decreased diastolic BP ($p = 0.15$), central diastolic BP ($p = 0.06$), and central pulse pressure ($p = 0.17$). There were no changes in RHR, deceleration time, max dP/dt, carotid-to-radial PWV, carotid-to-femoral PWV, carotid-to-ankle PWV, AIx, or COT ($p > 0.05$).

CONCLUSIONS: These results indicate that a dose of nitrate (~ 0.11 mmol nitrate/kg) seems to be an effective dose for improving BP, vascular function, and walking capacity in patients with PAD.

3274 Board #95 May 29 2:30 PM - 4:00 PM
Effects Of Aquatic Vs Land Based Exercise Training On Vascular Function In Peripheral Artery Disease Patients

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(No relevant relationships reported)

Peripheral artery disease (PAD) is an atherosclerotic disease that is associated with poor vascular function, walking impairment, and reduced quality of life. Walking is frequently recommended to improve vascular function and reduce symptoms; however, the efficacy of land-based walking training (LET) versus heated-water walking training (HWET) in PAD patients had not been elucidated. **Purpose:** We sought to compare effects of LET to HWET on vascular function, resting heart rate (RHR), exercise tolerance [6-min walking distance (6MWD), time to onset of claudication (COT)], muscular strength, physical function, body composition, and resting metabolic rate (RMR) in PAD patients. **METHODS:** PAD patients ($n = 53$) were recruited and randomly assigned to a LET group ($n = 25$) or HWET group ($n = 28$). The LET group performed a treadmill walking program while the HWET group performed a heated-water walking program for 12-weeks. Leg arterial stiffness (femoral-to-ankle pulse-wave velocity, legPWV), blood pressure (BP), ankle-brachial index (ABI), RHR, 6MWD, COT, muscular strength, physical function, body composition, and RMR were assessed before and after 12-weeks. **RESULTS:** There were significant group by time interactions ($p < 0.05$) for legPWV, BP, RHR, 6MWD, COT, leg strength, body mass, body fat percentage, and RMR. Both groups significantly reduced ($p < 0.05$) legPWV, BP, RHR, body mass, and body fat percentage, and HWET was significantly lower than LET ($p < 0.05$). Both groups significantly increased ($p < 0.05$) 6MWD, COT, leg strength, and RMR, and HWET group was significantly greater than LET ($p < 0.05$). There were no significant changes ($p > 0.05$) in ABI, grip strength, physical function, body mass index, or lean mass after 12 weeks. **CONCLUSIONS:** These results suggest that although treadmill walking may help improve vascular function, exercise tolerance, muscular strength, and body composition, heated-water walking may improve these measures to a greater extent in patients with PAD.

3275 Board #96 May 29 2:30 PM - 4:00 PM
Comparison Of Whole-forearm And Skin Post-occlusive Reactive Hyperemia As Indices Of Microvascular Function

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(No relevant relationships reported)

BACKGROUND: Post-occlusive reactive hyperemia (PORH) is often used as a test of microvascular function. However, the method of PORH measurement and the reporting of PORH values varies widely between studies, from measurements on the skin or whole-forearm to reporting peak or cumulative PORH values. As such, the optimal measurement and reporting of PORH values remains unclear.

PURPOSE: To compare whole-forearm and skin PORH between older adults with conditions typically associated with microvascular dysfunction (type 2 diabetes, T2D), macrovascular dysfunction (non-diabetic coronary artery disease, CAD) and healthy controls (CTRL).

METHODS: We retrospectively analyzed data obtained from 13 T2D patients (61 ± 9 years, 6 M; 7 W), 21 CAD patients (65 ± 9 years, 18 M; 3 W) and 13 CTRL (65 ± 7 years, 9 M; 4 W). Forearm vascular conductance (FVC, duplex ultrasound) and cutaneous vascular conductance (CVC, laser-Doppler) were measured simultaneously before and for 3 minutes after 5 minutes of forearm ischemia. PORH was quantified as: absolute peak (Peak), change from baseline to peak (Δ) and area under the curve above baseline (AUC).

RESULTS: Baseline FVC ($P = 0.84$) and CVC ($P = 0.31$) were similar between groups. Peak FVC was similar between groups ($P = 0.24$), while Δ FVC tended to be reduced in

T2D compared to CAD ($P = 0.06$) and CTRL ($P = 0.07$). FVC AUC was reduced in T2D compared to CTRL ($P = 0.03$), while values in CAD did not differ from T2D or CTRL. Peak CVC (T2D: $P = 0.04$, CAD: $P = 0.02$) and Δ CVC (T2D: $P = 0.03$, CAD: $P = 0.01$) were reduced in T2D and CAD. There was a trend for CVC AUC to differ between groups ($P = 0.06$). The different indices of PORH for a given measurement (forearm vs skin) were strongly correlated ($r = 0.755$ to 0.906 between FVC descriptors, $r = 0.768$ to 0.991 between CVC descriptors, all $P < 0.001$). However, FVC indices of PORH weakly correlated with CVC indices ($r = 0.237$ to 0.374 , $P = 0.01$ to 0.11).

CONCLUSIONS: Whole-forearm and skin PORH provide different information on microvascular function in older adults. A decreased PORH in the whole-forearm appears to be a feature of T2D and not CAD, while a decreased PORH in forearm skin seems to be detectable in both T2D and CAD.

3276 Board #97 May 29 2:30 PM - 4:00 PM

Role Of Akt And Mapk Signals Balancing In The Exercise-regulated Phenotype-switching In Spontaneously Hypertensive Rats

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The mechanisms regulating vascular smooth muscle cell (VSMC) phenotype switching and the critical signal modulation affecting the VSMCs remain controversial. Multiple studies have shown that physical exercise acts as an effective drug in preventing elevated blood pressure and improving vascular function.

PURPOSE: This study was designed to explore the influence of aerobic exercise on the suppression of VSMC phenotype switching by balancing of the Akt (protein kinase B) and mitogen-activated protein kinase (MAPK) signaling pathways. **METHODS:** Twelve-week old spontaneously hypertensive rats (SHRs) and age-matched normotensive rats (WKYs) were subjected to exercise (SHR-EX and WKY-EX) and sedentary (SHR-SED and WKY-SED) treatment for 8 weeks before measuring the vascular morphological and structural performances. **RESULTS:** (1) The thickness of thoracic aortas was significantly increased in the SHR-SED versus the WKY-SED (99.4 ± 1.97 vs 83.12 ± 1.45 μ m, $p < 0.01$). Physical exercise significantly suppressed the thickening of the blood vessel wall in the SHR-EX compared to SHR-SED (92.5 ± 1.52 vs 99.4 ± 1.97 μ m, $p < 0.05$). (2) Exercise training induced reverse expression of VSMC protein markers in SHR-EX group versus SHR-SED group (α -SM-actin: 0.91 ± 0.04 vs 0.71 ± 0.03 , $p < 0.05$; calponin: 0.97 ± 0.05 vs 0.76 ± 0.05 , $p < 0.05$; and OPN: 1.83 ± 0.16 vs 2.32 ± 0.18 , $p < 0.05$). (3) The phosphorylated Akt was significant upregulated in SHR-EX group versus SHR-SED group (0.98 ± 0.05 vs 0.75 ± 0.04 , $p < 0.05$). However, the expression of phosphorylated ERK (1.34 ± 0.12 vs 1.69 ± 0.09), and phosphorylated p38 MAPK (1.06 ± 0.04 vs 1.25 ± 0.03 , both $p < 0.05$) were significant downregulated in the SHR-EX versus the SHR-SED. (4) VSMCs and whole vessels were treated by inhibitors, p-Akt inhibitor, p-ERK inhibitor and p-p38 MAPK inhibitor, respectively. It is important to note that a significant reverse regulatory relationship was observed between the expression levels of MAPK and contractile markers in both normotensive and spontaneously hypertensive rats. **CONCLUSION:** Aerobic exercise regulates VSMC phenotype switching by balancing the Akt and MAPK signaling pathways in SHRs.

3277 Board #98 May 29 2:30 PM - 4:00 PM
Preliminary Study: Effect Of Body Fat Percentage On Arterial Stiffness In Young Healthy Hispanic Males

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(No relevant relationships reported)

Introduction: Obesity is a serious health concern worldwide and it is a common health condition in Hispanic population. High body fat percentage is inversely related to aerobic fitness and increased arterial stiffness, which is an independent CVD risk factor. However, there is

limited data about the effects of body fat percentage on arterial stiffness in Hispanic population. **Purpose:** To investigate the effects of Body Fat Percentage (BFP) on arterial stiffness in young healthy Hispanic males. **Methods:** Ten young (5 in each group, age: Low Fat group (LF, BFP < 25%) = 23.2 ± 1.8 yrs, High Fat group (HF, BFP > 25%) = 22.8 ± 4.3 yrs) healthy, casually active Hispanic males volunteered for the study. Aerobic capacity (VO_{2peak}) was measured by metabolic cart during graded exercise testing on the treadmill. Hemodynamic variables including

blood pressure (BP) and heart rate were measured in supine position by automated BP monitor. BFP was measured by Dual-Energy X-ray Absorptiometry (DXA) and arterial stiffness indices including heart rate normalized augmentation index (AIx@75) and Pulse Wave Velocity (PWV)

were acquired by tonometer and ambulatory BP monitor, respectively. **Results:** HF group exhibited significantly lower aerobic capacity (41.64 ml/kg/min) when compared to LF group (48.86 ml/kg/min) ($p < 0.05$). However, there was no significant

difference in hemodynamic variables including systolic BP, diastolic BP and HR ($p > 0.05$ for all). In addition, PWV (HF vs. LF; 5.5 ± 0.5 m/s vs. 5.3 ± 0.4 m/s) and $AIx@75$ (HF vs. LF: $0.0\% \pm 13.8\%$ vs. $-8.8\% \pm 5.3\%$) were not statistically different between groups ($p > 0.05$ for both) **Conclusion:** Although HF group exhibited significantly lower aerobic capacity, BFP does not affect arterial stiffness in young casually active Hispanic males. Future study with more participants will be needed.

3278 Board #99 May 29 2:30 PM - 4:00 PM
Impact Of Smoke Exposure On VO_{2max} And Arterial Stiffness In Wildland Firefighters: A Pilot Study

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Purpose: Inhalation of wildfire smoke can cause reduced lung function, chest pain, fatigue, and depressed respiratory immune defenses. Those at increased risk for these adverse effects would be wildland firefighters (WLF). Aerobic fitness is a key component of WLF performance. Additionally, it is known that higher levels of aerobic fitness correlate with lower levels of cardiovascular (CV) morbidity and mortality. The impact of wildland smoke exposure on CV health among WLF is unknown.

Methods: WLF from the Arizona high country were recruited for this study. WLF were asked to come to the lab at Grand Canyon University before and after fire season. WLF were asked to fill out a survey assessing the number of seasons they have actively engaged in wildland firefighting. Following anthropometric measurements, subjects had their carotid-femoral Pulse Wave Velocity (cfPWV) and VO_{2peak} measured. Identical measurements were taken before and after fire season. Hierarchical regression was completed to assess the relationship between the number of fire seasons completed and VO_{2peak} . Paired t-test was completed for pre-post testing.

Results: Twenty-eight subjects completed initial testing while 22 returned for post-testing. Subjects were 31.0 ± 5.7 yrs., with a BMI of 25.7 ± 3.0 kg/m², VO_{2peak} of 55.4 ± 6.6 mL/kg/min and completed on average 10.6 ± 5.8 seasons of wildland firefighting. Hierarchical regression was conducted with age in model one and number of seasons in model two, VO_{2peak} was the criterion variable. Model one was not a significant predictor of VO_{2peak} . Model two significantly explained 23% of the variance in VO_{2peak} ($P=0.044$). Significant reduction in absolute VO_{2peak} (4.3 ± 6 vs 3.2 ± 1.9 L/min, $P<0.04$) and significant increases in cfPWV (6.0 ± 1 vs. 6.6 ± 7 m/s, $P<0.042$) were seen following fire season.

Conclusion: This pilot study suggests that the duration of a WLF career may negatively impact CV health.

3279 Board #100 May 29 2:30 PM - 4:00 PM
Exercise Mediates Epigenetic Suppression Of LTCC And BK_{Ca} Channel In Mesenteric Arteries Of Hypertensive Rats

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Regular exercise is a lifestyle intervention for controlling hypertension and has an improving effect on vascular function. Voltage-gated L-type Ca^{2+} (LTCC) and large-conductance Ca^{2+} -activated K^{+} (BK_{Ca}) channels are two principal mediators of vascular smooth muscle contractility and arterial tone. Exercise-induced LTCC and BK_{Ca} channel alterations in arterial myocytes may contribute to the improvement of vascular function in pathological conditions. However, the mechanism underlying the functional changes of these ion channels is still unclear but critical for understanding the mechanistic basis of reliable arterial performance. **PURPOSE:** To investigate the role of DNA methylation in exercise-induced reprogramming of LTCC and BK_{Ca} channel in mesenteric arteries from spontaneously hypertensive rats (SHRs). **METHODS:** Twelve-week-old male SHRs and normotensive Wistar-Kyoto rats (WKYs) were assigned into sedentary and exercise groups. Exercise groups were performed a moderate-intensity treadmill running (about 55-65% of maximal aerobic velocity, 20 m/min, 0% grade, 60 min, 5 days/week). After 12 weeks, patch clamp study, Western blot, qPCR and bisulfite sequencing PCR were used to detect the LTCC and BK_{Ca} channel currents, protein expression and mRNA level of LTCC $\alpha 1c$ and BK_{Ca} $\beta 1$ subunits, DNA methylation level of $\alpha 1c$ and $\beta 1$ gene promoter region. **RESULTS:** Exercise training significantly decreased the systolic blood pressure in both WKYs (139.5 ± 0.48 vs. 132.3 ± 0.56 mmHg, $P<0.05$) and SHRs (199.4 ± 0.45 vs. 191.2 ± 0.71 mmHg, $P<0.05$). Exercise inhibited hypertension-induced upregulation of LTCC (-16.0 ± 1.6 vs. -11.4 ± 1.5 pA/pF, $P<0.05$) and BK_{Ca} (43.7 ± 2.8 vs. 23.1 ± 1.6 pA/pF, $P<0.05$) channel current density of mesenteric arterial myocytes by repressing LTCC $\alpha 1c$ (2.8 ± 0.3 vs. 1.7 ± 0.2 , $P<0.05$) and BK_{Ca} $\beta 1$ (1.7 ± 0.3 vs. 0.8 ± 0.2 , $P<0.05$) subunit expression. DNA bisulfite sequencing PCR showed that chronic exercise increased CpG methylation at $\alpha 1c$ (81.3 ± 1.6 vs. $87.9 \pm 0.8\%$, $P<0.05$) and $\beta 1$ (17.7 ± 0.4

vs. $25.2 \pm 2.0\%$, $P<0.05$) gene promoter in SHR mesenteric arteries. **CONCLUSION:** Exercise suppresses LTCC and BK_{Ca} channel function via hypermethylation of $\alpha 1c$ and $\beta 1$ subunits, which contributes to the restoration of mesenteric arterial function and vasodilation during hypertension.

3280 Board #101 May 29 2:30 PM - 4:00 PM
Evaluation Of Functional Sympatholysis Occurring Within Contracting Skeletal Muscle Microvasculature In Humans

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The ability of contracting skeletal muscle to blunt sympathetic vasoconstriction, termed functional sympatholysis, is thought to contribute to supplying adequate blood to the exercising muscle despite increased sympathetic tone. However, previous studies in humans primarily investigated vascular responses of exercising limb as a whole that reflects not only responses of contracting skeletal muscles but also responses of inactive tissues such as skin, adipose and bones. **PURPOSE:** We aimed to more directly investigate the functional sympatholysis occurring within exercising skeletal muscle in humans. **METHODS:** In 26 healthy male volunteers, we examined the effects of acute sympathoexcitation by 90-s forehead cooling at rest and during dynamic handgrip exercise at 10% and 30% of maximum voluntary contraction (10%Ex and 30%Ex), respectively. The handgrip exercises were continued 3 min and forehead cooling was applied at latter half of the exercise period. The subjects also performed handgrip exercises without forehead cooling as control conditions. We employed near-infrared diffuse correlation spectroscopy, an emerging optical technique for noninvasive measurement of deep tissue hemodynamics, to continuously measure the microcirculatory blood flow index (BFI) within the flexor digitorum superficialis muscle, the muscle primarily responsible for handgrip. **RESULTS:** The acute sympathoexcitation induced significant decrease in vascular conductance (BFI / mean arterial pressure) at rest (baseline vs. forehead cooling: 1.00 ± 0 vs. 0.75 ± 0.03 AU, $p < 0.05$) and during 10%Ex (control vs. forehead cooling: 1.66 ± 0.08 vs. 1.32 ± 0.10 AU, $p < 0.05$), but not during 30%Ex (control vs. forehead cooling: 4.00 ± 0.56 vs. 3.66 ± 0.50 AU, $p > 0.05$). In addition, the percentage reduction in vascular conductance by forehead cooling was significantly decreased during 30%Ex compared to rest (-25.2 ± 2.5 vs. $-4.9 \pm 5.1\%$, $p < 0.05$). **CONCLUSIONS:** Our study demonstrated the functional sympatholysis occurring within the contracting skeletal muscle microvasculature in humans. Furthermore, our results revealed the clear intensity-dependent response such that mild exercise hardly interferes with sympathetic vasoconstriction, whereas moderate exercise substantially attenuates it.

3281 Board #102 May 29 2:30 PM - 4:00 PM
Continuous Physical Activity Modulates Arterial Stiffening In Young People: A Prospective Longitudinal Observational Study

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PURPOSE: Higher physical activity is well known to prevent age-related increases in arterial stiffness in middle-aged and older people. However, no data are available concerning prospective longitudinal studies between physical activity and arterial stiffness, especially in young people. Therefore, this prospective longitudinal observational study aimed to examine the effects of continuous physical activity on arterial stiffening in young people.

METHODS: The data of the longitudinal study analyzed from 79 normal healthy young men and women (19.2 ± 0.2 years at baseline). At baseline (pre) and after 4-year follow-up (post), arterial stiffness, which was measured by using Cardio-Ankle Vascular Index (CAVI) and regular physical activity levels, which were measured by using International Physical Activity Questionnaire (IPAQ), were assessed. At each time point, participants were classified as having high (H) or low (L) physical activity based on the Physical Activity Reference for Health Promotion 2013 in Japan (23 Metabolic Equivalent Tasks-h/week), and then were finally divided into LL, HL, or HH groups.

RESULTS: After follow-up period, in addition to body weight, body mass index, and blood pressure, CAVI values of all participants significantly increased (Pre, 5.7 ± 0.1 unit; Post, 6.1 ± 0.1 unit). There were no significant differences in baseline CAVI values across the groups (LL, 5.7 ± 0.1 unit; HL, 5.7 ± 0.1 unit; HH, 5.8 ± 0.1 unit). However, the changes in CAVI from pre to post were significantly lower in HH group than in LL group ($P < 0.05$). With the status of continuous physical activity increasing, significant decreasing trends were observed in CAVI (LL, 0.6 ± 0.1 unit; HL, 0.4 ± 0.1 unit; HH, 0.1 ± 0.1 unit, $P < 0.05$).

CONCLUSIONS: These findings indicate that age-related increase in arterial stiffness is observed even in young healthy people. However, continuous higher physical activity can prevent this age-related arterial stiffening in young people.

3282 Board #103 May 29 2:30 PM - 4:00 PM

The Diversity Effect Of Exercise On Endothelial Function In Postmenopausal Women With ACE D/I Polymorphism

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PURPOSE: Increased incidences of cardiovascular disorder and metabolic syndrome particularly in postmenopausal women have raised curiosity for the underlying factors. One potential mechanism by which endothelial dysfunction may promote early arterial stiffness is by causing estrogen deficiency. It is reported that physical exercise counteracts the occurrence of above disorders, while a few others show no change. The training response differs among individuals partly due to genetic composition. Angiotensin-converting enzyme (ACE) insertion/deletion (D/I) polymorphism related to physical performance in athletes has been well-reported. The present study was to observe the effects of 12 weeks exercise (aerobic exercise and resistance training) on endothelial function in postmenopausal women with different D/I polymorphism of ACE gene.

METHODS: 122 postmenopausal women aged 45-75 years were randomly divided into aerobic exercise group (DI/II=65, DD=6) and resistance training group (DI/II=42, DD=9). Body composition, TC, HDL, LDL, endothelial function, endothelium-derived relaxing factor and contracting factor were analyzed.

RESULTS: TC, blood lipid abnormality rate, blood glucose and visceral fat in DI/II type were decreased more significantly after aerobic exercise compared with DD type. Aerobic exercise showed markedly positive effects in LDL, hyperglycemia, overweight/obesity, high body fat rate, abnormal waist-hip ratio and visceral fat in DI/II, while resistance training in LDL, blood glucose (5.34±0.73 vs 4.46±0.34mmol/L, P<0.01), waist-hip ratio and visceral fat (96.60±13.84 vs 61.33±8.65cm², P<0.05) in DD type. Aerobic exercise showed more obviously increased FMD (9.65±1.85 vs 11.00±1.99%, P<0.05), NO (68.31±4.67 vs 76.38±4.01umol/L, P<0.05), NO/ET-1 (0.91±0.11 vs 1.04±0.11, P<0.05) and decreased SBP (123.84±15.98 vs 109.89±13.56mmHg, P<0.05), DBP in DI/II than in DD type. Resistance training increased FMD (7.12±0.70 vs 9.56±0.78%, P<0.05), NO/ET-1 and decreased SBP, DBP, baPWV, ET-1, AngII more significantly in DD type than in DI/II type.

CONCLUSIONS: Exercise positively influences endothelial functions, independent of ACE D/I polymorphism; and DI/II carriers show a better response to aerobic exercise, while DD carriers to resistance exercise.

3283 Board #104 May 29 2:30 PM - 4:00 PM

Endothelial Function In Young Adults Reporting Histories Of Chronic Resistance Activity

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Endothelial dysfunction is a risk factor for cardiovascular disease (CVD) and is predictive of adverse events. However, endothelial function is rarely measured in apparently healthy, asymptomatic individuals that may benefit from early detection. Chronic cardiorespiratory endurance (CRE) activity appears to improve endothelial function and decrease CVD risk, but the role of chronic resistance activity is less clear. **PURPOSE:** The primary aim of this study was to describe endothelial function in young adults reporting histories of chronic resistance activity and minimal CRE activity. **METHODS:** Eight males (23.8 ± 2.2 yrs., 180.3 ± 7.6 cm, 100.8 ± 18.1 kg) and five females (24.6 ± 3.1 yrs., 164.9 ± 4.0 cm, 68.5 ± 4.2 kg) volunteered for digital peripheral arterial tonometry (PAT) and a one-repetition maximum (1-RM) barbell bench press. Endothelial function was measured as the logarithmic function of the reactive hyperemia index (LnRHI). Absolute strength was measured as the highest successful 1-RM lift (kg), and relative strength was measured as the bench press to body weight ratio (1-RM in kg / body mass in kg). Before PAT, participants fasted for 4 h and forwent alcohol, tobacco, vitamins, and ergogenic aids for 8 h. Before the 1-RM, participants fasted for 3 h, forwent the aforementioned substances for 8 h, and abstained from vigorous physical activity for 12 h. Independent *t*-tests compared the LnRHI between sexes. Effect size was calculated as Cohen's *d*. Pearson's *r* evaluated the relationships between absolute and relative strength and the LnRHI. Alpha level was set to .05 for all statistical tests. **RESULTS:** Males' LnRHI was significantly lower than females' (0.36 ± 0.12 vs. 0.84 ± 0.22); $t(5.739) = -4.462, p = .005, d = -2.61$

and abnormal according to the manufacturer (LnRHI > 0.51 is normal and ≤ 0.51 is abnormal). There were significant, moderate, and negative correlations between the 1-RM and the LnRHI ($r = -.60, p = .03$) and between the bench press to body weight ratio and the LnRHI ($r = -.66, p = .01$). **CONCLUSIONS:** Endothelial function was lower in males than in females reporting chronic resistance activity and minimal CRE activity. Males who develop considerable upper-body strength via chronic resistance activity may exhibit endothelial dysfunction as young adults. More research is warranted.

3284 Board #105 May 29 2:30 PM - 4:00 PM

Vascular And Blood Flow Responses To Upper Limb Exercise In Individuals With Posttraumatic Stress Disorder

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The physiological manifestations of posttraumatic stress disorder (PTSD) have been associated with an increase in risk of cardiovascular disease (CVD) independent of negative lifestyle factors. Peripheral vascular dysfunction may be a mechanism by which PTSD increases CVD risk. **PURPOSE:** This study sought to determine if blood flow regulation and peripheral vascular function are altered during exercise in individuals with PTSD when compared to age-matched controls. **METHODS:** Sixteen individuals with PTSD (10 women, 6 men; age 24 ± 4 years), and twenty-four age- and sex-matched healthy controls (CTRL); 15 women, 9 men, 24 ± 4 years, participated in the study. Upper limb vascular function and blood flow was assessed during rhythmic, progressive handgrip exercise (at rest, 3 and 6 kilograms (kg)) with Doppler ultrasonography. Exercise-induced changes in mean arterial pressure (MAP), brachial artery (BA) flow mediated dilation (normalized for BA shear rate), BA blood flow, and arm vascular conductance (VC) were quantified at each workload. **RESULTS:** Although no significance was noted in MAP, BA flow mediated dilation, or blood flow between groups, the PTSD group reported significantly lower VC at the highest exercise workload (6 kg - PTSD: 2.04 ± 0.9; CTRL: 2.87 ± 1.0 mL·min⁻¹·mmHg⁻¹; $p = 0.008$), when compared to the CTRL group. **CONCLUSION:** This study revealed that individuals with PTSD reported lower vascular conductance during upper limb arm exercise when compared to healthy controls. Further research is needed to determine if this finding translates to larger muscle mass exercise, potentially leading to exercise intolerance, as well as the potential mechanisms may be driving this dysfunction in individuals with PTSD, such as augmented sympathetic activity during exercise and/or microvascular dysfunction.

3285 Board #106 May 29 2:30 PM - 4:00 PM

Impaired Cardiovascular Responses To Acute Exercise In Adults With Cerebral Palsy

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(No relevant relationships reported)

Cerebral palsy (CP) is a non-progressive and permanent neurological disorder leading to musculoskeletal dysfunction and immobility. A major clinical problem with CP is early development of cardiovascular diseases with increased rates of mortality. Due to the inevitability of motor dysfunction adults with CP can develop health risk factors, such as obesity and hypertension, at a higher rate compared to the general population. To date, the physiological basis for CP has not been established; how cardiovascular dynamics, such as heart rate (HR), blood pressure (BP), and blood flow (BF), are controlled in individuals with CP has never been identified. **PURPOSE:** To determine differential cardiovascular responses to acute dynamic exercise in adults with CP. **METHODS:** Total of ten adults with and without CP participated in the study. HR from ECG, beat-to-beat arterial BP from Finapres and brachial BP, and respiration via pneumobelt were continuously measured before, during and after 2 minutes of dynamic handgrip exercise at 35% and 50% of maximal voluntary contraction. In addition, diameter, blood velocity, and flow of the brachial artery were measured using Doppler ultrasound on the contracting arm throughout the experiment. **RESULTS:** HR was significantly increased to exercise from rest in both groups with no group differences ($\Delta 9.8 \pm 1.2$ control vs. $\Delta 10.1 \pm 8.4$ CP, bpm). Both control and CP groups had increases in BF during exercise compared to at rest ($\Delta 132 \pm 22$ control vs. $\Delta 75 \pm 32$ CP, ml/min). Mean BP was significantly increased to exercise from rest in control; however, there were only minor changes in BP to exercise from rest in CP group ($\Delta 7.2 \pm 1.6$ control, $\Delta 2.2 \pm 0.1$ CP, mmHg). **CONCLUSION:** While HR and BF increased to exercise from rest in similar fashion, BP did not change to exercise in adults with CP. Our preliminary data speculate that other mechanisms, possibly vascular contribution from non-contracting limbs, may contribute to impaired BP response during exercise in CP. Supported by CASA RSCA Infusion, Central RSCA, and Undergraduate Research Grant, SJSU

3286 Board #107 May 29 2:30 PM - 4:00 PM
VALIDATION OF HEART-FEMORAL PULSE WAVE VELOCITY AS A MEASURE OF CENTRAL ARTERIAL STIFFNESS
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 (No relevant relationships reported)

BACKGROUND: Central Pulse Wave Velocity (PWV) is the gold-standard measure of arterial stiffness and an important clinical parameter for evaluating cardiovascular risk. The most frequently used measure of central PWV is carotid-femoral PWV (cfPWV); however, cfPWV may be unsuitable for use in patients who are obese, have had an ischemic stroke, or those with advanced carotid artery atherosclerosis. A potential alternative is heart-femoral PWV (hfPWV), which is simpler to conduct as the measurement does not require assessment of the carotid artery. The aims of this study were to determine (1) the strength of the association between cfPWV and hfPWV; and (2) determine whether change in cfPWV is associated with change in hfPWV. **METHODS:** Thirty healthy participants (23.5 y ± 2.9, 53% F, BMI 24.1 ± 2.3) were recruited for Aim 1, and 20 participants (24.1 ± 3.1, 55% F, BMI 23.9 ± 2.5) for Aim 2. Using Doppler ultrasound, cfPWV was measured using the foot-foot method on ECG-gated doppler waveforms captured from the common carotid and superficial femoral arteries. hfPWV was measured using the R wave to the foot of the superficial femoral artery doppler waveform. To induce change in cfPWV (Aim 2) the upper leg was occluded to 60 mm Hg. To estimate inter-individual associations between cfPWV and hfPWV (Aim 1), Pearson's product moment correlation was used. To estimate intra-individual associations between change (cuff vs. baseline) in cfPWV and change in hfPWV (Aim 2), the repeated measures correlation package for R was used. **RESULTS:** There was a large positive correlation ($r = 0.72$, 95% CI 0.48-0.86, $P < 0.001$.) between hfPWV and cfPWV (Aim 1). There was also a large positive correlation between change in cfPWV and change in hfPWV ($r = 0.83$, 95% CI 0.61-0.93, $P < 0.001$). **CONCLUSION:** The current findings indicate that cfPWV and hfPWV are strongly associated, and that change in cfPWV is strongly associated with change in hfPWV.

3287 Board #108 May 29 2:30 PM - 4:00 PM
Exaggerated Pulsatility During Exercise Is Associated With Reduced Muscle Strength And Quality In Elderly Hypertensives
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It is well-established that hypertensive individuals have an exaggerated systolic blood pressure in response to exercise. Leg muscle weakness is related to greater left ventricular (LV) mass in hypertensive individuals via exaggerated increases in blood pressure during aerobic exercise. Pulse pressure (PP) is an indicator of LV pulsatile hemodynamic load. Increased PP is associated with LV hypertrophy and dysfunction in older adults. **PURPOSE:** To determine differences in PP responses to resistance exercise in normotensive versus hypertensive older adults and the influence of lean mass and strength on these responses. **METHODS:** Nine normotensive (NTN) and 11 hypertensive (HTN) older adults (NTN aged 66 ± 3, HTN aged 68 ± 5) performed plantar flexion exercise at progressively increasing intensities (5, 15 and 30% of estimated calf flexion 1RM). During exercise, blood pressure was recorded in the right arm using an automated oscillometric device. Body composition was measured using dual-energy x-ray absorptiometry. Leg strength was measured using the leg press 10 repetition maximum (10RM). Leg muscle quality (LMQ) was calculated as leg strength (kg)/leg lean mass (kg). **RESULTS:** PP response to plantar flexion exercise at 30% of 1RM was significantly greater in the HTN (15 ± 1 mmHg) compared to NTN (6 ± 4 mmHg, $p = .02$). LMQ was significantly greater in the NTN (5.85 ± .75 kg/kg) compared to the HTN (5.00 ± 1.0 kg/kg, $p = .05$). Leg lean mass was not significantly different between groups. PP response at 30% was negatively correlated with LMQ ($r = -.570$, $p = .009$) and leg strength ($r = -.465$, $p = .039$). **CONCLUSIONS:** Hypertensive older adults have a greater pulse pressure response to calf flexion exercise when compared to normotensives. Reduced leg muscle strength and quality, but not mass, may contribute to the exaggerated pulse pressure response to calf flexion exercise in older adults with hypertension.

3288 Board #109 May 29 2:30 PM - 4:00 PM
Abstract Withdrawn

3289 Board #110 May 29 2:30 PM - 4:00 PM
Endothelial Function Contributes To Acute Changes In Pulse Wave Velocity
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 (No relevant relationships reported)

BACKGROUND: Pulse-wave velocity (PWV) can potentially be used to assess acute change in endothelial function. Previous studies have reported that increasing or decreasing nitric oxide bioavailability results in reciprocal changes to PWV. However, nitric oxide is not the only molecule regulating endothelial function and at this time, no in-vivo studies have examined whether PWV changes in acute, non-specific endothelial dysfunction. **PURPOSE:** Determine effects of acute endothelial dysfunction on PWV. In this study, retrograde shear stress was induced by increasing retrograde flow for 30 minutes. Our hypothesis is that acute endothelial dysfunction will result in decreased in PWV. **METHODS:** Twenty-two young, healthy adults (23.8 years [SD 4.1], 16 F, BMI 22.8 kg/m² [SD 2.8]) were recruited. PWV and flow-mediated dilation (FMD) were measured at baseline and immediately following the endothelial dysfunction protocol. FMD was measured to confirm the presence of endothelial dysfunction. PWV was measured between the upper arm and wrist using an oscillometric device, and brachial FMD using ultrasound. The association between PWV and FMD was assessed using Pearson's product moment correlation. Linear mixed models were used to assess baseline versus endothelial dysfunction protocol changes in PWV and FMD, controlling for within-subject changes in mean arterial pressure and the shear rate area under the curve, respectively. **RESULTS:** At baseline, there was a large association between FMD and PWV ($r = 0.60$, 95%CI: 0.23, 0.81). Following the endothelial dysfunction protocol, there was a moderate significant increase in PWV ($\Delta = 0.38$ m/s, 95%CI: 0.07, 0.69, ES = 0.5) and a large significant decrease ($\Delta = -3.10$, 95%CI: -4.15, -2.05, ES = -1.3) in FMD. **CONCLUSIONS:** Acute change in PWV is at least partially driven by changes in endothelial function, indicating that PWV could be a useful tool for assessing endothelial function changes.

3290 Board #111 May 29 2:30 PM - 4:00 PM
Validation Of Flow-mediated Slowing As A Measure Of Endothelial Function
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 (No relevant relationships reported)

BACKGROUND: Flow-Mediated Slowing (FMS) is a potentially simple, automated and user-objective test for assessing endothelial function. FMS can be defined as the minimum pulse wave velocity (PWV_{min}) during reactive hyperemia. **PURPOSE:** The purpose of this study was to determine the effects of acute endothelial dysfunction on PWV_{min}. It was hypothesized that endothelial dysfunction would increase PWV_{min}. **METHODS:** 22 young, healthy adults (23.8 yrs ± 4.1, 73% F, 22.8 kg/m² ± 2.8) underwent simultaneous assessment of Flow-Mediated Dilation (FMD) and PWV_{min} at baseline and immediately following 30min of an endothelial dysfunction protocol. FMD is the current gold-standard test of endothelial function and was used to confirm endothelial dysfunction. Endothelial dysfunction was induced by increasing retrograde shear stress in the brachial artery via inflation of a pneumatic tourniquet to 75 mm Hg around the forearm. PWV was measured from the upper-arm to the wrist using an oscillometric-based device, and brachial FMD was measured using duplex Doppler ultrasound. FMD (%) was calculated as the mean increase in diameter during reactive hyperemia, and PWV_{min} as the minimum pulse wave velocity during reactive hyperemia. Linear mixed models were used to assess baseline versus endothelial dysfunction changes in PWV_{min} and FMD, controlling for within-subject changes in mean arterial pressure. Inter-individual associations between baseline PWV_{min} and FMD were examined using Pearson's product moment correlation, and intra-individual associations between change (baseline vs. endothelial dysfunction) in PWV and change in FMD using the repeated measures correlation package for R. **RESULTS:** The endothelial dysfunction protocol resulted in large effect size (ES) decrease in FMD ($\Delta = -3.10$, 95%CI: -4.15, -2.05, ES = -1.3), and a moderate significant

increase in PWV_{min} ($\Delta = 0.16$, 95%CI: 0.05, 0.28, ES = 0.6). There was a moderate inter-individual association between FMD and PWV_{min} ($r = 0.46$), and a large intra-individual association between FMD and PWV_{min} ($r = -0.61$). **CONCLUSIONS:** Acute changes in PWV_{min} may be a user-objective, automated, and viable tool for monitoring acute changes in endothelial function.

3291 Board #112 May 29 2:30 PM - 4:00 PM
Can Racial Differences In Endothelial Dysfunction Be Explained By Mirnas?

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MicroRNAs (miRs) are short noncoding RNAs that regulate gene expression post-transcriptionally. It is well documented that exercise improves endothelial function, possibly, by modifying flow-responsive miR expression (e.g. miRs-126*, -92-a and -21). miR-126* is an anti-atherogenic miR that regulates vascular integrity, angiogenesis, and inflammation. Whereas, miR-92a and -21 are pro-atherogenic miRs that result in a reduction in endothelial nitric oxide synthase (eNOS) activity. miR-92a targets the transcription factor Kruppel-like factor 4 (KLF4) leading to lower eNOS expression. Whereas miR-21 targets phosphatase and tensin homologue (PTEN) to inhibit activation of the PI3K/Akt signaling pathway involved in activating eNOS. We have shown that African Americans (AA) exhibit a low grade of chronic systemic inflammation, exaggerated response to inflammatory cytokines, and a higher prevalence of endothelial dysfunction compared to Caucasians (CA). **PURPOSE:** To investigate potential racial differences in miRs expression and downstream target proteins in activated endothelial cells (EC).

METHODS: Human Umbilical Vein Endothelial Cells ($n=6$ cell lines; 3 CA & 3 AA) were cultured under two conditions: Control or TNF- α (10 ng/mL) for 4 hours. Protein expression was measured for PTEN, KLF4, p-eNOS^{ser-117} and eNOS. Total RNA was harvested to measure miR-21, miR-126*, and miR92a. A two-way ANOVA was used to assess the effects of race and condition.

RESULTS: No racial differences were found in protein expression of PTEN, KLF4, and eNOS at baseline or with TNF- α stimulation. AA had lower p-eNOS expression ($p=0.008$) compared to CA ECs under both conditions. No racial differences were found in miR-126 and miR-21 in either condition. However, AA were trending towards higher miR-92a expression ($p=0.07$) compared to CA ECs under both conditions.

CONCLUSIONS: Although we show significantly lower levels of p-eNOS and higher miR-92a expression in activated ECs of AA compared to CA, KLF4 protein levels were not significantly different. Therefore, the specific miRs studied do not explain the racial differences observed in endothelial dysfunction in an inflammation model. Future research should investigate potential racial differences in how miRs respond to high laminar shear stress, as an exercise mimetic.

3292 Board #113 May 29 2:30 PM - 4:00 PM
Acute Hypotension Blunts Brachial Flow-mediated Dilatation In Young Healthy Men

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Recent clinical studies using a vasovagal syncope suggest that endothelial function is a key factor controlling blood pressure (BP) regulation during acute hypotension. Acute increase in BP is known to attenuate brachial flow-mediated dilatation (FMD). However, the influence of acute hypotension on peripheral FMD remains unclear.

PURPOSE: To test the hypothesis that acute hypotension blunts brachial FMD, an index of endothelial function, in young healthy humans. **METHODS:** Twelve healthy men (21.8 \pm 1.6 yrs; body mass index: 22.2 \pm 1.6 kg/m², mean \pm standard deviation) underwent 3 trials of brachial FMD measurement. The trials involved a standardized FMD protocol (control trial), a trial with an abrupt decrease in BP via both thigh-cuff inflation and the deflation method (hypotension trial), and a trial with a decrease in shear rate (SR) via a shortened occlusion time for 3 min without a change in BP (SR reduction trial). Trials were randomized with 30-min intervals during a single visit. Duplex ultrasound was employed to measure brachial diameter and blood velocity. BP and heart rate were continuously measured using a non-invasive beat-to-beat BP monitoring system. To adjust the effect of SR area under the curve (SR_{AUC}) on FMD, normalized FMD were calculated.

RESULTS: There was a marked fall in mean arterial pressure during reactive hyperemia in the hypotension trial (-24 ± 6 mmHg), but not in the control and SR reduction trials. SR_{AUC} was attenuated in the SR reduction trial ($p<0.001$), but not in the hypotension trial ($p=0.316$), compared with the control trial. Thus, FMD was

attenuated in the hypotension and SR reduction trials compared with the control trial ($p=0.003$ and $p=0.043$, respectively). The attenuation in FMD was greater in the hypotension trial than in the SR reduction trial ($p=0.006$; control, 6.9% \pm 3.5%; hypotension, 3.5% \pm 1.7%; SR reduction, 5.0% \pm 2.2%). After adjusting FMD using SR_{AUC}, the normalized FMD remained attenuated in the hypotension trial ($p=0.014$), but not in the SR reduction trial ($p>0.05$). **CONCLUSION:** Current findings indicate that BP could be an important determinant of FMD. Blunted FMD of the peripheral arteries may be a physiological response to restore BP and/or prevent a further reduction in BP following acute hypotension in healthy humans.

3293 Board #114 May 29 2:30 PM - 4:00 PM
The Association Between Physical Inactivity And Vascular Dysfunction May Be Related To Low Testosterone Concentrations

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Increased sitting time is associated with increased arterial stiffness, poor cardiometabolic health outcomes, increased risk of developing cardiovascular disease, and all-cause mortality. Further, excess sitting time likely reduces aerobic capacity and increases adiposity, which have been shown to be related to low testosterone (T) in young men. Low T has been linked to increased arterial stiffness, however, it remains unclear how T may contribute to the associations between physical inactivity, adiposity, aerobic capacity, and vascular health. **PURPOSE:** To determine the influence of T on the relationships between VO₂max, body composition, physical activity, endothelial function, and arterial stiffness. **METHODS:** 87 healthy male adults aged 18-75 years (mean \pm SD; 53 \pm 14 years, BMI=27.6 \pm 4.4 kg/m²) underwent VO₂max testing, physical activity monitoring (accelerometry), body composition (DXA), and vascular (endothelial function via brachial artery flow-mediated dilation, FMD; arterial stiffness via pulse wave velocity, PWV) testing. Serum T was measured under fasted conditions in the morning. **RESULTS:** Bivariate correlation analysis indicated that VO₂max ($p=0.003$, $R=0.33$), body fat ($p<0.001$, $R=-0.42$), sitting time ($p=0.020$, $R=-0.28$), PWV ($p=0.049$, $R=-0.22$), and FMD ($p=0.046$, $R=0.24$) were related to T concentrations. Body fat ($p<0.001$, $R=-0.39$), VO₂max ($p<0.001$, $R=0.41$), and sitting time ($p=0.029$, $R=0.24$) were correlated with PWV. Body fat ($p=0.001$, $R=0.44$) and VO₂max ($p=0.001$, $R=0.41$), but not sitting time ($p=0.185$, $R=-0.17$), were related to FMD. After controlling for T using partial correlation analysis, sitting time was no longer significantly related to PWV ($p=0.297$, $R=0.141$), however correlation coefficients between PWV and VO₂max or body fat were unchanged. **CONCLUSIONS:** These data indicate that the association between physical inactivity may be related to low T concentrations.

3294 Board #115 May 29 2:30 PM - 4:00 PM
Preliminary Study Of Ethnic Differences In Hemodynamic Responses Following High Intensity Exercise: Wave Separation Analysis

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The Hispanic population is at a high risk of developing cardiovascular disease (CVD), especially cerebrovascular disease. High blood pressure (BP) and inadequate BP regulation are related to future CVD events. Sympathoexcitatory stimulation through high intensity exercise temporarily increases risk of cardiovascular events and alters hemodynamics. It is unknown whether there is an ethnic difference in the regulation of BP and pulse wave characteristics—including forward or reflected pressure waves—between Hispanic and White populations. **PURPOSE:** To investigate the ethnic differences in BP and pulse wave characteristics measured with wave separation analysis in response to high intensity exercise. **METHODS:** 10 male volunteers (9 Hispanic; 23 \pm 3 yr, 1 White; 21 yr) completed the study. Aerobic capacity was measured by indirect calorimetry and a treadmill graded exercise test (GXT). Brachial BP was measured by an automated BP monitor. Central hemodynamic variables and pulse waves were obtained by tonometer at baseline, 15-minute, and 30-minute after high intensity treadmill exercise (GXT). Pulse waves were further separated into forward pulse height (FH) and reflected pulse height (RH) for analysis. A 2 x 3 repeated measure analysis of variance was performed to investigate ethnic differences in BP and pulse wave responses to high intensity exercise. **RESULTS:** (See table 1) There were no significant ethnic differences in brachial systolic BP, brachial diastolic BP, aortic systolic BP, aortic diastolic BP, and aortic mean arterial pressure ($p > 0.05$ for all). Furthermore, FH and RH were not statistically different between Hispanic and White males at rest and following high intensity exercise ($p > 0.05$). **CONCLUSION:**

Results suggest that blood pressure, forward and reflected pulse height exhibited similar at rest and following high intensity exercise in young, healthy, casually active Hispanic and white males.

Table 1. Blood pressure and pulse wave characteristic responses to high intensity exercise in

	Baseline	Hispanic (N = 9)		White (N = 1)		
		15 min post	30 min post	Baseline	15 min post	30 min post
Aortic SBP (mmHg)	98 ± 9	97 ± 9	94 ± 8	100 ± N/A	100 ± N/A	99 ± N/A
Aortic DBP (mmHg)	67 ± 8	66 ± 10	66 ± 7	63 ± N/A	68 ± N/A	68 ± N/A
Aortic MAP (mmHg)	80 ± 9	79 ± 9	78 ± 7	81 ± N/A	82 ± N/A	80 ± N/A
FH (mmHg)	28.7 ± 2.8	29.5 ± 2.9	26.2 ± 3.5	29.0 ± N/A	31.5 ± N/A	27.5 ± N/A
RH (mmHg)	12.8 ± 2.8	9.9 ± 2.6	9.3 ± 3.0	16.5 ± N/A	12.5 ± N/A	10.0 ± N/A

Mean ± SD. Significant at $p < 0.05$

3295 Board #116 May 29 2:30 PM - 4:00 PM
Age- And Sex-related Differences In Skeletal Muscle Oxygen Consumption Rate And Microvascular Reactivity

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(No relevant relationships reported)

Purpose: To examine the influence of age and sex on non-invasive measurements of oxygen consumption rate and microvascular reactivity. **Methods:** Seven young females (YF; mean ± SD, age = 20.9±2 y), 6 older females (OF; 57.5±10 y), 14 younger males (YM; 22.2±2 y), and 8 older males (OM; 59.5±5 y) visited the laboratory on one occasion during which skeletal muscle oxygen utilization and microvascular function were assessed following a 10-h fast using the near-infrared spectroscopy with vascular occlusion test (NIRS-VOT). During the NIRS-VOT, tissue saturation (StO₂) was monitored, and the rate of decrease in StO₂ (Slope 1) during cuff inflation (i.e., ischemia) was quantified, as were the reperfusion magnitude (Rep_{MAG}), rate of increase in StO₂ (Slope 2), and the reperfusion area under the curve (StO_{2AUC}) following cuff deflation. Two-way (age × sex) ANOVAs were used to examine the differences in Slope 1, Rep_{MAG}, Slope 2, and StO_{2AUC} among the YW, OW, YM, and OM. Means ± 95% CIs are reported. **Results:** There were significant age and sex effects for Slope 1 ($p = 0.01$ and 0.02 , respectively), which was more negative (i.e., steeper) in males versus females (-0.132 ± 0.12 vs. -0.108 ± 0.15 %·s⁻¹) and in the young versus older adults (-0.133 ± 0.13 vs. -0.107 ± 0.14 %·s⁻¹). There was an age effect for Rep_{MAG} ($p < 0.001$), which was greater in the younger than older adults (50.7 ± 4.0 vs. 38.5 ± 4.6 %). While there was no effect of age on Slope 2, Slope 2 was steeper ($p = 0.002$) in males than females (1.71 ± 0.24 vs. 1.06 ± 0.34 %·s⁻¹). Finally, there were age ($p = 0.02$) and sex ($p = 0.03$) main effects for StO_{2AUC}, which was greater in males versus females (1228.5 ± 148.8 vs. 960.1 ± 178.9 %·s) and in the young versus older adults (1240.7 ± 148.8 vs. 947.9 ± 178.9 %·s). **Conclusions:** Overall, our results suggest that there are age and sex-related differences in skeletal muscle oxygen consumption rate and microvascular reactivity, as assessed using the NIRS-VOT technique. However, because the degree of tissue desaturation is the stimulus for subsequent reperfusion responses and the rate of desaturation was greater in the younger than older adults and in males than females, it is not clear if the differences in Slope 2 and StO_{2AUC} reflect differences in microvascular reactivity, per se. Additional studies are needed to more fully explore this interplay.

3296 Board #117 May 29 2:30 PM - 4:00 PM
Altered Microvascular Reactivity In Young Healthy Adults With A Family History Of Hypertension

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(No relevant relationships reported)

Young healthy adults with a family history of hypertension (+FHH) display some of the phenotypic characteristics of adults with established hypertension. These similarities may serve as early warning signs for the development of hypertension, and therefore, should be examined. **Purpose:** To determine if, like hypertensives, normotensive +FHH adults display lower conduit artery function and microvascular reactivity than normotensive adults without a family history of hypertension (-FHH). **Methods:** Healthy normotensive adults self-reported if a first degree relative had been diagnosed with hypertension. A forearm vascular occlusion test was performed while resting in the supine position. An ultrasound probe placed on the brachial artery

above the occlusion cuff was used to assess flow mediated dilation (FMD); a test of conduit artery function. Simultaneously, a near infrared spectroscopy (NIRS) sensor placed on the anterior forearm measured skeletal muscle oxygen saturation (SmO₂). SmO₂ kinetics were examined to evaluate microvascular function. **RESULTS:** Twenty-one participants were included in this investigation (-FHH = 12, +FHH = 9). Groups were young (-FHH 24±5, +FHH 24±6yr; $p = 0.756$), with a non-significant trend towards higher mean arterial pressure in the +FHH group (-FHH 82±10, +FHH 89±8mmHg; $p = 0.082$). There were no group differences in baseline brachial artery diameter (-FHH 0.247±0.164, +FHH 0.325±0.119cm; $p = 0.234$), total shear (-FHH 53244±55326, +FHH 34430±36875AUC; $p = 0.384$), and vessel dilation (-FHH 6.92±4.55, +FHH 6.97±6.65Δ% $p = 0.984$). Baseline SmO₂ (-FHH 69±9, +FHH 64±13%; $p = 0.271$), and the 30s peak desaturation slope obtained during vascular occlusion (-FHH -0.38±0.12, +FHH -0.42±0.14%/s; $p = 0.393$), were also not different between groups. Following cuff release the resaturation slope (1st 10s, -FHH 2.90±1.96, +FHH 5.00±2.51%/s $p = 0.046$), and the SmO₂ overshoot (-FHH 1177±719, +FHH 2024±974AUC; $p = 0.029$) were greater in the +FHH group. **CONCLUSIONS:** Contrary to our hypothesis, the +FHH group displayed greater NIRS reperfusion microvascular reactivity than the -FHH group. This may be due to a greater perfusion pressure in the +FHH group as evidenced by a trend for greater mean arterial pressure.

3297 Board #118 May 29 2:30 PM - 4:00 PM
Abstract Withdrawn

3298 Board #119 May 29 2:30 PM - 4:00 PM
Self-reported Sleep Habits Are Related To Arterial Stiffness In Apparently Healthy Individuals

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(No relevant relationships reported)

Insufficient sleep is associated with cardiovascular disease. Whether this relationship is mediated through decrements in vascular function has yet to be fully elucidated. **Purpose:** This study investigated relationships between self-reported sleep habits and vascular health in apparently healthy individuals. **Methods:** Thirty-one individuals (14 females/17 males, 30±10 yrs, 24.7±3.2 kg/m²) free of cardiovascular disease, diabetes, and not using medications were enrolled. Subjective sleep habits were characterized using the Pittsburgh Sleep Quality Index to generate a composite score (PSQI score) ranging from 0 (better) to 21 (worse). Vascular health including brachial and aortic pressures, pulse pressure, and augmentation pressure (a measure of arterial stiffness) was quantified via arterial pressure waveforms. **Results:** Mean PSQI score was 4±3, where a score >5 is deemed to be "poor" sleep quality. Initial regression models for age, gender, body mass index, and PSQI score predicted ($P < 0.01$) pulse pressure (31.2±5.9 mmHg) and augmentation pressure (2.4±3.7 mmHg). The final model including only significant predictors for pulse pressure ($P < 0.01$, $R^2 = 0.38$) included PSQI score ($\beta = 0.47$, $P < 0.01$) and BMI ($\beta = 0.38$, $P = 0.02$). Meanwhile, the final model for augmentation pressure ($P < 0.01$, $R^2 = 0.31$) included PSQI score ($\beta = 0.34$, $P = 0.04$), BMI ($\beta = 0.36$, $P = 0.03$), and gender ($\beta = 0.46$, $P = 0.01$). PSQI score was not associated ($P > 0.05$) with brachial or aortic systolic (123±11 and 108±10 mmHg) or diastolic (76±9 and 77±9 mmHg) pressures. **Conclusions:** These data demonstrate that self-reported sleep habits, quantified via PSQI score, are related to indices of arterial stiffness (i.e., pulse pressure and augmentation pressure) in apparently healthy individuals. Large artery stiffening resulting from sleep deficiency may play a role in the development of hypertension and cardiovascular disease.

3299 Board #120 May 29 2:30 PM - 4:00 PM
Mitochondrial Targeted Antioxidant Intake Improves Vascular Function And Exercise Tolerance In Peripheral Artery Disease Patients

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(No relevant relationships reported)

Peripheral artery disease (PAD) is a manifestation of atherosclerosis in the lower leg arteries, which causes reduced blood flow and leg pain. This may be in part due to excessive mitochondria-produced reactive oxygen species (ROS) and attenuated mitochondrial respiratory function. Mitoquinol mesylate, a mitochondrial-targeted antioxidant, has been shown to scavenge ROS and improve vascular function in older adults and animal models. However, the impacts of mitoquinol on vascular function in patients with PAD are unknown. **Purpose:** To examine the impacts of acute mitoquinol intake (80mg) on endothelial function (flow mediated dilation, FMD), resting heart rate (RHR), blood pressure (BP), arterial stiffness (pulse wave velocity, PWV), and exercise tolerance in patients with PAD. **Methods:** 10 patients with

PAD (stage II-III) received either mitoquinol or placebo in a randomized crossover design. At each visit, measurements of RHR, central and peripheral BP, brachial and popliteal artery FMD, PWV, augmentation index (AIx), maximal walking capacity, and time to claudication (COT) were measured before and after mitoquinol and placebo. **RESULTS:** There were significant group by time interactions ($p<0.05$) for brachial FMD, popliteal FMD, and COT, which significantly increased ($p<0.05$). There were trends for decreases in diastolic BP ($p=0.10$), carotid-to-ankle PWV ($p=0.08$), and increases in maximal walking time ($p=0.06$), and maximal walking distance ($p=0.06$). There were no changes in RHR, systolic BP, central BP, deceleration time, max dP/dt, carotid-to-radial PWV, carotid-to-femoral PWV, or AIx ($p>0.05$). **CONCLUSIONS:** Mitoquinol intake may be an effective strategy for targeting mitochondrial ROS, which may be useful for treating endothelial dysfunction, leg pain, and improving walking time in patients with PAD.

3300 Board #121 May 29 2:30 PM - 4:00 PM

AUTONOMIC AND CARDIOVASCULAR RESPONSES TO ACUTE EXERCISES IN CHILDREN WITH AUTISM SPECTRUM DISORDER

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(No relevant relationships reported)

Autism Spectrum Disorder (ASD) is a complex neurological disorder identified in early childhood and is characterized by impaired social interaction and atypical behaviors. Limited studies reported that children with ASD tend to have higher heart rate (HR) and blood pressure (BP) at rest compared to typically developing children (TDC). Previously, we reported that HR and blood flow (BF) did not alter while BP increased from rest to acute exercise in ASD. Thus, we thought that ASD may have impaired autonomic nervous system activity to differentially control HR and stroke volume (SV) to regulate BP through changes in cardiac output. **PURPOSE:** To determine autonomic and cardiovascular responses to acute dynamic exercise in children with ASD. **METHODS:** 36 adults, TDC and children with ASD participated in the study. HR from ECG, beat to beat arterial BP from Finapres and brachial BP, and SV from Modelflow, were continuously measured before, during and after 2 minutes of dynamic handgrip exercise at 35% and 50% of maximal voluntary contraction. Diameter, blood velocity, and flow of the brachial artery were measured using Doppler ultrasound on the contracting arm throughout the experiment. Time and frequency domains of HR variability indexes were used. **RESULTS:** Mean BP was significantly increased to exercise from rest in all groups with no group differences ($\Delta 9.8 \pm 1.8$ adults, $\Delta 8.3 \pm 1.2$ TDC, and $\Delta 6.9 \pm 1.8$ ASD, mmHg). HR was significantly increased to exercise from rest in adults and TDC; however, there was no change in HR to exercise from rest in ASD ($\Delta 11 \pm 1$ adults, $\Delta 7 \pm 1$ TDC, and $\Delta 1 \pm 1$ ASD, bpm). SV was unaltered from rest to exercise in all groups. Both adults and TDC had similar increase in BF during exercise compared to rest ($\Delta 17 \pm 3$ adults vs. $\Delta 14 \pm 2$ TDC cm/s); however, BF did not change from rest to exercise ($\Delta 0.6 \pm 2.2$ ASD cm/s) in ASD. The rMSSD and high frequency of HRV were similar in all groups while very low frequency HRV was significantly lower in ASD. **CONCLUSION:** While HR and BF were altered to exercise in both adults and TDC groups in similar fashion, HR and BF did not change in ASD children indicating impaired autonomic and vascular function. Higher total peripheral resistance may contribute to increase BP during exercise in ASD children without a significant contribution of cardiac output.

3301 Board #122 May 29 2:30 PM - 4:00 PM

ET_B Receptor Responses In Young Women With A Family History Of Hypertension

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(No relevant relationships reported)

Endothelin-1 (ET-1) contributes to endothelial dysfunction, a primary driver of hypertension and cardiovascular disease. Young women with a family history of hypertension (+FH), a group at risk for developing hypertension, display elevated resting plasma ET-1. Our lab has previously shown that in healthy young women, the ET_B receptor mediates vasodilation. However, the function of ET_B receptors has yet to be determined in young women +FH. **PURPOSE:** The purpose of this study was to test the hypothesis that +FH young women display attenuated ET_B-mediated vasodilation. **METHODS:** Eight young women without a family history of hypertension (-FH; 23±2 yrs, 24±1 kg/m²) and 8 women +FH (23±2 yrs, 22±1 kg/m²) completed the study. Family history status was self-reported on a medical history questionnaire. Cutaneous vasodilatory responses to local heating were measured using laser doppler flowmetry during microdialysis perfusions of lactated Ringer's (Control) and ET_B receptor blockade (BQ-788, 300nM). Cutaneous vascular conductance (CVC) was calculated during the plateau phase of local heating (42°C), and normalized to maximal vasodilation achieved by perfusion of sodium nitroprusside (28mM) and heating to 43°C. A two-way ANOVA was performed to compare the impact of familial

history of hypertension on vasodilatory responses. Threshold for significance was set a priori at $P<0.05$. Data are presented as mean ± SEM. **RESULTS:** Resting mean arterial pressure (-FH: 80±3 vs. +FH: 85±2 mmHg, $P=0.25$) and plasma ET-1 (-FH, $n=5$: 1.2±0.2 vs. +FH, $n=6$: 1.5±0.2 pg/mL, $P=0.43$) were similar between groups. There was a trend for a significant group x time interaction for cutaneous vasodilatory responses (Drug: $P=0.33$, Group: $P=0.63$, Interaction: $P=0.09$); vasodilatory responses to Control tended to be lower in +FH (-FH: 95±1 vs. +FH: 89±4 %CVC max). Furthermore, blockade of ET_B receptors tended to reduce vasodilation in -FH (Control: 95±1 vs. 87±3 %CVC max) but not +FH (Control: 89±4 vs. 91±2 %CVC max). **CONCLUSION:** These preliminary data suggest that in young, otherwise healthy women, ET_B receptor function may be altered based on hypertensive family history status; however additional data are needed. Furthermore, data in +FH young men are needed given the known sex differences in the ET-1 system. Supported by: NIH R01 HL 146558, P20 GM 113125.

3302 Board #123 May 29 2:30 PM - 4:00 PM

Higher Aortic Stiffness Is Related With Lower Physical Fitness In Older Adults

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PURPOSE: To compare physical fitness levels according to arterial stiffness reference values in older adults. **METHODS:** This is a cross-sectional study comprising 156 (75.24 ± 6.5 years; 69.2% female) apparently healthy older adults. Carotid-femoral pulse wave velocity (cfPWV) was assessed through applanation tonometry and classified as $<$ or \geq 10 meters per second (m/s). Physical fitness was assessed through the Senior Fitness Test [cardiorespiratory fitness (6-Min Walk), agility (8-foot Up and Go), upper (30-second Arm Curl) and lower body strength (30-second Chair Stand), and flexibility tests (Chair Sit & Reach and Back Scratch)]. A Z-score including all physical fitness components was computed as a global index of physical fitness. Total physical activity was objectively measured and recorded as counts per minute. Between-group comparisons were performed through ANCOVA. **RESULTS:** Eighty-five (59.1%) of the subjects had cfPWVs \geq 10 m/s. After adjusting for age and total physical activity, compared to the cfPWV $<$ 10m/s group, the cfPWV \geq 10 m/s group exhibited significantly lower physical fitness scores (0.355 ± 0.074 vs. 0.076 ± 0.077 , respectively; $p = 0.017$). **CONCLUSION:** Seniors with higher levels of arterial stiffness present lower values of physical fitness. Strategies to improve physical fitness might be important to prevent the rapid augmentation of arterial stiffness.

3303 Board #124 May 29 2:30 PM - 4:00 PM

Test-Reliability Of Blood Pressure Criteria For Defining An Exaggerated Blood Pressure Response To Exercise

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(No relevant relationships reported)

Exaggerated blood pressure responses (EBPR) during exercise are associated with increased risk of mortality. Due to the prognostic value of EBPR, it is important to evaluate the reliability of criteria used to define this response. **PURPOSE:** This study assessed the test-retest reliability of two different criteria used to define EBPR: the maximal systolic blood pressure (SBP) and the SBP/METs-slope which is the ratio of the change in SBP to the change in the metabolic equivalents of task (METs). **METHODS:** Twenty healthy, normotensive adults (8 males: 21±1 years, 12 females: 21±1 years) completed two identical modified Bruce treadmill tests on separate days. Blood pressure was measured using an automated motion-tolerant auscultatory device at rest (i.e., standing on treadmill) and during the last minute of each exercise stage. For each test, maximal SBP was identified, METs were estimated, and the change in these indices (i.e., maximal - rest) were calculated to determine the SBP/METs-slope. Test-retest reliability of the two criteria were assessed using intraclass correlation coefficients (ICC), with an ICC $>$ 0.60 considered reliable. **RESULTS:** Total exercise time was similar between visits (1000±123 s vs. 1005±128 s, $P=0.33$). Reliability of the EBPR criteria are presented as (ICC; 95% confident intervals). Maximal SBP (0.45; 0.02-0.74) and SBP/METs-slope (0.29; -0.16-0.64) were not reliable. Participants were then separated based on sex. In males, maximal SBP (0.85; 0.44-0.97) was reliable while the SBP/METs-slope only demonstrated moderate reliability (0.59; -0.13-0.90). In females, both maximal SBP and the SBP/METs-slope were not reliable (ICCs $<$ 0.17). Using the criteria of a maximal SBP 210 and 190 mmHg for males and females respectively, 50% of males and 33% of females had EBPR on both visits. **CONCLUSION:** Criteria used to define EBPR are only reliable in males. Further investigation is warranted to understand the potential sex effects on the SBP responses to maximal exercise testing.

3304 Board #125 May 29 2:30 PM - 4:00 PM

Effects Of Resistance Exercise Training On Estradiol, Gh, Igf-1, Dhea-s, And Blood Pressure In Postmenopausal Women With Stage 1 HypertensionJung-Jun Park¹, Song-Young Park², Kook-Eun Seo¹, Liz Pekas², Won-Mok Son². ¹*Pusan National University, Busan, Korea, Republic of.* ²*University of Nebraska at Omaha, Omaha, NE.*
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PURPOSE: Menopause is often accompanied by decreased estradiol, growth hormone (GH), insulin-like growth factor-1 (IGF-1) and dehydroepiandrosterone sulfate (DHEA-s) and increased blood pressure (BP), which may collectively increase risks for cardiovascular disease (CVD). It is important to combat the negative effects on estradiol, GH, IGF-1, DHEA-s, and BP by incorporating appropriate lifestyle interventions, such as exercise. We sought to examine the effects of resistance exercise training program on estradiol, GH, IGF-1, DHEA-s, and BP in postmenopausal with stage 1 hypertension.

METHODS: Postmenopausal women ($n=20$) were recruited and randomly assigned to a resistance exercise group (EX, $n=10$) or control group (CON, $n=10$). The EX group performed a total-body resistance band exercise training program for 12 weeks. Levels of estradiol, GH, IGF-1, DHEA-s, as well as BP were assessed before and after 12 weeks

RESULTS: There were significant group by time interactions ($p<0.05$) for estradiol ($\Delta 0.8\pm 0.0$), GH ($\Delta 0.5\pm 0.1$), IGF-1 ($\Delta 5.7\pm 1.2$), and DHEA-s ($\Delta 10.4\pm 5.5$) which significantly increased ($p<0.05$), and systolic BP ($\Delta 3.0\pm 1.7$) which significantly decreased ($p<0.05$) after exercise training compared to no changes in CON. There were no significant differences ($p>0.05$) in diastolic BP after 12 weeks

CONCLUSIONS: These results indicate that resistance exercise training may be an effective, easily accessible, and cost efficient intervention for improving estradiol, GH, IGF-1 and DHEA and decline BP in postmenopausal women with stage 1 hypertension

3305 Board #126 May 29 2:30 PM - 4:00 PM

Blood Flow And Arterial Stiffness In Amputated Subjects.Anna Pedrinolla, Valentina Cavedon, Chiara Milanese, Massimo Venturelli. *University of Verona, Verona, Italy.*
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PURPOSE: To investigate arterial adaptations in amputated soccer players of the Italian National Amputated team. **METHODS:** Basal blood flow (BF, corrected for muscle volume), and pulse wave velocity (PWV) were measured in 11 amputated soccer players (35±13 years; 14±8 years from the amputation) of the Italian National Amputated team. BF and PWV were measured right and left-hand at carotid arteries, brachial arteries, radial arteries, common femoral arteries, and superficial femoral arteries. Basal BF and PWV of amputated limbs were compared with the non-amputated limbs. **RESULTS:** Basal BF was found to be reduced in amputated limbs compared with the contralateral non-amputated limbs (-30%, $p<0.05$). However, PWV was not found to be statistically different between amputated and non-amputated limbs (3%, $p=0.32$). **CONCLUSIONS:** Although an adaptation of basal BF seems to take place in amputated limbs, PWV seems to be unaltered in the amputated side in national soccer players. Since PWV reflects cardiovascular risk and vascular adaptation, based on this results we can speculate that soccer training served as a good stimulus to maintain vascular health even in amputated subjects.

3306 Board #127 May 29 2:30 PM - 4:00 PM

Reliability Of Non-invasive Vascular Function Tests And Their Responsiveness To A High-fat Meal In FemalesEmily M. Rogers, Nile F. Banks, Hannah F. Bryan, Claire M. Smith, Nathaniel D.M. Jenkins. *Oklahoma State University, Stillwater, OK.**(No relevant relationships reported)*

PURPOSE: To examine the reliability of non-invasive assessments of micro- and macrovascular function and their responsiveness to a high-fat meal (HFM) in females.

METHODS: During 2 visits (T1 and T2) separated by 28 ± 2 days, 11 women (age = 30.7 ± 17.2 y, BMI = 24.4 ± 3.1 kg/m²) consumed a standardized HFM (12 kcal/kg body weight; 63% fat) after a 10-h fast. Before (BL) and 3-h after the HFM, blood triglyceride (TG) levels were measured to quantify the lipemic response, and micro- and macrovascular function were assessed using the NIRS-VOT and FMD technique, respectively. During the NIRS-VOT assessment, the occlusion slope (Slope 1), the minimum tissue saturation (StO_{2MIN}), the reperfusion slope (Slope 2), and the reperfusion area under the curve (StO_{2AUC}) were calculated. Reliability was assessed

on BL values using one-way ANOVAs, intraclass correlation coefficients, and standard errors of measurement reported as coefficients of variation (CV). We also examined the responsiveness of each of the assessments to a HFM, as well as repeatability of the response by examining differences and relationships between the 3-h values at T1 and T2 for each of the variables. **RESULTS:** The reliability of each of the variables is reported in Table 1. All variables demonstrated moderate to strong relative reliability, although the CVs for TG, StO_{2MIN}, and FMD were moderately high. Interestingly, only TG responded to the HFM at 3-h. There were also no differences between the 3-h values at T1 versus T2 for any of the dependent variables (all $p > 0.05$), which were moderately to strongly ($r = 0.66 - 0.72$, $p \leq 0.04$) related, except for StO_{2AUC} and FMD ($r = 0.46 - 0.47$, $p \geq 0.16$). **CONCLUSION:** Each of the variables assessed displayed sufficient repeatability and were similarly (non-)responsive to a HFM before and after a 28-day period. Further, it appears that StO_{2AUC} and FMD may display lower absolute reliability and studies may require greater sample sizes when using these as outcomes in intervention studies.

	T1 Mean	T2 Mean	ICC (95% CI)	CV (%)	p-value
TG	104.0 ± 75.8	87.3 ± 40.9	0.757 (0.321 - 0.928)	31.4	0.221
Slope 1	-0.128 ± 0.03	-0.119 ± 0.03	0.578 (0.019 - 0.865)	17.4	0.385
StO _{2MIN}	28.0 ± 11.9	23.8 ± 12.2	0.577 (0.046 - 0.862)	29.7	0.231
Slope 2	1.10 ± 0.45	1.12 ± 0.48	0.688 (0.165 - 0.906)	24.2	0.820
StO _{2AUC}	1068.7 ± 368.6	1016.7 ± 355.9	0.645 (0.102 - 0.891)	20.9	0.592
FMD (%)	5.3 ± 3.3	5.0 ± 3.4	0.668 (0.134 - 0.899)	38.1	0.705

3307 Board #128 May 29 2:30 PM - 4:00 PM

Impacts Of Prolonged Sitting With Mild Hypercapnia In Healthy AdultsRonald J. Headid, III, Elizabeth J. Pekas, TeSean K. Wooden, Won-Mok Son, Song-Young Park. *University of Nebraska at Omaha, Omaha, NE.*

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(No relevant relationships reported)

Previous research suggests that prolonged sitting attenuates vascular function. It is common for people to sit for prolonged periods of time in places such as offices and classrooms which are accompanied by mild hypercapnic conditions due to poor ventilation. However, the effects of prolonged sitting with mild hypercapnic conditions on vascular function has not been investigated. **PURPOSE:** The purpose of this study is to investigate the responses in heart rate (HR), blood pressure (BP), vascular function, and autonomic function in healthy young adults to a single bout of prolonged sitting in mild hypercapnic conditions. **METHODS:** In a randomized crossover design, 12 subjects (6M/6F) sat for 2.5 hours in a control condition (PSIT) or a mild hypercapnic condition (HCAP, CO₂=1,500 ppm). During each visit, HR, central and peripheral BP, brachial and popliteal artery endothelial function (flow-mediated dilation, FMD), arterial stiffness (pulse-wave velocity (PWV), augmentation index (AIx)), and heart rate variability (HRV) were assessed before and after prolonged sitting. **RESULTS:** Both brachial and popliteal FMD were significantly reduced ($p<0.05$) in HCAP and PSIT, and the reduction in popliteal FMD was significantly greater in HCAP than PSIT ($p<0.05$). Additionally, there were trends for increased carotid-to-distal (cd) PWV ($p=0.083$) in HCAP compared to PSIT. HR was significantly reduced ($p<0.05$) and carotid-to-radial (cr) deceleration time (DT) and cdDT were significantly increased ($p<0.05$) in HCAP. There were also trends for reduced augmentation pressure (AP) ($p=0.07$) and LF/HF ratio ($p=0.09$). AP, AIx, AIx normalized to 75 beats per minute, and crAIx were all significantly reduced ($p<0.05$) in PSIT. There were no significant changes in BP and HRV in either group ($p>0.05$). **CONCLUSIONS:** These results indicate that prolonged sitting in mild hypercapnic conditions attenuate endothelial function to a greater extent than prolonged sitting in normal atmospheric conditions. Our findings suggest that mild hypercapnic conditions in our daily life exacerbate the negative effects of prolonged sitting.

3308 Board #129 May 29 2:30 PM - 4:00 PM
Reproducibility Of The Impact Of Menstrual Phase On Arterial Stiffness Over Two Consecutive Menstrual Cycles

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(No relevant relationships reported)

Chronic increases in arterial stiffness are associated with increased risk of cardiovascular disease. Estrogen (E2), the primary female sex hormone, has been found to have cardioprotective effects, with several but not all, studies reporting a reduction in arterial stiffness in the late follicular (high E2; LF) phase compared to the early follicular (low E2; EF) phase of the menstrual cycle. Individual heterogeneity in the impact of phase on arterial stiffness and the consistency of these responses across consecutive cycles has yet to be explored. **PURPOSE:** to determine the impact of menstrual phase E2 fluctuations on arterial stiffness over two consecutive cycles. **METHODS:** 13 premenopausal women completed 4 experimental visits over 2 menstrual cycles (EF_{visit 1}, LF_{visit 2}, EF_{visit 3}, LF_{visit 4}). Central (CF) and peripheral (FF) PWV were measured twice during each visit using arterial tonometry. Participants were classified as positive, negative or non-responders, wherein positive responders experienced a reduction in PWV from EF to LF and negative responders experienced an increase in PWV from EF to LF that was greater than 2*typical error. **RESULTS:** At the group level, CF PWV did not differ between phases (p=0.11) or cycles (p=0.18; EF_{visit 1} =5.8±0.8, LF_{visit 2} =5.6±0.5, EF_{visit 3} =5.9±0.6, LF_{visit 4} =5.8±0.7). Likewise, FF PWV did not differ between phases (p=0.979) or cycles (p=0.58; EF_{visit 1} =8.1±1.0, LF_{visit 2} =8.1±1.1, EF_{visit 3} =7.9±1.4, LF_{visit 4} =8.0±1.3). Phase changes in E2 were not associated with phase changes in PWV in cycle 1 (CF: r=0.38, p=0.20; FF: r=0.11, p=0.73) or cycle 2 (FF: r=0.38, p=0.36). Classification of individuals as responders or non-responders revealed that no participants were consistently positive or negative responders for both cycles. **CONCLUSION:** At the group level, arterial stiffness was not impacted by menstrual phase over two cycles. Individual changes in arterial stiffness were inconsistent, with phase changes in cycle 1 not reflecting phase changes in cycle 2. Variability in phase changes in arterial stiffness does not appear to be driven by inter-individual differences in E2 fluctuation across phase. Future research is needed to investigate the mechanisms resulting in inter-individual variability in arterial stiffness and inconsistency between cycles.

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F-57 Free Communication/Poster - Basic Science
Applications in Skeletal Muscle

Friday, May 29, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

3309 Board #130 May 29 1:30 PM - 3:00 PM
The Impact Of CD146⁺ Serum Extracellular Vesicles On Recovery Of Skeletal Muscle Following Hindlimb Immobilization

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(No relevant relationships reported)

Our laboratory recently reported a significant decline in muscle-resident pericyte quantity following hindlimb immobilization, and subsequently demonstrated the capacity for pericyte transplantation to accelerate recovery of skeletal muscle mass during the rehabilitation period. **PURPOSE:** The purpose of this study was to determine the extent to which pericyte-derived extracellular vesicles (EVs) effectively recover skeletal muscle mass following hindlimb immobilization. **METHODS:** Two groups of donor mice (n=6/group) were used to isolate serum EVs before ("Pre") and after ("Post") an acute bout of contraction using a sciatic nerve stimulation procedure. Serum EVs were isolated using ultracentrifugation followed by magnetic bead sorting to isolate CD146⁺ EVs and CD146⁻ EVs. Five groups of mice (n=4/group) underwent unilateral hindlimb immobilization for 14 days. At 14 days, the mice were intramuscularly (tibialis anterior) injected with 1) PBS, 2) CD146⁺Pre EVs 3) CD146⁺Post EVs, 4) CD146⁻Pre EVs, or 5) CD146⁻Post EVs (in 40 µL of PBS), then remobilized for 2 weeks to determine therapeutic capacity. **RESULTS:** A significant decrease in serum CD146⁺ EVs was observed following 14 days of hindlimb immobilization (p<0.05). CD146⁻Post EVs demonstrated significant recovery of myofiber cross-sectional area compared to PBS control (p<0.05). CD146⁺Pre and CD146⁺Post EVs significantly restored capillary density compared to PBS control

(p<0.05). CD146-Pre EVs recovered capacity for collagen remodeling compared to PBS control (p<0.05). **CONCLUSIONS:** The results from this study suggest that CD146- serum EVs positively benefit regrowth of skeletal muscle following a period of disuse. Additionally, CD146⁺ serum EVs enhance skeletal muscle capillarization. Overall, a combination of both EV fractions may optimize recovery of skeletal muscle mass following disuse. Supported by NIH NIAMS R01 AR072735 (to MDB) and ACSM NASA Space Physiology Research Grant (to SD).

3310 Board #131 May 29 1:30 PM - 3:00 PM
PHITE: Precision High Intensity Training Through Epigenetics

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(No relevant relationships reported)

Purpose: To investigate and mechanistically link acute molecular changes in the mRNA transcriptome and splice variant profile, miRNA profile, DNA methylome, and histone acetylation profile to changes in performance from exercise training. **PHITE** will: (1) Reveal potential molecular mechanisms underlying training and detraining adaptations; (2) Differentiate molecular responses to moderate vs. high intensity training, and identify potential underpinnings of inter-individual response heterogeneity; (3) Perform a rigorous proof-of-concept epigenomic biomarker study that scales to and improves Navy physical training. **Methods:** This is an ongoing single-blind randomized trial of 18-27 y/o untrained adults. Participants are randomized to moderate or high intensity combined training 3 d/wk x 12 wk, followed by a 4-wk detraining period. Participants perform an acute exercise bout at wks 0 and 12 to assess acute molecular responses to exercise in untrained and trained states with serial biospecimen (muscle, blood) collections; repeated after 4 wk of detraining. Performance/phenotyping at wks 0 and 12 include aerobic power (VO_{2peak}), strength, anaerobic power, explosive power, body composition (DXA), and phenotyping of blood and muscle. Because the trial is ongoing, randomized assignment remains blinded as groups A and B. Blinded phenotyping data were analyzed using repeated measures ANOVA for the effects of time (T), dose (A vs. B) and dose x time interaction. **Results:** Phenotyping data on the first 51 completed participants confirm significant training effects and early indices of differential adaptations by exercise dose, along with substantial inter-individual response heterogeneity. Differential molecular mapping responses demonstrate sensitivity to exercise dose (A vs. B), timing of sample collection post-exercise, and training state (untrained vs trained vs detrained). **Conclusion:** Molecular response patterns to dose A vs. dose B share limited commonality, and differential responses across individuals provide novel preliminary evidence that dose-specific and individual-specific molecular response patterns may enable discrimination of adaptability.

3311 Board #132 May 29 1:30 PM - 3:00 PM
Mitochondrial Biogenesis Is Dysregulated In Thyroid Hormone Depleted Muscle Cells Despite Stimulatory Effects Of Formoterol

Emily L. Zumbro, Gena D. Guerin, Ryan A. Gordon, Chase M. White, Dreanna M. McAdams, Matthew L. Sokoloski, David L. Nichols, FACSM, Anthony A. Duplanty. *Texas Woman's University, Denton, TX.* (Sponsor: David L. Nichols, FACSM)

(No relevant relationships reported)

Skeletal muscle (SKM) is an important regulator of metabolism and adaptations from exercise training influences mitochondrial function. Thyroid hormone (TH) is a regulator of SKM processes, including mitochondrial biogenesis.

PURPOSE: To use an in vitro model of hypothyroidism to test the hypothesis that SKM cells will have dysregulated mitochondrial homeostasis. Additionally, the exercise mimetic, formoterol, was used to determine the effects of exercise signaling on mitochondrial biogenesis.

METHODS: Human SKM myoblasts (n = 6 per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON), TH depleted cells (ThD), and TH depleted cells plus formoterol stimulation (ThD+F; 30nM for 3h). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for Peroxisome

Proliferator-Activated Receptor Gamma Coactivator-1 Alpha (PGC-1 α), Mitochondrial Transcription Factor A (TFAM), and Nuclear Respiratory Factor 1 (NRF1) was determined by qPCR. Data was analyzed by repeated measures ANOVA.

RESULTS: Significant differences between conditions and time points are detailed in Table 1.

CONCLUSION: ThD media resulted in reduced NRF1 signaling in both D4 and D6 with a subsequent decrease in D6 only for TFAM. Formoterol resulted in the expected stimulation of PGC-1 α at both D4 and D6, but subsequent signaling for genes associated with mitochondrial biogenesis common to PGC-1 α stimulation were lost as a result of TH depletion at D6 only for TFAM and both D4 and D6 for NRF1.

This work was supported by a Texas ACSM SRDA grant. Table 1.

Gene	Comparison	Fold Change	P Value
PGC-1 α	D4 ThD < D4 ThD+F	-4.6	<0.05
	D4 ThD+F > D4 CON	4.6	<0.05
	D6 CON < D6 ThD+F	-2.9	<0.05
	D6 ThD < D6 ThD+F	-3.7	<0.05
TFAM	D4 ThD+F > D4 CON	3.6	<0.05
	D4 ThD+F > D6 ThD+F	3.6	<0.05
	D6 ThD < D6 CON	-0.55	<0.05
	D6 ThD+F < D6 CON	-0.63	<0.05
NRF1	D4 ThD < D4 CON	-0.31	<0.001
	D4 ThD > D4 ThD+F	0.36	<0.001
	D4 ThD > D6 ThD	0.17	<0.05
	D4 ThD+F < D4 CON	-0.67	<0.001
	D6 CON < D4 CON	-0.18	<0.05
	D6 ThD < D6 CON	-0.3	<0.001
	D6 ThD+F < D6 CON	-0.42	<0.001

3312 Board #133 May 29 1:30 PM - 3:00 PM

Age-dependent Skeletal Muscle Outcomes Following Resistance-type Training Improve With Pit1 Mutation And Training Frequency Modulation

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(No relevant relationships reported)

Delayed aging in various tissues has been observed for Snell dwarf mice (*Pit1^{dw/dw}*) yet muscular performance has not been characterized for this model. **PURPOSE:** The purpose of the present study was to characterize muscle mass and performance for 3 months old and 12 months old Snell dwarf mice in non-trained and resistance-trained states. **METHODS:** Muscles of Snell dwarf mice and their wild-type littermates were exposed to 1 month of stretch-shortening contraction training. **RESULTS:** For non-trained muscles at both ages, muscles of Snell dwarf mice exhibited 70% less mass and 85% less isometric force relative to those of control mice. At young age, training 3 days per week had no effect regardless of mouse strain. With aging, 3 days per week training decreased muscle mass and isometric force by 12% and 25%, respectively, for control mice while no such decreases were observed for Snell dwarf mice. For control mice, training 2 days per week increased isometric force by 20% at young age with no training-induced decrements with aging. **CONCLUSIONS:** While Snell dwarf mice exhibit a trade-off between longevity and muscular performance, the *Pit1* mutation counters age-related maladaptation to training. For wild-type muscle, modulation of frequency is a means for offsetting the maladaptive training response.

3313 Board #134 May 29 1:30 PM - 3:00 PM

Effects Of Angiotensin Receptor Blockade On Overload-induced Muscle Growth And Function In Mice

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(No relevant relationships reported)

Muscle hypertrophy induced by functional overload (FO) provides an *in vivo* model to study muscle growth. Angiotensin II (ANG II) has been associated with muscle

atrophy and reduced growth hormone levels while ANG II Receptor Blockers (ARBs) may protect against atrophy and restore insulin-like growth factor 1 (IGF-1) signaling. However, the effects of ARB during muscle growth is unclear. **PURPOSE:** It was hypothesized that ARB treatment would positively impact skeletal muscle growth as evidenced by greater hypertrophy, increased growth factor levels, and improved contractile function compared to placebo.

METHODS: Mice underwent FO of the plantaris or sham surgery. *In vivo* plantaris force and fatigue resistance (% of max force after 10 contractions) were measured 14 days after FO or sham in mice receiving daily candesartan (6 mg/kg body mass) or placebo (n=7-9/group). IGF-1 and fibroblast growth factor (FGF) were measured in the plantaris by ELISA. Data were analyzed with 2-way ANOVAs.

RESULTS: FO increased plantaris mass in both groups; however, ARB attenuated hypertrophy compared to placebo (Placebo: 13 \pm 0.5 vs. 26 \pm 2 mg and ARB: 13 \pm 0.6 vs. 20 \pm 1 mg, for sham and FO, respectively, p<0.05). Maximal force relative to body mass was unchanged with FO, independent of ARB. However, force tended to decrease only in placebo group with FO compared to sham. Fatigue resistance was increased with FO compared to sham, independent of treatment (Placebo: 53 \pm 6 vs. 65 \pm 5% and ARB: 48 \pm 4 vs. 61 \pm 4%, for sham and FO, respectively, p<0.05). Plantaris IGF-1 levels were increased with FO, with a significantly greater response in ARB than placebo (Placebo: 51 \pm 7 vs. 109 \pm 12 pg/mg protein and ARB: 36 \pm 3 vs. 148 \pm 17 pg/mg protein, for sham and FO, respectively, p<0.05). Plantaris FGF levels were increased with FO in ARB group only (Placebo: 788 \pm 88 vs. 901 \pm 88 pg/mg protein and ARB: 649 \pm 31 vs. 1075 \pm 104 pg/mg protein, for sham and FO, respectively, p<0.05).

CONCLUSIONS: The hypertrophic response to FO was attenuated with ARB in spite of greater IGF-1 and FGF responses compared to placebo. Comparing FO-associated changes in muscle force between treatments suggests ARB may positively impact muscle specific tension which could be associated with the augmented growth factor responses with ARB.

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3314 Board #135 May 29 1:30 PM - 3:00 PM
Skeletal Muscle Phenotype Is Augmented Through The Epigenomic Regulation Of Myogenic Transcription Factors

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(No relevant relationships reported)

Purpose: Recently, a training-retraining (TRT) paradigm in which 3 month old rodents underwent an initial cycle of SSC RTET followed by another bout at 6 months led to increases in isometric/dynamic peak force and muscle mass relative to naïve 6 month old rats, thus augmenting the trainability of muscle into adulthood. However, the molecular underpinnings of this response is unknown. Therefore, we sought to determine whether this TRT paradigm has positive effects on transcription factor (TF) methylation and expression in adult skeletal muscle. **Methods:** F344xBN hybrid rats were SSC RTET on an *in vivo* dynamometer 3 days/week for 1 month at 3 months and again at 6 months of age (TRT), or just at 6 months (T). Gene expression and DNA methylation were quantified via PCR Arrays (Qiagen®). **Results:** TRT group had 17 significantly differentially expressed genes (SDEGs) in the TF pathway, including Myf5; T expressed only 3 SDEGs. TRT had decreased TF methylation compared to T (4.1 \pm 0.01 vs. 2.6 \pm 0.01%; p<0.05). **Conclusions:** Adaptive benefits at adulthood following an initial SSC RTET stimulus are supported by altered TF methylation and gene expression. These results advocate RTET at early life to preserve muscle as one ages through an epigenomic muscle memory.

3315 Board #136 May 29 1:30 PM - 3:00 PM

Leucine Supplementation Exacerbates Atrophy In Cancer Cachectic Mice

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(No relevant relationships reported)

Nearly 80% of cancer patients are afflicted with cachexia, which is defined by wasting of lean body mass and associated with increased morbidity and mortality. The amino acid leucine has been shown to promote muscle growth by augmenting protein synthesis through mTOR activation. Therefore, supplementation of leucine could prove beneficial for mitigating skeletal muscle wasting during cancer cachexia. **PURPOSE:** To determine the effect of leucine supplementation on cancer cachexia in APC^{Min/+} (APC) mice. **METHODS:** 18 male APC (n=9) and wildtype (WT, n=9) littermate mice were used in this study. Within each of these two groups, 4 were given water (NL) and 5 were given 1.5% leucine-supplemented water (L), with *ad libitum* access to food and water. Gastrocnemius (GA) muscle and tibias (TL) were extracted at ~14-21 weeks

of age—when mice became moribund. Muscle tissue was homogenized and analyzed for gene expression via RT-qPCR. Gene expression data were analyzed via Two-Way ANOVA, followed by a Fisher's LSD post-hoc to determine between group differences when significant F-ratios were found. The relative frequency of tumor polyp size was analyzed via a Student's t-test. Significance set at $p < 0.05$. **RESULTS:** Body weight for APC-NL mice was ~14% lower than both WT-NL and WT-L ($p < 0.05$). Body weight for APC-L mice was ~25% lower than all WT, and ~13% lower than APC-NL ($p < 0.05$). There were main effects of APC genotype and L supplementation for lower GA mass and GA/TL ($p < 0.05$). In APC mice, there was a ~20% increase in the relative frequency of polyps <1mm in diameter, and a ~15% decrease in the relative frequency of polyps 1-2mm in diameter due to L supplementation ($p < 0.05$). There was no difference in the relative frequency of polyps >2mm. There was a main effect for APC mice to have elevated expression of *IL-6*, *IL-1 β* , *Atrogin-1*, and *MuRF-1* when compared to WT mice ($p < 0.05$). **CONCLUSION:** Surprisingly, leucine supplementation appeared to exacerbate cancer cachexia. Cancer cachexia has previously shown marked increases in skeletal muscle atrophy, commonly through atrophy and inflammatory related markers such as *Atrogin-1*, *MuRF-1*, *IL-6* and *IL-1 β* . Leucine supplementation may not influence these markers directly, but may alter the cachectic environment to induce greater overall wasting.

3316 Board #137 May 29 1:30 PM - 3:00 PM
Abstract Withdrawn

3317 Board #138 May 29 1:30 PM - 3:00 PM
Dysregulated Thyroid Hormone Metabolism Following Formoterol Stimulation In Thyroid Hormone Depleted Skeletal Muscle

Gena D. Guerin, Emily L. Zumbro, Ryan A. Gordon, Chase M. White, Dreanna M. McAdams, Matthew L. Sokoloski, David L. Nichols, FACSM, Anthony A. Duplanty. *Texas Woman's University, Denton, TX.* (Sponsor: David L. Nichols, FACSM) (No relevant relationships reported)

In skeletal muscle (SKM), signal transduction of thyroid hormone (TH) exerts subcellular downstream effects by influencing mechanisms of gene expression. People with hypothyroidism commonly experience SKM pain, fatigue, and intolerance to exercise, which may be driven by dysregulated TH metabolism.

Purpose: To use an in vitro model of hypothyroidism to test the hypothesis that SKM cells will have dysregulated TH metabolism. Additionally, the exercise mimetic, formoterol, was used to determine the effects of exercise signaling on TH depleted cells.

Methods: Human SKM myoblasts ($n = 6$ per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON), TH depleted cells (ThD), and TH depleted cells plus formoterol stimulation (ThD+F; 30nM for 3h). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for Thyroid Hormone Receptor Alpha (THR α), Deiodinase 2 (DIO2), and Deiodinase 3 (DIO3) was determined by qPCR. Data were analyzed by repeated measures ANOVA.

Results: Significant differences between conditions and time points are detailed in Table 1.

Conclusion: THR α was reduced by ThD and further decreased by ThD+F, suggesting that the combination of ThD+F is highly suppressive of this receptor. Intracellular activation of TH (T3) by DIO2 stimulates nuclear transcripts leading multiple cellular functions. Formoterol stimulation increased DIO2 but was decreased in the ThD group, indicating a potential lower availability of T3. Interestingly, DIO3 was also increased by formoterol stimulation, which could counteract availability of T3 via conversion to reverse T3. More research addressing hypothyroidism and exercise is warranted as there may be negative consequences regarding exercise mode and intensity. This work was supported by a Texas ACSM SRDA grant.

Table 1.

Gene	Comparison	Fold Change	P Value
THR α	D4 ThD < D4 CON	-0.35	<0.001
	D4 ThD > D4 ThD+F	0.34	<0.001
	D4 ThD+F < D4 CON	-0.69	<0.001
	D4 ThD+F < D6 ThD+F	-0.17	<0.05
	D6 ThD < D6 CON	-0.31	<0.05
	D6 ThD > D6 ThD+F	0.18	<0.05
DIO2	D6 ThD+F < D6 CON	-0.49	<0.001
	D4 ThD < D4 ThD+F	-1.59	<0.001
	D4 ThD > D6 ThD	0.70	<0.05
	D4 ThD+F > D4 CON	1.6	<0.001
	D4 ThD+F > D6 ThD+F	1.4	<0.001
	D6 ThD < D6 CON	-0.78	<0.05
DIO3	D6 ThD < D6 ThD+F	-0.55	<0.05
	D4 ThD+F > D4 CON	12.25	<0.05
	D4 ThD+F > D6 ThD+F	12.17	<0.05

3318 Board #139 May 29 1:30 PM - 3:00 PM
Mitochondrial Health During The Development Of Cancer Cachexia In Female Mice

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Cancer-cachexia is a syndrome characterized by weight loss, anemia, and skeletal muscle wasting. Muscle mass in males and females is a strong predictor of quality of life and morbidity during cancer treatment. Mitochondrial dysfunction during cancer-cachexia has been well described in males, specifically our laboratory has found mitochondrial deteriorations to precede muscle loss in male models of cachexia. However, if these aberrations are conserved between biological sexes has yet to be investigated. **PURPOSE:** To investigate muscle mitochondrial health during cancer-cachexia development in female mice. **METHODS:** ~40 female C57BL/6J mice were implanted with ~1X10⁶ Lewis Lung Carcinoma (LLC) cells in the right hind flank. Tumors were allowed to develop up to 4 weeks. After 3-4 weeks of tumor development, a clear dichotomy was noted in tumor burden. As such, tumor injected females were divided into high tumor (HT, tumor size > 2000 mg) and low tumor groups (LT, tumor size < 1300 mg). CON animals were age-matched to tumor mice and injected with phosphate buffered saline (PBS); therefore creating 3 experimental groups HT, LT, and CON ($n = 12-14$ /group). Mitochondrial health was measured by fluorescent histology of pMitoTimer. Results were analyzed by one-way ANOVA with Tukey's post hoc when significant F ratios were found ($p < 0.05$). **RESULTS:** Tibialis anterior, plantaris and gastrocnemius muscle masses were ~10%, ~11% and ~5% lower in HT compared to LT and CON. Analysis of pMitoTimer demonstrated no differences between groups. Circulating progesterone and estrogen were ~42% and ~60% lower in HT and LT animals compared to CON with no differences between HT and LT. **CONCLUSION:** LT had negligible muscle wasting when compared to HT, these differences in muscle loss did not correspond to alterations in mitochondrial health. This directly contrasts prior literature in male models of cancer-cachexia suggesting divergent mechanisms between males and females in the development of cancer-cachexia. As such, further examination of why females had a dichotomy in tumor development and subsequent wasting mechanisms are necessary in order to further understand mechanisms contributing to development of cancer-cachexia. This study was funded by the National Institutes of Health, Award: R15 AR069913/AR/NIAMS.

3319 Board #140 May 29 1:30 PM - 3:00 PM

A New Muscle Disuse Model Using A Removable Tissue-engineering Muscle

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(No relevant relationships reported)

PURPOSE: Physical inactivity and subsequent skeletal muscle disuse may cause muscle atrophy, which is associated with a reduction in muscle function, physical performance, quality of life, and loss of independence, particularly in elderly. Traditionally, 2D muscle cell cultures (e.g. C2C12) have been used to study biological processes and identify and validate pharmacological and/or nutritional compounds to treat skeletal muscle disease including muscle atrophy. However, cell culture studies basically use a pharmacological method to induce muscle atrophy, and not an actual muscle disuse induced by a reduction of mechanical stress (i.e., mechanical unloading). Previously Nakamura et al. (2017) developed 3D engineered muscle (OITem: Osaka institute technology engineered muscle) with artificial tendons at both ends of the muscle, which is removable, thereby allowing us to mechanically release muscle tension by taking off (removing) one side of the muscle. Therefore, the purpose of the present study was to investigate whether removable tissue-engineering muscle effectively induce muscle atrophy, and thus is useful for muscle disuse model.

METHODS: OITem was made from C2C12 skeletal muscle cells and a cold type-I collagen gel and placed between two artificial tendons (Nakamura et al., 2017). OITem was differentiated for 2-weeks and then divided into two groups: 1-week stretched on control group (CON: n = 6) in which the both ends of the muscle fixed with tendons, and 1-week stretched off group (OFF: n = 6) in which the one side of the muscle was removed. We analyzed expressions of muscle atrophy-related proteins MuRF-1 and Atrogin-1, and myogenesis-related protein myogenin using Western blotting. As well, we analyzed expression of MHC-fast or -slow (fast- or slow-twitch muscle fiber specific myosin heavy chain (MHC), respectively). **RESULTS:** The protein expression of MuRF-1 and myogenin was significantly lower in the OFF than those in the CON ($P < 0.05$). Moreover, the protein expression of MHC-fast and -slow was significantly lower in the OFF than those in the CON ($P < 0.01$). However, the protein expression of Atrogin-1 did not differ between two groups.

CONCLUSIONS: The present findings suggest that OITem may be useful model for muscle disuse.

3320 Board #141 May 29 1:30 PM - 3:00 PM

Abstract Withdrawn

3321 Board #142 May 29 1:30 PM - 3:00 PM

Insulin Resistance, Skeletal Muscle Extracellular Matrix Remodeling, And The Effect Of Exercise

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(No relevant relationships reported)

Abstract

Extracellular matrix (ECM) remodeling in skeletal muscle is a potential mechanism linking obesity with metabolic dysfunction. It is also a constructive feature of skeletal muscle adaptation to exercise training.

Purpose: To test the hypothesis that skeletal muscle ECM remodeling associated with insulin resistance can be minimized by exercise training.

Methods: Six-week-old male C57/BL6J mice (n=48) were divided into two groups, high-fat (60% calories from fat) diet (HF, n=36) and normal chow-fed control (C, n=12) group. After 12 weeks of feeding, HF mice developed insulin resistance, as confirmed by insulin and glucose tolerance tests (ITT and GTT). HF mice were then randomly assigned to three groups: high-fat diet only group (HFS, n=12), high-fat diet + aerobic exercise group (HF+AE, n=12), high-fat diet + resistance training group (HF+RT, n=12). The HF+AE and HF+RT groups were subject to aerobic (treadmill running) and resistive (vertical ladder climbing) training, for 12 weeks. After training, gastrocnemius muscle was harvested and analyzed for ECM factors using immunohistochemistry, ECM PCR array, and western blotting. ANOVA was performed to test the significance of group differences at $p < 0.05$.

Results: High-fat feeding induced higher deposition of collagens (COL1, III and IV) in the skeletal muscle of HFS group, and increased gene and protein expression of MMP3, CDH1, ITGAL and SELL and decreased the expression of TIMP3 in HFS group, as compared to group C. These changes were minimized even reversed by either

aerobic or resistance exercise training (mRNA fold change relative to C in HF+AE and HF+RT vs. HFS: MMP3, 1.1 and 1.6 vs. 2.6; CDH1, 1.7 and 1.1 vs. 2.0; ITGAL, 1.9 and -1.0 vs. 2.0;

SELL, 1.4 and 1.0 vs. 2.1; TIMP3, 1.2 and -1.0 vs. -1.2; $p < 0.05$). These effects were accompanied by a significant improvement in insulin sensitivity (GTT AUC glucose in mmol/l x 120 min: C, 27.2±3.0; HFS, 39.7 ± 7.0; HF+AE, 32.4± 7.5; HF+RT, 30.3± 6.1; $p < 0.05$).

Conclusion: Both aerobic and resistive exercise training can minimize changes in skeletal muscle ECM associated with insulin resistance. Skeletal muscle ECM remodeling may play a significant role in mediating the metabolic benefits of exercise training.

This study was supported by National Nature Science Foundation of China (31470060).

3322 Board #143 May 29 1:30 PM - 3:00 PM

Exercise Reverses Disuse Atrophy In Rat Gastrocnemius Muscle

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(No relevant relationships reported)

PURPOSE: To investigate the effects of different exercise interventions on disuse atrophy and atrophy-related proteins in rat gastrocnemius muscle.

METHODS: Male Sprague-Dawley rats were randomly divided into a control group (C, n=16) and a suspension group (T, n=40). Rats in the T group were suspended by a tail suspension system for two weeks. Rats in the C group were further divided into a post-suspension blank group (C1) and a post-exercise blank group (C2), and rats in the T group were further divided into a post-suspension control group (T1), a post-exercise control group (T2), an endurance exercise group (TA), a resistance exercise group (TR) and a combined endurance and resistance exercise group (TAR). Rats in the TA, TR, and TAR groups were subjected to exercise training for four weeks. Body weight and wet weight of gastrocnemius muscle were measured immediately after suspension or at 24 hours after the last training session. Protein expression levels of Muscle Ring Finger 1 (MURF1), Muscle Atrophy F-Box (MAFbx), Insulin-Like Growth Factor-1 (IGF-1) and CysteinyL Aspartate Specific Protease-3 (Caspase-3) in gastrocnemius muscle were determined by western blot. Student t-tests and one-way ANOVAs were used for data analysis.

RESULTS: After suspension, body weight and wet weight of gastrocnemius muscle in the T1 group were significantly lower than those in the C1 group ($p < 0.05$ to $p < 0.01$). After exercise intervention, body weight, wet weight of gastrocnemius muscle, and the protein expression levels of MAFbx in the TA, TR, and TAR groups were significantly higher than those in the T2 and C2 groups, the protein expression levels of Caspase-3 in the TA, TR and TAR groups were significantly lower than those in the T2 and C2 groups, and the protein expression levels of MURF1 in the TA and TR groups were significantly lower than those in the T2 group ($p < 0.05$ to $p < 0.01$).

CONCLUSIONS: Exercise interventions, such as endurance exercise, resistance exercise, and combined endurance and resistance exercise, can effectively reverse disuse atrophy of gastrocnemius muscle in rats, which may be through altering the expression levels of several atrophy-related proteins.

3323 Board #144 May 29 1:30 PM - 3:00 PM

Resistance Exercise-Induced Hormone Change Promotes Autophagy Response In Untrained Women

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Introduction: Autophagy is a catabolic process for maintaining skeletal muscle homeostasis by recycling malfunctioning protein aggregates. Evidence suggests that hormones (e.g., cortisol) promote autophagic activity in muscle cells; however, no prior study has examined the effect of resistance exercise (RE)-induced hormonal response on the autophagic response.

Purpose: To determine the effect of an acute RE-induced hormonal response on the autophagic response after muscle damage in untrained young women.

Methods: Untrained women (n=8, 20 ± 1y; height: 164.1 ± 9.2 cm; weight 60.7 ± 7.8 kg) completed 2 sessions of 80 unilateral maximal eccentric knee extensions followed by either an upper body RE protocol (EX; aimed to induce an increase in cortisol) or a 20-min rest (CON). Muscle samples were collected and analyzed for markers of autophagic initiation signaling (FOXO3A, AKT, MTOR), phagophore initiation (ATG5, ULK1, BECN1), elongation (ATG7, LC3A, LC3B), and autolysosomal degradation (SQSTM1/p62) by real-time PCR at before exercise (PRE), 12 hours (+12h) and 24 hours (+24h) after exercise.

Results: A significant ($p < 0.05$) time x condition effect was found for ULK1. At +24h (0.81 ± 0.26-fold), ULK1 gene expression was greater in EX than CON. A significant

time effect was found for FOXO3A. FOXO3A expression decreased at +12h (0.33 ± 0.07 -fold) and +24h (0.25 ± 0.07 -fold) from PRE. A trend was found for BECN1 ($p=0.055$) towards an increased in expression from PRE to +12h (1.94 ± 0.65 -fold). A significant time effect was found for the AUC of cortisol with a greater AUC of cortisol for EX than CON.

Conclusion: These results suggest that the RE-induced hormone response can be important to the initiation of the phagophore after muscle damage in untrained young women.

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Myogenic Regulatory Factor Expression Is Downregulated Following Formoterol Stimulation In Thyroid Hormone Depleted Skeletal Muscle

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In skeletal muscle (SKM), gene expression of transcription factors regulating myogenesis are dependent on thyroid hormone (TH) signal transduction. Expression of myogenic regulatory factors may be altered due to dysregulated TH metabolism, which may result in SKM dysfunction and intolerance to exercise in individuals with hypothyroidism.

PURPOSE: To use an in vitro model of hypothyroidism to test the hypothesis that SKM cells will have dysregulation in transcription factors regulating myogenesis. Additionally, the exercise mimetic, formoterol, was used to determine the effects of exercise signaling during myogenesis.

METHODS: Human SKM myoblasts ($n = 6$ per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON), TH depleted cells (ThD), and TH depleted cells plus formoterol stimulation (ThD+F; 30nM for 3h). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6). Gene expression for myogenic regulatory factors (Myf5, MyoD, MyoG) was determined by qPCR. Data were analyzed by repeated measures ANOVA.

RESULTS: Significant differences between conditions and time points are detailed in Table 1.

CONCLUSION: TH depletion had no effect on MyoG but did reduce the expression of both Myf5 and MyoD at both D4 and D6. Additionally, ThD+F resulted in the lowest expression of MyoG and MyoD for both time points. These results indicate TH depletion and formoterol stimulation may inhibit myotube maturation.

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Table 1.

Gene	Comparison	Fold Change	P Value
Myf5	D4 ThD < D4 Con	-0.36	<0.001
	D4 ThD < D4 ThD+F	-0.32	<0.05
	D4 ThD+F > D6 ThD+F	0.21	<0.05
	D6 ThD < D6 CON	-0.31	<0.001
	D6 ThD+F < D6 CON	-0.19	<0.05
	D4 ThD > D4 ThD+F	0.36	<0.001
MyoD	D4 ThD > D4 ThD+F	0.36	<0.001
	D4 ThD > D6 ThD	0.32	<0.001
	D4 ThD+F < D4 CON	-0.91	<0.001
	D4 ThD+F < D4 ThD	-0.36	<0.001
	D6 ThD < D6 CON	-0.13	<0.001
	D6 ThD > D6 ThD+F	0.09	<0.001
	D6 ThD+F < D6 CON	-0.22	<0.001
	D6 CON < D4 CON	-0.75	<0.001
	D4 ThD > D4 ThD+F	0.77	<0.001
	D4 ThD > D6 ThD	0.42	<0.05
MyoG	D4 ThD+F < D4 CON	-0.75	<0.001
	D4 ThD+F < D4 ThD	-0.77	<0.001
	D6 ThD < D4 ThD	-0.42	<0.05
	D6 ThD > D6 ThD+F	0.37	<0.001
	D6 ThD+F < D6 CON	-0.40	<0.001
	D6 ThD+F < D6 ThD	-0.37	<0.001
	D6 CON < D4 CON	-0.38	<0.05

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The Immunoproteasome, A Potential Link To The Loss Of Muscle Mass In Diet-induced Obesity

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PURPOSE: Obesity is associated with reductions in muscle mass and regeneration. Although chronic inflammation and oxidative stress may play a role, the way in which these processes regulate catabolism in obese muscle is unclear. Since the catalytic subunit of the immunoproteasome (LMP7) is increased in muscle of other atrophic diseases, we sought to determine the impact of diet-induced obesity (DIO) on muscle mass, LMP7 protein content, and regeneration in response to exercise-induced muscle damage (EIMD) in mice. Intramuscular levels of pro-(CD11b and CD38) and anti-(CD206 and EGR2) inflammatory macrophages and oxidative stress (8-isoprostane) were also assessed. **METHODS:** Sixty male C57BL/6J mice (4 weeks old) were randomly assigned to either a high-fat diet (HFD, 45% fat) or lean diet (LD, 10% fat). After 12 weeks of feeding, the mice were randomly subdivided into EIMD or non-exercise, no muscle damage (NMD) control groups. EIMD was achieved via a downhill treadmill run at 13-14m/min for 68min. The gastrocnemius muscle (GS) was excised 1 or 5 d after EIMD, resulting in 6 experimental groups ($n = 10$ /group) at study completion. **RESULTS:** Total body mass was greater (HFD $43.3 \pm .6$ g vs LD $30.8 \pm .6$ g, $p = .000$), however, GS mass relative to body mass was lower (HFD $4.1 \pm .1$ mg/g vs LD $5.3 \pm .1$ mg/g, $p = .000$) in mice with DIO. Despite no change in pro- or anti-inflammatory macrophages ($p > .05$), GS oxidative stress was increased in mice with DIO (HFD 46.0 ± 5.1 pg/ml, vs LD 29.2 ± 4.6 pg/ml, $p = .029$). Oxidative stress was enhanced 1 d post-EIMD, but only in DIO mice (HFD 77.9 ± 8.6 pg/ml vs LD 31.4 ± 3.3 pg/ml, $p = .015$). Muscle LMP7 was also elevated with DIO (HFD $3.6 \pm .2$ ng/ml vs LD $2.6 \pm .1$ ng/ml, $p = .000$), and increased 5 d post-EIMD ($3.5 \pm .2$ ng/ml) when compared to NMD ($2.7 \pm .1$ ng/ml, $p = .005$). However, the response of LMP7 to EIMD did not differ between obese or lean mice ($p = .504$). When controlling for muscle damage group assignment, LMP7 was correlated with 8-isoprostane ($r = .39$, $p = .027$) and both markers were inversely correlated with relative GS mass ($r = -.48$ (LMP7), $-.62$ (8-isoprostane), $p = .000$). Muscle regeneration (myogenic differentiation protein) was unaltered by DIO ($p = .741$) or EIMD ($p = .455$). **CONCLUSIONS:** The immunoproteasome may be a critical link between obesity-induced oxidative stress and diminished muscle mass.

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An Evaluation Of Skeletal Muscle Aging Using A Novel Guinea Pig Model

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Maintenance of the musculoskeletal system is critical to prevent falls and loss of mobility with aging. Sarcopenia, the age-related loss of muscle mass and function, affects 10% of those over 65 years and as much as 50% of people over 80 years of age. Aging is a major risk factor for osteoarthritis (OA) which is characterized by a concomitant loss of skeletal muscle, further contributing to decreased mobility. The "inflammatory" phenotype, (i.e., age-related increases in low-grade inflammation and oxidative stress) is common to both OA and sarcopenia. While progress has been made in understanding the mechanisms of sarcopenia a preclinical model that recapitulates human conditions is lacking. Dunkin Hartley (DH) guinea pigs rapidly and spontaneously develop primary knee OA beginning at about 4 months of age. Thus, we speculate that DH guinea pigs may also be a valuable model of sarcopenia. **PURPOSE:** To determine if DH guinea pigs can serve as a model to understand human skeletal muscle aging. **METHODS:** We compared skeletal muscle age-related changes in the gastrocnemius (GAS) and soleus (SOL) from 5, 9, and 15-mo DH guinea pigs. We also compared these changes to a strain of guinea pig, strain 13, that does not develop knee OA at an early age. Magnetic resonance imaging was used to examine volume and then used to calculate muscle density. Immunofluorescent histochemistry was used to assess myofiber size distribution. Formalin fixed muscles were stained in India ink to measure pennation angle. Fibrosis was assessed using muscles paraffin embedded and stained with Masson's Trichrome to quantify % collagen. Analyses are ongoing to identify if DH pigs are characterized by an inflammatory phenotype similar to aging human muscle. **RESULTS:** DH guinea pigs had a significant decrease in GAS density between 5 and 15-mo that was not present in the SOL ($p<0.05$). Both in the GAS and SOL, DH guinea pigs also demonstrated a shift towards a smaller average myofiber size with age. However, there were no age-related changes in pennation angle or fibrosis. **CONCLUSION:** Based on these analyses, the DH guinea pig appears to be a potentially valuable model

of musculoskeletal aging. Identifying a model to study muscular aging that mimics human conditions but in a shortened time frame, will potentially allow for effective screening and treatment interventions.

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Skeletal Muscle Transcriptome Profiling: Investigating Regulators Of Temporal Improvements In Glucose Metabolism Following Muscle Contraction

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Exercise-induced improvements in skeletal muscle glucose metabolism follow a distinct time-course profile, with immediate increases in glucose uptake followed by improved insulin sensitivity. Molecular mediators controlling this temporal effect could be targeted to optimise the efficacy of exercise in preventing insulin resistance and associated metabolic abnormalities. **PURPOSE:** To characterise the transcriptional changes associated with time-dependent changes in glucose metabolism following muscle contraction. **METHODS:** C2C12 myotubes were exposed to either 24 h of contractile activity (electrical pulse stimulation; EPS) or rest (no EPS), followed by a further 0, 6, 18 or 24 h rest (no EPS). Temporal profiling of the contraction-mediated responses in functional (basal and insulin-stimulated glucose uptake) and transcriptional (RNA sequencing and bioinformatics) outcomes was evaluated at all time points. Data are presented as mean \pm SEM. **RESULTS:** Compared to time-matched control cells (no EPS), contraction-mediated glucose uptake (i.e. without insulin) was increased 0 h post-EPS only ($162 \pm 28\%$ relative to control, $P < 0.05$), whereas insulin sensitivity was increased at 24 h post-EPS only ($163 \pm 35\%$ relative to control, $P < 0.05$). This distinct temporal profile for contraction-induced changes in muscle glucose metabolism was associated with a similarly distinct temporal transcriptional profile. Firstly, EPS-induced improvements in contraction-mediated glucose uptake (0 h post-EPS) and insulin sensitivity (24 h post-EPS) coincided with differential expression of 143 (76 up-regulated; 67 down-regulated) and 145 transcripts (71 up-regulated; 74 down-regulated), respectively. Notably, only 35 were differentially regulated at both 0 and 24 h post-EPS. Of these, only 20 were regulated in the same direction (e.g. miR-206, miR-207), with the remaining 15 oppositely regulated (e.g. miR-99b, miR-6790). **CONCLUSION:** Similar to exercise *in vivo*, our model of *in vitro* skeletal muscle contraction induced distinct temporal profiles for contraction-mediated glucose uptake and insulin sensitivity. These time-dependent changes in skeletal muscle glucose metabolism are associated with an equally distinct contraction-specific transcriptional profile. Supported by: The Physiological Society

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Comparison Of Exercise-induced Regulation Of Skeletal Muscle Hif-1 α Between Endurance Trained And Untrained Individuals

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The regulation of gene transcription is essential for muscle adaptations resulting from endurance exercise training. Recent findings implicate hypoxia inducible factor 1 α (HIF-1 α) in this adaptive process as it regulates genes involved in O₂ homeostasis and substrate utilization. Athletes have greater resting levels of muscle HIF-1 α inhibitors than untrained individuals, suggesting that suppression of HIF-1 α underlies skeletal muscle adaptations to endurance training. However, it is unknown if the exercise-induced expression of HIF-1 α and its inhibitors differs between trained and untrained individuals. Further, differences in expression of HIF-1 α target genes following acute exercise between trained (ET) and untrained (UT) individuals have yet to be examined. **PURPOSE:** To compare regulation of HIF-1 α and HIF-1 α -target genes between ET and UT individuals following acute exercise. **METHODS:** Five ET and five UT subjects performed an acute bout of cycling consisting of twenty, 10s sprints. Muscle samples were collected pre, post and 3 hours (3H) after exercise and analyzed for HIF-1 α , the HIF-1 α regulators: PHD2, FIH, VHL and SIRT6, and HIF-1 α target genes (BNIP3, PINK1, VEGF, PDK-M, GLUT4, GAPDH). **RESULTS:** 2x3 repeated measures ANOVA revealed that post-exercise HIF-1 α protein was greater in UT compared to ET individuals (.310 \pm .020 vs .244 \pm .001 AU, $p < .05$). PHD2 (.056 \pm .012 vs .032 \pm .023 AU), FIH (.008 \pm .001 vs .004 \pm .002 AU) and SIRT6 (.04 \pm .001 vs .002 \pm .001 AU) levels were higher in ET compared to the UT individuals at 3H post exercise ($p < .05$). Post-exercise fold change values for PDK (2.2 \pm 1.2 vs .90 \pm .21) and BNIP3 (2.2 \pm 1 vs .94 \pm .16) were greater in UT compared to ET ($p < .05$). **CONCLUSION:** Exercise-induced expression of HIF-1 α is blunted in ET individuals compared to UT individuals. This is due to the greater post-exercise expression of

HIF-1 α regulating proteins. The suppression of HIF-1 α in response to exercise in ET individuals is evident at the transcriptional level, as expression of PDK and BNIP3 are lower in ET individuals compared to UT. This suggests that endurance training suppresses transcription of PDK, facilitating ATP-resynthesis via oxidative phosphorylation. The suppression of BNIP3 may reflect a reduction in mitophagy, further supporting mitochondrial function in ET individuals.

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Diurnal Physical Activity Regulates Skeletal Muscle Ulk-1 Phosphorylation In Tumor Bearing Male Mice

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Introduction: Cancer cachexia is characterized by severe muscle mass loss associated with increased autophagy. Unc-51 like kinase 1 (ULK1) plays a primary role in initiating autophagy. Under conditions of energetic stress, AMPK activates ULK1 at serine 555 to initiate autophagosome formation for removal of damaged proteins. Daily physical activity and feeding behaviors in mice exhibit diurnal fluctuations that can impact skeletal muscle ULK1 activation. **Purpose:** We investigated the effect of diurnal regulation of skeletal muscle ULK1 phosphorylation in tumor bearing mice. We also examined the impact of increased physical activity on skeletal muscle ULK1 phosphorylation in the cancer environment. **Methods:** Free living male C57BL/6 (B6; N=24) and *Apc^{Min/+}* (MIN; N=22) mice were single housed without wheel access. An additional cohort of B6 (B6+W; N=16) and MIN (MIN+W; N=19) mice were given wheel access for 2-weeks. To examine diurnal fluctuation, all mice were sacrificed at 7:00AM or 7:00PM under *ad libitum* conditions. ULK1 was measured in the gastrocnemius muscle as phosphorylation to total ratio at serine 555 by western blot. **Results:** Free living MIN mice exhibited body weight loss ($p < 0.001$) and reduced gastrocnemius mass ($p < 0.001$) when compared to B6 mice. In the MIN free living mouse, ULK1 phosphorylation was associated with greater body weight loss ($R = -0.505$; $p = 0.023$) and reduced cage activity ($R = -0.548$; $p = 0.012$). ULK1 phosphorylation in MIN and MIN+W mice exhibited diurnal fluctuation, being increased at 7AM when compared to 7PM. This diurnal variation was not present in B6 or B6+W mice. Interestingly, regardless of sacrifice time ULK1 phosphorylation was inversely related to total wheel distance ($R = -0.498$; $p = 0.049$). **Conclusion:** ULK1 demonstrated diurnal fluctuation in MIN mice but not in B6 mice. This change in ULK1 phosphorylation was associated to body weight loss and reduced activity. These data suggest that ULK1 phosphorylation is dependent on the time of day in the tumor environment, further research is warranted to examine if this induction of ULK1 is sufficient to induce autophagy.

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The Role Of Omi/htra2 During Autophagy In Skeletal Muscle Induced By Exercise Injury

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Omi/HtrA2 is known to be a pro-apoptotic protein and also participates in the regulation of autophagy. Previous studies have found that centrifugal exercise can induce an increase in Omi/HtrA2 protein expression in damaged skeletal muscle cells. Omi/HtrA2-Hax1-Beclin1, as the newly discovered autophagy signaling pathway in cells since 2010, has not been reported whether can be specifically expressed in injured skeletal muscle.

Purpose: This study was designed to explore the role of Omi/HtrA2 during autophagy in skeletal muscle induced by centrifugal exercise injury. **Methods:** 168 SD rats were randomly divided into control group (C), dummy control group (D), ucf-101 group (U), exercise group (E) and exercise+ucf-101 group (EU). The U group was injected with ucf-101, a specific inhibitor of Omi/HtrA2; D injection of equal amount of normal saline; for group E with acute heavy load treadmill exercise, the slope was -16° , the speed was 16m/min, and the continuous exercise was 90 min; the EU group performed the same exercise after injection of ucf-101. Soleus muscle was taken from the rats at 0h, 12h, 24h, 48h and 72h after intervention. Ultrastructural changes of autophagosomes in soleus muscle cells were observed by TEM; the expressions of Omi/HtrA2, hax-1 and Beclin1 were detected by Western Blot; the position and content of LC3 were observed by immunofluorescence technique; The binding levels of Hax-1 and Beclin1 were determined by immunoprecipitation. **Results:** The expression of Omi/HtrA2 protein was increased in group E (0h, 2.056 \pm 0.114, $P < 0.05$), and the binding of Hax-1 and Beclin1 protein was weakened (0h, 0.805 \pm 0.095, $P < 0.05$). The expression of Omi/HtrA2 protein was decreased in the U group (0h, 0.406 \pm 0.178, $P < 0.01$), and the binding of Hax-1 and Beclin1 protein was enhanced (0h, 1.536 \pm 0.051, $P < 0.05$; 24h, 8.000 \pm 0.197, $P < 0.01$). Compared with group E, autophagy in EU group was

decreased, Beclin1 expression was inhibited, and LC3 fluorescence intensity was decreased(Beclin1, U0=0.718±0.039, E0=1.870±0.291, EU0=0.871±0.096). **Conclusion:** A high-load centrifugal exercise can induce autophagy in skeletal muscle, which may enhance the cutting effect of Omi/HtrA2 on Hax-1 through exercise, reduce the binding inhibition level of the latter on Beclin1, and finally enhance autophagy.

3331 Board #152 May 29 1:30 PM - 3:00 PM
Effects Of 16 Weeks Hiit And Vitamin E On The Ros-nfkb-bnip3 Pathway In Aging Rat Muscle
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 (No relevant relationships reported)

The effect of high intensity interval exercise (HIIT) combined with Vitamin E(VE) in the intervention of aging degeneration of skeletal muscle is still unclear. **PURPOSE:** In this study, the effects of 16-week HIIT intervention and VE supplementation on the mitochondrial autophagy related Ros-NFκB-Bnip3 pathway and the number of mitochondria in aged rat skeletal muscle were observed. To provide theoretical basis for delaying sarcopenia by means of exercise and nutrition. **METHODS:** 60 male Wistar rats aged 8 months were randomly divided into the control group (C, n=20), the HIIT intervention group (H, n=20) and the HIIT group supplemented with VE (EH, n=20) according to the random number table. H and EH adjusted the exercise intensity with the results of the VO₂max test every two weeks. The EH was given VE gavage according to 50mg/kg body weight everyday at 1 hour before each training. Rats were taken from each group randomly at the basic state, week 8 and 16 for sampling. During sampling, the soleus muscle of rats was removed. The mitochondria were photographed using a transmission electron microscope, the fluorescence intensity of ROS was measured by Multifunctional enzyme marker, The NF-κB, beclin-1 and Bnip3 were measured by Western blot. The data were analyzed by multivariate ANOVA. **RESULTS:** At 8 weeks, the number of mitochondrial in H and EH were increased (P=0.033, P=0.001) and higher than that in C (P=0.046, P=0.003). At 16 weeks, H was higher than C (P=0.004), EH (P=0.01) and baseline (P=0.046). ROS in C and EH increased at 8 weeks (P=0.024, P=0.001). C and EH were higher than H (P=0.018, P=0.002). At 16 weeks, H and EH were higher than baseline values (P=0.027, P=0.010). Although the content of NF-κB changed in each group, no significant difference occurred. At week 16, beclin-1 expression of soleus muscle in H increased (P=0.036). EH was lower than H and C (P=0.004, P=0.002). The expression of Bnip3 in soleus muscle in C increased at 8 weeks and 16 weeks (P=0.030, P=0.001). H increased at 8 and 16 weeks (P=0.001, P=0.001), and was higher in H than in EH (P=0.006, P=0.020). **CONCLUSIONS:** The 16 week HIIT intervention and the combined effect of HIIT and VE to alleviate the reduction of mitochondrial number caused by aging may be due to the delayed protein expression of the Ros-NFκB-Bnip3 pathway in the soleus muscle of rats.

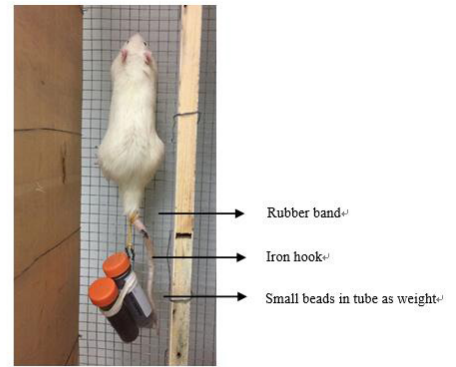


Fig 1. A photograph of climbing ladder with weight attached tail of rat.

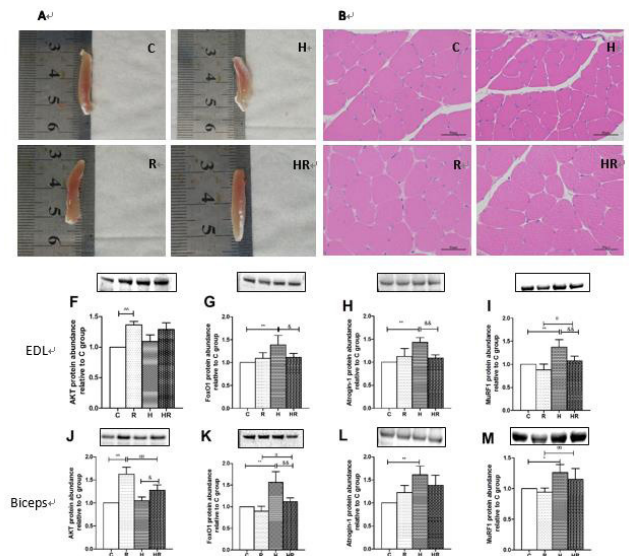


Fig 2. A-B: photographs and HE stained images of muscle (EDL). F-M: Western blot was used to detect protein relative expression of EDL and Biceps after hypoxia exposure and resistance training.

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Akt-FOXO1 Takes Part In Regulating Protein Metabolism During Resistance Training At Hypoxia
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PURPOSE: To research the effects of resistance training on skeletal muscle at hypoxia and Akt-FoxO1 pathway regulatory role during this process. **METHODS:** 40 male Sprague-dawley rats were divided into four groups randomly and were raised at normoxia and hypoxia (12.4% O₂) respectively. Two groups were trained to climb ladder (height 1.2m, inclined at 85°) with load every other day lasting 4-week. Other two groups were quiet control group. Body composition was tested by using DEXA. Isolated extensor digitorum longus (EDL), biceps and soleus were made HE stained paraffin section to analyze muscle fibre cross section area (CSA). Total protein and RNA were abstracted to detect Akt, FoxO1, FoxO1 (S256) and downstream E3 ligase (MuRF1 and Atrogin-1) transcription and expression level. **RESULTS:** Rats lean body mass and CSA of EDL and soleus were decreased significantly (P<0.05 and P<0.05) after 4-week hypoxic exposure. Akt and FoxO1 (S256) expression were decreased, while the expression of FoxO1, MuRF1 and Atrogin-1 were increased (P<0.05). Relatively, resistance training could effectively reduce this atrophy and stimulate rat biceps and EDL hypertrophy (P<0.05 and P<0.05). Meanwhile, Akt and FoxO1(S256) expression were higher than hypoxia training group (P<0.05). **CONCLUSIONS:** Akt-FoxO1 pathway plays an important role in regulating muscle protein during resistance training in hypoxia. Akt activation lead to the nuclear exclusion of phosphorylated FoxO1, which is an important mechanism of resistance training alleviate muscle atrophy.

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Single Cell RNA Sequencing Of Regenerating Skeletal Muscle Reveals A Senescence Response Which Is Necessary For Optimal Muscle Repair
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Satellite cells drive skeletal muscle regeneration, a process regulated by factors released into the local muscle environment; however the source of this trophic support is poorly defined. In this regard, recent work has identified a supportive role for cells commonly associated with aging and pathology, termed "senescent cells". The **PURPOSE** of this study was to determine the function of cellular senescence in normal skeletal muscle repair in rodents. **METHODS:** The tibialis anterior (TA) of C57BL6 mice was injured with cardiotoxin (CTX) and collected across a time-course. To examine senescent cell function during muscle repair, mice were treated with the senolytic compound (ABT-263) to selectively ablate senescent cells. **RESULTS:** The number of senescent cells (SA-β-gal+ cells) rapidly increased following injury (p <0.05) which returned to baseline by 21 days post-CTX. SA-β-gal+ cells displayed other markers consistent with senescence such as a lack of proliferation (EDU-) and the presence of DNA damage (γH2AX). qPCR analysis of putative senescence pathways including p16, p21 and p53 as well as factors commonly secreted by senescent cells were significantly upregulated in CTX-injected muscle in comparison to uninjured muscle (p <0.05). To identify the cell types which become senescent, single-cell RNA sequencing (scRNAseq) was performed on 5-day post CTX skeletal muscle which revealed that fibrogenic-adipogenic progenitors (FAPs), endothelial cells and macrophages

demonstrated increased expression of the senescence markers *Glb1*, *CDKN1A* and *Trp53* while no satellite cells become senescent. These findings were confirmed *in vivo* through IHC analysis of SA- β -gal and marker specific analysis of FAPs (PDGFR α), endothelial cells (CD31) and macrophages (F4/80). Importantly, senolytic treatment during regenerative myogenesis *in vivo* reduced the number of SA- β -gal+ cells by 44% which coincided with significant reductions in muscle fibre cross-sectional area (25%) and the number of nuclei/fibre (12%). **CONCLUSION:** A transient wave of cellular senescence contributes to endogenous muscle repair to influence muscle fibre size following injury.

3334 Board #155 May 29 1:30 PM - 3:00 PM

Inhibiting Drp1-Mediated Mitochondrial Fission Attenuates High-Fat Diet Induced Skeletal Muscle Insulin Resistance

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Dynamins-related protein 1 (Drp1) is a critical mediator of mitochondrial fission. Recent studies have reported increased Drp1 activation in obese skeletal muscle, which is associated with reduced mitochondrial function and insulin sensitivity. **Purpose:** To determine if inhibiting Drp1-mediated mitochondrial fission by a pharmacologic inhibitor attenuates skeletal muscle insulin resistance induced by a high-fat diet (HFD) in mice. **Methods:** 6-week old male C57BL/6J mice (n=9/group) were assigned to either a HFD (45% Fat) or low-fat diet (LFD, 10% Fat) group for a total of 5-weeks. A subgroup of HFD-fed mice received intraperitoneal injections of Mitochondrial Division Inhibitor 1 (MDIVI-1) (20 mg/kg) while the other mice received saline every other day for the last week of diet intervention. A glucose tolerance test was performed after 4 hours of fasting. Twenty-four hours after the final injection, quadriceps and gastrocnemius muscles were collected for further analysis. H₂O₂ levels were detected using Amplex Red Hydrogen Peroxide kit. Insulin signaling and protein markers of mitochondrial dynamics were measured by immunoblot analysis. **Results:** HFD significantly increased glucose area under the curve (AUC) than LFD mice (19074 \pm 2137 vs. 10726 \pm 1254; p < 0.05), but MDIVI-1 treatment attenuated glucose AUC in HFD-fed mice (15354 \pm 1278). MDIVI-1 treatment reduced Drp1 expression in mitochondrial fraction from HFD-fed mice when compared to the saline-treated counterparts (0.003 \pm 0.001 vs. 0.012 \pm 0.003; p < 0.05). The mitochondrial fraction Drp1 expression was positively associated with glucose AUC (r = 0.497, p = 0.042). Insulin-stimulated Akt^{ser473} phosphorylation was reduced in insulin-stimulated skeletal muscle from HFD-fed mice compared to mice fed with LFD (0.70 \pm 0.22 vs. 2.21 \pm 0.39; p < 0.05), but no difference was found between HFD-fed mice treated with MDIVI-1 and LFD-fed mice. HFD had a significant increase in H₂O₂ than LFD-fed mice (0.351 \pm 0.046 \pm 0.186 \pm 0.043; p < 0.05), while MDIVI-1 treatment reduced H₂O₂ production in HFD-fed mice (0.351 \pm 0.046 vs. 0.215 \pm 0.364; p < 0.05) **Conclusion:** These data suggest that inhibiting Drp1-mediated mitochondrial fission attenuates skeletal muscle insulin resistance and improves whole-body glucose homeostasis in mice fed by HFD.

3335 Board #156 May 29 1:30 PM - 3:00 PM

Activation Of Specific Estrogen Receptor Isotype Mediates Skeletal Muscle Force Potentiation In Ovariectomized Mice

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Estrogens affect force generation of skeletal muscle. Post-tetanic potentiation (PTP) of force is low in ovariectomized mice, and estradiol supplementation rescues potentiation both *in vivo* and *in vitro*. However, it is not known whether this estrogenic influence is through estrogen receptors, and if so, which isotype. **PURPOSE:** We hypothesized activation of estrogen receptor beta (ER β) or G protein-coupled estrogen receptor (GPER), but not estrogen receptor alpha (ER α) would enhance *in vivo* muscle PTP in ovariectomized mice. **METHODS:** Adult female C57BL/6J mice (n = 4-12 per treatment) had a nerve cuff surgically implanted on the left common peroneal nerve. Six weeks later mice were ovariectomized (OVX). Four weeks later, PTP of the anterior crural muscles was measured immediately before and 1 h after treatment with either vehicle (OVX+Veh), 17 β -estradiol (OVX+E₂), ER α agonist PPT (OVX+PPT; 1 μ M PPT), ER β agonist DPN (OVX+DPN; 50 nM DPN) or GPER agonist G1 (OVX+G1, 2.4 nM G1) via tail vein injection. PTP was calculated as the percent increase in twitch torque from baseline to the highest torque of the post-tetanic twitches. One-way ANOVAs with Holm-Sidak post hoc tests were used for data analysis. Results are reported as mean \pm SE. **RESULTS:** Peak torques of unpotentiated, baseline twitches were not different among the five groups: 0.47 \pm 0.03,

0.59 \pm 0.04, 0.62 \pm 0.12, 0.52 \pm 0.11 and 0.54 \pm 0.03 mN*m, respectively (p=0.25). Potentiated twitches generated 7-108% more torque than unpotentiated twitches. PTP of OVX+E₂ and OVX+G1 was significantly greater than that of OVX+Veh mice (59 \pm 5% and 61 \pm 7% vs 35 \pm 5% increase, respectively; p=0.01). PTP of OVX+PPT and OVX+DPN were not significantly different from OVX+Veh mice (41 \pm 4% and 49 \pm 7% vs 35 \pm 5% increase, respectively; p=0.37). **CONCLUSION:** Acute treatment with ER α or ER β agonist does not increase *in vivo* PTP of the anterior crural muscles in OVX mice to the extent that E₂ or GPER agonist does. This result partially supports our hypothesis that estrogenic modulation of skeletal muscle force potentiation is not through ER α , and is through GPER. Supported by NIH grants R01-AG031743 and T32-AR050938, and Metropolitan State University Professional Development Grant.

3336 Board #157 May 29 1:30 PM - 3:00 PM

Myogenic Regulatory Factor Expression Time Course Following Doxorubicin Injection In Rats Supplemented With Dietary Creatine

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Doxorubicin (Dox) is a powerful chemotherapy agent known to cause muscle dysfunction. In response to skeletal muscle damage and stress, such as DOX treatment, myogenic regulatory factors (MRF) play a role in restoring muscle integrity. Creatine (Cr) supplementation has been shown to increase MRF expression and could attenuate Dox-induced skeletal muscle damage by enhancing repair, but the effects of Cr supplementation on Dox in this context has yet to be explored. **PURPOSE:** To explore the effects of Cr and Dox on the early time course of MRF expression. **METHODS:** Male Sprague-Dawley rats were randomly assigned to one of three feeding groups: rodent chow supplemented with 2% Cr for four weeks (Cr1), rodent chow supplemented with 4% Cr for one week followed rodent chow supplemented with 2% Cr for three weeks (Cr2), or standard rodent chow for four weeks as a control diet (Con). Animals then received 15 mg/kg Dox or saline as a placebo (Sal). Extensor digitorum longus (EDL) muscles were excised at 1, 3, or 5 days after injection, and expression of the primary MRFs Myf5 and MyoD and the secondary MRFs myogenin and Mrf4 were quantified with Western blotting. **RESULTS:** Between group Myf5 (p=0.0203), MyoD (p<0.0001), and myogenin (p=0.0031) expression differences were observed at day 1 with Cr2+Dox expressing higher Myf5 than Con+Sal (p<0.05) and higher MyoD than Con+Sal, Con+Dox, and Cr1+Dox (p<0.05). Furthermore, both Cr1+Dox and Cr2+Dox expressed higher Myf6 than Con+Sal (p<0.05) with only Cr2+Dox expressing higher Myf6 than Con+Dox (p<0.05), and EDLs from Cr1+Dox and Cr2+Dox had higher myogenin levels than Con+Sal (p<0.05) at the 1 day time point. At the 3 and 5 day time points, however, no between-group differences in MRF expression were observed. **CONCLUSIONS:** Cr feeding prior to Dox treatment increased MRF expression 1 day following Dox injection, and including a Cr loading phase (Cr2) led to a heightened response than no Cr loading phase (Cr1). This elevated MRF expression with Cr, however, was not evident at day 3 and 5 following Dox treatment suggesting that Cr feeding may help to enhance early skeletal muscle repair signaling in response to Dox treatment which may be critical to protecting against Dox myotoxicity.

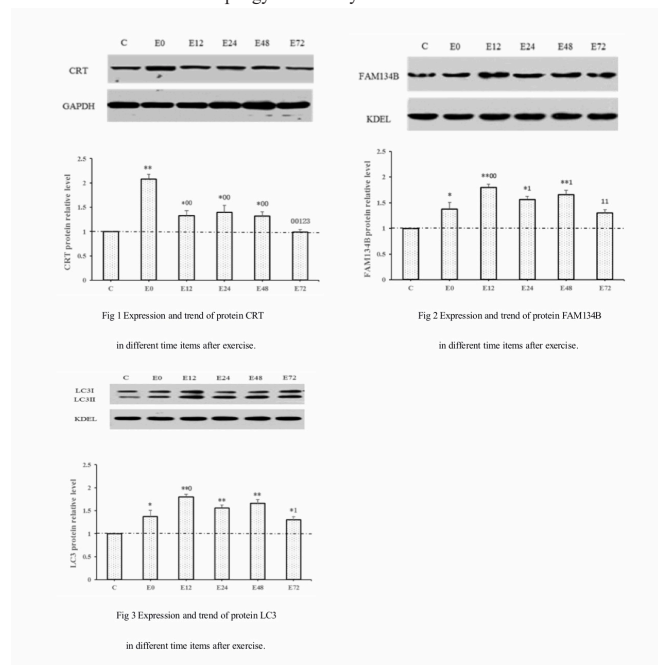
3337 Board #158 May 29 1:30 PM - 3:00 PM

The Mechanism Of Fam134b Mediated Endoplasmic Reticulum Autophagy In Skeletal Muscle After Heavy Load Exercise

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(No relevant relationships reported)

Endoplasmic reticulum(ER) is a significant organelle involved in the contraction of skeletal muscle. **PURPOSE:** To investigate the role of FAM134B in ER autophagy of skeletal muscle cells after exercise. **METHODS:** (1)Subjects and groups:48 healthy male 8-week-old SD rats were randomly divided into control group (Group C, n=8) and exercise group (Group E, n=40). The time items of group E were divided into 5 subgroups of 0h/12h/24h/48h/72h. (2)Exercise program: the rats were trained by using the electric running platform of small animals with large load exercise and reference to the Armstone's.(3)Sampling and index detection: rats were anesthetized after weighing, soleus was isolated and prepared protein samples and frozen sections;Western blot was used to detect the expression of CRT, FAM134B and LC3 protein in skeletal muscle,and double immunofluorescence staining combined with laser confocal was used to observe the co-location of FAM134B, LC3 and CRT.

RESULTS: (1) Compared with group C, the change rate of skeletal muscle protein expression in rats showed that ① CRT ($2.080 \pm 0.096^{**} 1.325 \pm 0.105^{*00} 1.395 \pm 0.142^{*00} 1.315 \pm 0.096^{*00} 0.990 \pm 0.052^{00123}$); in Group E increased by 1.08 times at 0 h after exercise, showing significant difference ② FAM134B ($1.301 \pm 0.076^{*} 1.967 \pm 0.119^{*00} 1.379 \pm 0.112^{*} 11.500 \pm 0.073^{**} 1.277 \pm 0.09611$); in Group E, it was significantly increased at 12 h and 48 h after exercise, 96.7% and 50% respectively. ③ LC3 ($1.376 \pm 0.132^{*} 1.799 \pm 0.063^{**} 0.562 \pm 0.063^{**} 1.659 \pm 0.084^{**} 1.300 \pm 0.067^{*1}$); it was significantly increased in Group E from 0 h to 72 h after exercise. (2) the results of CO location of fam134b and CRT, and co-location of LC3 and CRT showed that compared with group C, group E significantly increased from 0 h to 48 h after exercise. **CONCLUSIONS:** The expression of FAM134B and LC3 in ER increased and co-located with CRT after heavy load exercise, indicating that FAM134B may be involved in the occurrence of ER autophagy after heavy load exercise.



3338 Board #159 May 29 1:30 PM - 3:00 PM

Autophagy Response To High-intensity Interval Exercise And Moderate-intensity Continuous Exercise Is Dissimilar In Skeletal Muscle And Peripheral Blood Mononuclear Cells

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Few human data exist investigating the autophagic response to exercise in humans including the response to high-intensity interval training (HIIT) compared to moderate-intensity continuous training (MICT). Further, the relationship between post-exercise autophagy in distinct tissues including skeletal muscle and peripheral blood mononuclear cells (PBMCs) is not known. **PURPOSE:** The purpose of this study was to investigate the autophagy response in skeletal muscle and PBMCs following an acute bout of HIIT exercise and MICT exercise. **METHODS:** Using a crossover design, ten recreationally-active males (n=5) and females (n=5) performed a bout of MICT (60 minutes at 55% of max velocity [V_{max}]) and HIIT (6 bouts of 1 minute at 100% V_{max} and 1 minute at 3 MPH, followed by 5 minutes at 3 MPH, followed by another 6 bouts of 1 minute and 100% V_{max} and 1 minute at 3 MPH). Muscle biopsies from the vastus lateralis and PBMCs from venous blood were collected pre- and 3 hours post-exercise. Exercise bouts were separated by ≥ 72 hours and performed after abstaining from alcohol for ≥ 24 hours and food and caffeine for ≥ 8 hours. Muscle tissue and PBMCs were analyzed for protein expression of markers of autophagy LC3I, LC3II, and p62 via western blot analysis. **RESULTS:** No differences were detected in LC3I, LC3II, and p62 protein content 3 hours post-exercise compared to pre-exercise in both HIIT and MICT bouts in skeletal muscle or PBMCs (p>0.05).

However, LC3II:I ratio 3 hours post-exercise was different between HIIT ($108.1 \pm 54.5\%$) and MICT ($64.3 \pm 47.3\%$; p<0.05) in skeletal muscle. There were no differences in LC3II:I in PBMCs between HIIT and MICT. **CONCLUSION:** Our findings show that HIIT and MICT exercise results in distinct changes in autophagy flux as suggested by LC3II:I in human skeletal muscle, but not in PBMCs. Our data suggest that the autophagy response to acute exercise in skeletal muscle and PBMCs are dissimilar which may indicate that distinct exercise thresholds exist.

3339 Board #160 May 29 1:30 PM - 3:00 PM **Myosin Heavy Chain Isoform Mrna Expression In Low-And High-capacity Running Rats**

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Differential expression of Myosin Heavy Chain (MHC) isoforms in skeletal muscle determines its metabolic and functional characteristics. Endurance exercise training is associated with fast-to-slow MHC isoform transition, and which is considered to mediate the beneficial effects of exercise on metabolic health. Rats genetically bred for low-capacity running (LCR) and high-capacity running (HCR) are characterized by the health benefits typically described after endurance exercise training. LCR and HCR rats differed in maximal running capacity 14 fold. **PURPOSE:** To quantify mRNA expression for slow (MHC-I) and fast (MHC-IIa, MHC-IIb) MHC isoforms in soleus, gastrocnemius and vastus skeletal muscle of LCR and HCR male adult rats, and determine if HCR rats have higher mRNA expression for slow, and lower mRNA expression for fast, MHC isoforms. **METHODS:** Muscle tissue from 5 HCR and 5 LCR rats was homogenized and mRNA was isolated. The mRNA content of MHC isoforms in muscle was quantified using reverse transcriptase polymerase chain reaction (RT-PCR), and standardized to the 18S mRNA content in muscle. Differences between groups were calculated using the comparative CT method ($2^{-\Delta\Delta CT}$). LCR were the control group. **RESULTS:** Expression of mRNA of the MHC isoforms differed between groups and the type of skeletal muscle analyzed. MHC-I mRNA expression was lower in the HCR compared to LCR across all muscle groups, but this difference ($2^{-\Delta\Delta CT}$) was more pronounced for the gastrocnemius muscle [LCR: 1.0 ± 0.6 (mean \pm SE); HCR: 0.3 ± 0.2 ; $P = 0.08$]. Although MHC-IIa mRNA expression appeared lower in soleus and vastus in the HCR, it was higher in the HCR compared to LCR in the gastrocnemius muscle [LCR: 1.0 ± 1.0 ; HCR: 4.6 ± 3.6 ; $P = 0.07$]. MHC-IIb mRNA expression was lower in the HCR compared to LCR across all muscle groups, but this difference was more pronounced for the soleus muscle [LCR: 1.0 ± 1.1 ; HCR: 0.2 ± 0.4 ; $P = 0.08$]. **CONCLUSION:** Genetic differences linked to the MHC transcriptome (i.e., decrease in MHC-I mRNA) in muscle do not explain the exercise performance observed in HCR rats. Changes in the muscle MHC transcriptome may not directly be responsible for the health benefits associated with exercise training. It remains to be determined on whether the differences we observed at the MHC mRNA level are translated to the MHC proteome level.

3340 Board #161 May 29 1:30 PM - 3:00 PM

Effect Of Aerobic Capacity, Ampk-pgc-1α Pathway In Skeletal Muscle For Detraining Of Different Training
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PURPOSE: By observing HIIT group rats and MIT group rats' changes in the timing and content of AMPK and PGC-1 α in skeletal muscle, changes in aerobic capacity given the same load and training time and then stop the training. To provide a reasonable arrangement of retraining programs. **METHODS:** 27 4-month-old male Wistar rats were randomly divided into 3 groups (N=9): control (Group C), MIT (Group M), HIIT (Group H). C do not exercise, H training at 50%-70%-90% VO2max intensity according to the VO2max test results, M training at 70% VO2max intensity. Both H and M were performed for 50min/day, 5 days/week for 6 weeks of training. Rats were randomly selected from 3 groups on the 1st, 3rd, 7th, and 10th day after the training was stopped. They were intraperitoneal injected by 5% chloral hydrate to get soleus muscle. Using western blot to analysis AMPK and PGC-1 α . The results are expressed as mean \pm standard deviation. one-way ANOVA and non-parametric test are performed in accordance with the normal distribution. **RESULTS:** 1.The AMPK in the skeletal muscle in H was significantly higher than that in C (P<0.05). The trend of AMPK in M was similar to that in H. 2.The level of PGC-1 α in skeletal muscle compared to C was significantly increased in H (P<0.05). The change trend of PGC-1 α in M was similar to that in H. 3.The VO2max shows a downward trend. **CONCLUSIONS:** 1.After 6 weeks of HIIT or MIT, all indicators showed a downward trend. 2.HIIT is superior to MIT in improving and maintaining AMPK, and PGC-1 α level, but it is less effective in maintaining VO2max.

FRIDAY, MAY 29, 2020

The content of AMPK (related)			
Stop training time	Group C	Group H	Group M
1 day	1.00±0.00	1.50±0.26	1.38±0.32
3 days		1.47±0.42	1.32±0.18
7 days		1.25±0.26	1.26±0.45
10 days		1.03±0.23	1.18±0.48

The content of PGC-1 α (related)			
Stop training time	Group C	Group H	Group M
1 day	1.00±0.00	1.52±0.28	1.28±0.15
3 days		1.43±0.15	1.16±0.18
7 days		1.25±0.22	1.19±0.17
10 days		0.84±0.24	1.02±0.26

3341 Board #162 May 29 1:30 PM - 3:00 PM
EFFECT OF FORCE ACTIVATION OF NOTCH SIGNALING ON MTOR

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 (No relevant relationships reported)

PURPOSE: Notch signaling is a prominent pathway necessary for repair of injured muscle. The interactions of Notch with other signaling pathways, specifically mechanistic/ mammalian target of rapamycin (mTOR), in regulating myogenesis is not well known. Studies have been conducted on Notch inhibition, but little research has been performed on activated Notch and the interactions with mTOR. This study was implemented to develop a Notch force activation protocol and to measure the effect of overexpressed Notch on C2C12 proliferation, differentiation and mTOR signaling. **METHODS:** Notch signaling was force activated via suspension or adhesion. For suspension, Notch-1 antibody was introduced to a 12-well plate with C2C12 cells at a concentration of 1:10. For adhesion, Notch ligand, Delta-like Ligand 1 (DLL1), was mixed with Extracellular Matrix (ECM) and coated on a 12-well plate at different concentrations (control, 2.5 μ g, 5 μ g, and 10 μ g) for 12 hours. C2C12 cells were seeded at a concentration of 15,000 cells/well and differentiated for 96 hours. Following designated time period, lysates were collected for Western Blots. Primary antibodies probed for Notch (Hes1), total mTOR signaling (TmTOR), and β -actin. **RESULTS:** Preliminary data for suspension was analyzed via a two-way ANOVA (time x treatment). There is a significant difference in percent change of proliferation at 48 hours ($p=0.02$). Preliminary data of adhesion was analyzed via one-way ANOVA. There is a trend between Hes1 concentration in ligand concentration of 2.5 μ g ($p=0.0739$). It shows no significant difference in TmTOR concentrations between the various Notch force activation concentrations in proliferating C2C12 cells ($p=.4298$). **CONCLUSIONS:** Preliminary data shows a stronger effect of suspension over adhesion for force activating Notch. A concentration of 2.5 μ g of ligand is possibly sufficient to force activate Notch, any higher appears too concentrated to activate Notch. Preliminary data also suggests that force activating Notch does not affect mTOR signaling. Experiments are currently testing the ideal DLL1 to activate Notch signaling, as well as examining the effect of force activating Notch on proliferation, differentiation and other markers of mTOR signaling. Different time points for differentiation should be tested in future research.

3342 Board #163 May 29 1:30 PM - 3:00 PM
EXERCISE MODIFIES K_{ATP} CHANNEL KIR6.X SUBUNITS EXPRESSION IN SLOW-TWITCH AND FAST-TWITCH MUSCLES OF DIABETIC RATS

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Diabetes Mellitus (DM) and the associated hyperglycemic state may adversely affect muscle, which has been called diabetic myopathy. In skeletal muscle, ATP sensitive potassium (K_{ATP}) channels link metabolic cell state and electrical excitability. It has been reported that DM is associated with a K_{ATP} channel dysfunction, reducing their

protecting role in preventing fiber damage and contractile dysfunction. While regular exercise can improve hyperglycemic status in DM, its impact on the expression of K_{ATP} channels subunits is unknown, and could vary in different types of muscle.

PURPOSE: To assess the effect of regular exercise on mRNA expression of the K_{ATP} channel Kir6.x subunits (Kir6.1 and Kir6.2) in slow-twitch and fast-twitch muscles of streptozotocin-induced diabetic rats.

METHODS: Male Wistar rats (25 days old) were randomly divided into four groups: sedentary control, trained control, sedentary diabetic, trained diabetic. Diabetes was induced by a single streptozotocin injection (100 mg/kg body weight), animals with fasting blood glucose levels ≥ 300 mg/dL were considered as diabetic. Groups with training program performed exercise on a treadmill (30 minutes daily, 5 days/week) for 8 weeks. At the end of the intervention, gastrocnemius (fast-twitch) and soleus (slow-twitch) muscles were dissected and real-time quantitative PCR experiments were performed to quantify Kir6.1 and Kir6.2 expression.

RESULTS: In control conditions, the regular exercise increased Kir6.2 subunit mRNA levels significantly in slow and fast muscle (60 \pm 13.49% and 132 \pm 43.81%, respectively), while Kir6.1 mRNA levels did not differ, respect to sedentary control group. In diabetes, relative mRNA expression of the subunit Kir6.1 were significantly higher in both muscles (229.7% and 152%), whereas the mRNA levels of Kir6.2 were downregulated only in slow muscle by 66.8%. These effects were counteracted by the exercise, Kir6.1 expression was decreased in slow and fast muscle (47.28 and 47.57%, respectively), instead the expression of kir6.2 was increased in both muscles.

CONCLUSION: Our results indicate that regular exercise modifies the gene expression patterns of Kir6.x subunits during diabetes, by increases the expression of Kir 6.2 subunits and regularizes Kir6.1. These effects are dependent on muscle fiber type.

3343 Board #164 May 29 1:30 PM - 3:00 PM
MiRNAs As Possible Predictors For Training Efficacy

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 (No relevant relationships reported)

Recent research suggests that genes encoding micro RNA (miRNA) molecules are differentially expressed in response to training.

Purpose: To determine whether specific miRNAs serve as possible predictors for training efficacy.

Methods. Six healthy, sedentary female subjects (mean \pm SD: age 23.2 \pm 3.1 years, peak oxygen uptake (VO_{2peak}) 31.7 \pm 1.6 mL \cdot kg⁻¹ \cdot min⁻¹, body mass index 23.0 \pm 1.2 kg/m²), aged between 20 and 27 years, performed exercise training on a cycle ergometer, three times a week, for 6 weeks. Participants were randomly assigned to either moderate intensity continuous training (MICT, n=3) or high intensity interval training (HIIT, n=3). The MICT group performed 60 min of continuous cycling at the power output (PO) calculated as corresponding to 90% of the first lactate threshold (LT). The HIIT group performed a warm-up for 10 min at the PO calculated as corresponding to 70% of the maximal heart rate (HRmax), followed by four 4-min intervals at the PO calculated as corresponding to 90% of HRmax, with 4-min recovery periods at 30 W in between. Muscle biopsies were taken pre- and post-training from the *vastus lateralis* muscle, followed by isolation of total RNA. Samples were then analyzed using a commercial miRNA array.

Results. Participants increased their VO_{2peak} after 6 weeks of training by 4.2 mL \cdot kg⁻¹ \cdot min⁻¹ in mean (SD: 0.9). MICT and HIIT induced significant changes in miRNA expression patterns, part of which were specific for one of the two training regimens. For instance, there was a significant ($p<0.006$), 5.5-fold upregulation of the anti-apoptotic miRNA 21-5p in both training groups. Furthermore, we could identify distinct shift in miRNA patterns that correlated with exercise-induced changes in physiological parameters, such as changes in VO_{2peak} (delta VO_{2peak} vs delta expression of miRNA 503, $r=-0.9$, $p=0.01$) or microvascular properties.

Conclusions. Our data suggest that MICT and HIIT exert distinct, but also overlapping effects on miRNA expression patterns. In addition, basal miRNA expression patterns might be associated with the individual response to training. Furthermore, the data are currently reproduced using semi-quantitative RT-PCR (qPCR). Our results might have important implications for the development of personalized exercise recommendations and therapeutic strategies.

3344 Board #165 May 29 1:30 PM - 3:00 PM
The Role Of Collagen Composition And Orientation In Lateral Force Transmission With Aging

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PURPOSE: Collagen is the most abundant protein in the body and functions to provide the mechanical strength of connective tissues. In muscle, collagen fibrils function both to hold muscle fibers together and transmit force laterally between fibers. With aging, force transmission is reduced; however, how changes to specific collagen isoforms or the matrix orientation contribute to force loss is currently unclear. The current study was designed to compare lateral force transmission in the gastrocnemius muscle of young and old people with changes in specific collagen proteins and the orientation of the matrix.

METHODS: The calf strength of 12 subjects, 5 between 18 and 30 years old and 7 over the age of 65, was measured within an MRI. Images were taken to determine lateral force transmission. Following strength testing, biopsies were obtained under local anesthetic from the gastrocnemius muscle. Biopsies were pinned to cork at resting length and frozen in isopentane cooled in liquid nitrogen. Cross-sections were taken to determine collagens I, III, IV, and V content, whereas longitudinal sections were stained with picrosirius red to determine matrix orientation. The collagen IV image was also used to determine muscle fiber cross-sectional area (CSA).

RESULTS: Collagen I and V were evenly dispersed throughout the cross-sections, whereas Collagen IV and VI were denser around individual muscle fibers. Collagen IV content was similar in young and old. As expected, fiber CSA tended ($p = 0.1$) to decrease in the old subjects. Picrosirius red staining showed that the collagen matrix is oriented at a $22.3 \pm 3.1\%$ angle to the fibers in young and $30.2 \pm 8.7\%$ in old subjects. **CONCLUSIONS:** Preliminary data suggests that, in the old, fiber CSA decreases and the extracellular matrix becomes less aligned. By establishing the role of specific collagen proteins during aging, we hope to better understand the relationship between the extracellular matrix and force transmission in muscle and how this relationship is modified by age.

3345 Board #166 May 29 1:30 PM - 3:00 PM
Human Medial Gastrocnemius Conversion To Adipose Tissue, A Histological Analysis

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There are very rare reports in the biomedical literature of entire human skeletal muscles being replaced by adipose tissue and thereby affecting lower limb function and ambulation. The causes are unknown. A fully preserved example was discovered in a Medical Anatomy course. **PURPOSE:** To examine the histological characteristics of a bilateral conversion of the medial gastrocnemii, presumably from skeletal muscle to adipose tissue. **METHODS:** Small specimens were collected for preservation, wax embedding, and histological analysis of the affected muscle, unaffected lateral-head of the muscle, nerve, and a control muscle. **RESULTS:** Hematoxylin and Eosin staining revealed an 88% decrease in the number of skeletal muscle fibers with a corresponding increase in the number of adipocytes. Connective tissue was similar between samples; however, the lateral gastrocnemius exhibited signs of inflammation with no necrosis. **CONCLUSIONS:** This is to our knowledge the first full histological analysis of a seeming conversion of the bilateral gastrocnemius medial heads into adipose tissue. The cause is unknown but could be related to the immune cell infiltration.

3346 Board #167 May 29 1:30 PM - 3:00 PM
PGC-1 α mRNA Isoform-specific Response To Exercise And Cold

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 (No relevant relationships reported)

PGC-1 α mRNA Isoform Specific Response to Exercise and Cold

Ben Meister, Camille Larson and Dustin Slivka
 University of Nebraska at Omaha.
 Cold exposure in conjunction with aerobic exercise has been shown to increase the gene expression of PGC-1 α , the master regulator of mitochondrial biogenesis. PGC-1 α can be expressed as multiple different isoforms due to alternative splicing mechanisms, including the truncated NT-PGC-1 α isoform. These isoforms have differing structures and functions but relatively little about the specificity and response is known.

PURPOSE: Determine the difference of PGC-1 α isoform expression following an acute bout of cycling in cold and room temperature conditions. **METHODS:** 8 male participants cycled for 1 hour at 65% W_{max} at $-2^{\circ}C$ and $20^{\circ}C$. A muscle biopsy was taken from the vastus lateralis before, 3 h post, and 6 h post exercise. qRT-PCR was used to analyze gene expression of total PGC-1 α and NT-PGC-1 α expression. **RESULTS:** Gene expression of both total PGC-1 α and NT-PGC-1 α increased due to the exercise intervention at both 3 h and 6 h time points ($p < 0.05$), with mRNA expression peaking at 3 h ($p < 0.05$). At 3 h total PGC-1 α was higher in the cold (13.2 ± 6.3 fold increase) compared to room temperature (7.4 ± 2.0 fold increase, $p = 0.03$). NT-PGC-1 α was also higher in cold (20.8 ± 12.5 fold increase) compared to room temperature at 3 h (10.7 ± 3.7 fold increase, $p = 0.029$). Total PGC-1 α and NT-PGC-1 α were similar in cold and room temperature at 6 h ($p > 0.05$). **CONCLUSION:** Exercise and cold exposure induced alterations in gene expression for total-PGC-1 α and its truncated isoform, NT-PGC-1 α . It appears that NT-PGC-1 α contributes to the reported alterations in the cold-induced PGC-1 α exercise response.

3347 Board #168 May 29 1:30 PM - 3:00 PM
Formoterol Stimulation In Vitro Influences Myogenic Regulatory Factors During Myogenesis In Human Skeletal Muscle Cells

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 (No relevant relationships reported)

The process of myogenesis within skeletal muscle (SKM) is essential for growth and repair and is coordinated via the expression of myogenic regulatory genes. Previous animal studies have reported that formoterol, a beta-adrenergic receptor agonist, has stimulating effects on genes related to SKM mitochondrial function and biogenesis, similar to effects found for exercise. Lesser known is the potential "exercise mimetic" influence that formoterol stimulation may have during the stages of myogenesis, especially in human SKM cells.

Purpose: To investigate the effects of formoterol stimulation on expression of myogenic regulatory genes during myogenesis in human SKM cells. **Methods:** Human SKM myoblasts ($n = 6$ per group) were cultured and differentiated until mature myotube formation (Day 6). Groups included control cells (CON) and cells stimulated by 30nM formoterol for 3h prior to RNA extraction points (FORM). Total RNA was extracted during mid-myogenesis (Day 4) and at terminal differentiation (Day 6) (a cell culture model of investigating myogenesis). Gene expression for Myogenic factor 5 (Myf5), Myogenic differentiation 1 (MyoD), and Myogenin (MyoG) was determined by qPCR. Data were analyzed using repeated measures ANOVA. **Results:** Significant differences between conditions and time points are detailed in Table 1.

Conclusions: For the FORM group, Myf5 expression was elevated at D6 compared to CON while MyoG and MyoD expression was lower than CON for D4 and D6. The interpretation is that FORM stimulation increased stimulus of D4 myoblast proliferation and, thus, delayed initiation of differentiation. These results, coupled with other preliminary data from our lab showing increased mitochondrial biogenesis with this model of investigation, suggests that this exercise mimetic stimulation may cause shift in the cell towards bioenergetic preference rather than fusion of myotubes. Table 1.

Gene	Comparison	Fold Change	P Value
Myf5	D6 CON < D4 CON	-0.25	<0.05
	D6 FORM > D4 FORM	0.65	<0.001
	D6 FORM > D6 CON	0.75	<0.001
MyoD	D4 FORM < D4 CON	-0.57	<0.000
	D6 FORM > D4 FORM	0.85	<0.05
	D6 FORM < D6 CON	-0.16	<0.05
MyoG	D6 CON < D4 CON	-0.33	<0.001
	D4 FORM < D4 CON	-0.72	<0.001
	D6 CON < D4 CON	-0.44	<0.001
	D6 FORM < D6 CON	-0.24	<0.001

3348 Board #169 May 29 1:30 PM - 3:00 PM
Diurnal Regulation Of Exercise-induced Anabolic And Catabolic Signaling In White Adipose Tissue

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(No relevant relationships reported)

Purpose: Autophagy is a degradation system where damaged cellular components can be recycled, resulting in higher cellular efficiency. White adipose tissue has been shown to have a catabolic response to exercise where autophagy will increase immediately after exercise. mTOR is an anabolic signaling pathway that inhibits autophagy, and plays a key role regulating cell size. Autophagy is sensitive to bioenergetic stressors such as exercise and has been shown to be regulated in a circadian fashion. However, it is currently unknown if exercise-induced autophagy is sensitive to the time-of-day at which exercise occurs. The purpose was to assess anabolic and catabolic signaling in white adipose tissue following exercise at two times of day; Zeitgeber time (ZT) 0 (light phase) and ZT12 (dark phase).

Methods: 21 week old male C57/BL6 mice (n=38) were habituated to treadmill exercise for 5 days under red light during the active phase, and allowed to recover for 2 days. Following a single 60-minute bout of treadmill exercise at 10 m/min, mice were sacrificed at 3 time points, pre exercise (SED), immediately post exercise (POST), and 1-hour post exercise (1HR). Tissue was analyzed for anabolic (p-mTOR (Ser2448) and p-S6 (Ser204/244)), and catabolic (LC3II/I) signaling pathways via western blotting. Results were analyzed with a 2x3 ANOVA and significance was accepted at p<0.05.

Results: Following exercise, there was a significant repression of mTOR (SED=0.990 ± 0.17 vs POST=0.747 ± 0.14, p<0.05) and S6 (SED=0.702 ± 0.39 vs POST=0.186 ± 0.14, p<0.05) activation (Main Effect (ME) Exercise; p<0.05, both), which was significantly stronger following exercise performed at ZT12 (Interaction Effect for p-S6; p<0.05). Autophagy signaling (LC3II/I) was increased at ZT12 (ZT0=1.22 ± 0.33 vs ZT12=2.28 ± 1.09, p<0.05), which appeared to be driven by changes in LC3I expression. LC3II (normalized to total protein) was increased following exercise (SED=0.81 ± 0.26 vs POST=1.28 ± 0.43 and 1HR=1.22 ± 0.28, p<0.05, both) and was higher at ZT0 (ZT0=1.33 ± 0.33 vs ZT12=0.91 ± 0.33, p<0.05), although no interaction was present.

Conclusion: Anabolic and catabolic signaling in adipose tissue may be differentially impacted by exercise performed at different times of day.

3349 Board #170 May 29 1:30 PM - 3:00 PM
The Role Of Mitochondrial Dysfunction And Redox Disturbances After Non-invasive Anterior Cruciate Ligament Injury

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(No relevant relationships reported)

Anterior cruciate ligament (ACL) injury results in protracted quadriceps atrophy, however the mechanisms that drive atrophic pathways remain undefined. Mounting evidence has revealed that mitochondrial dysfunction and redox disturbances are causal events in the initiation of quadriceps atrophy, yet the extent to which mitochondria damage play a key role in quadriceps muscle atrophy after ACL injury has yet to be explored.

PURPOSE: Using a pre-clinical animal model of ACL injury, a time course study was performed to investigate the role of mitochondria and Reactive Oxygen Species (ROS) after injury.

METHODS: 48 Long Evans rats (n=8 per group; 4m/4f) underwent non-invasive rupture of the right ACL and were euthanized at 1, 3, 7, 14, 28, 56 days post-injury. 8 rats (4m/4f) served as healthy controls (HC). Respiration was measured by high-resolution respirometry in permeabilized muscle fibers from the right vastus lateralis (VL). ROS production was determined using Amplex Red assays. VL weight was normalized to total body mass for measuring muscle mass loss. One-way ANOVAs with Bonferroni post-hoc were used to determine differences between groups (P < 0.05).

RESULTS: Reductions in complex I + II state 3 respiration were observed at 7 and 56 days post-injury (HC: 33.92 ± 4.26 pmol·s⁻¹·mg⁻¹; 7D: 15.95 ± 1.38 pmol·s⁻¹·mg⁻¹; 56D: 18.80 ± 2.15 pmol·s⁻¹·mg⁻¹; F = 5.99, P = 0.002 and P = 0.015 respectively). State 4 respiration did not differ between groups (P > 0.05). Respiratory Control Ratio (RCR), defined as respiration in state 3 divided by respiration in state 4, significantly decreased 7 through 56 days post-injury (HC: 4.00 ± 0.13; 7D: 1.54 ± 0.16; 56D: 1.82 ± 0.20; F = 13.29, P = 0.001 and P = 0.001 respectively) along with increased mitochondrial ROS production 7 through 56 days post-injury (HC: 10.16 ± 0.41 pmol·s⁻¹·mg⁻¹; 7D: 12.23 ± 0.54 pmol·s⁻¹·mg⁻¹; 56D: 26.83 ± 0.54 pmol·s⁻¹·mg⁻¹; F =

178.05, P = 0.001 and P = 0.001 respectively). VL atrophy was observed at 7 and 14 days post-injury (HC: 3.52 ± 0.08 mg·g⁻¹; 7D: 3.14 ± 0.07 mg·g⁻¹; 14D: 3.18 ± 0.07 mg·g⁻¹; F = 5.06, P = 0.013 and P = 0.044 respectively).

CONCLUSION: Mitochondria are an important source of muscular ROS production after ACL injury. Mitochondrial dysfunction and redox disturbances contribute to ACL injury-induced quadriceps atrophy.

Funding Source: NIH grant K01AR071503

3350 Board #171 May 29 1:30 PM - 3:00 PM
Relationship Between Content Of Mitochondria And Z-disk Or Fiber Types

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(No relevant relationships reported)

PURPOSE: To estimate the relationship between mitochondrial volume contents and z-disks width determined by electron microscopy, analyzed from 13968 images from 582 fibers. **METHODS:** Eleven recreationally active individuals were recruited. Each subject had three endurance tests at 75% VO₂max following three different diets and nine biopsies in total. We obtained ten muscle fibers from each of the nine biopsies and used z-disk width as the discriminator of fiber types. From each fib23 24 EM images were obtained in each biopsy (12 intermyofibrillar, IMF, and 12 subsarcolemmal, SS, images, respectively), and point counting method was used to quantify IMF and SS mitochondrial content, and the total content. Relationships between fibers' mitochondrial contents and z-disk width were tested by Pearson's correlation coefficient and linear regression. Interactions and main effects were tested by a mixed effect model with fiber type and diet as fixed factors. **RESULTS:** The total mitochondria volume contents correlated highly significant with fiber z-disk width (Fig 2A. P<.001, R² = .20). Also, there were strong correlations between the mitochondrial volume contents in the IMF as well as SS and fiber z-disk (P<.001, R² = .18; P<.001, R² = .14, respectively, Fig. B, C). The type1 fibers have, on average, a 47% higher total mitochondrial content compared to the type 2 fibers, with 67% higher in SS and 41% in IMF, respectively (P<.001, Mean±SD, IMF:0.065±0.023μm³·μm⁻² vs 0.046±0.021μm³·μm⁻²; SS: 0.450±0.298μm³·μm⁻² vs 0.270±0.253μm³·μm⁻²; Total: 0.087±0.033μm³·μm⁻³ vs 0.059±0.031μm³·μm⁻³ Fig. D, E, F) **CONCLUSIONS:** The total mitochondrial volume contents, as well as the IMF and SS mitochondrial volume contents are strongly correlated with z-disk width in human muscle fibers (P<.001, R² = .20). Thus, fiber typing based on z-disk width is a strong predictor of fiber typing based on mitochondrial volume.

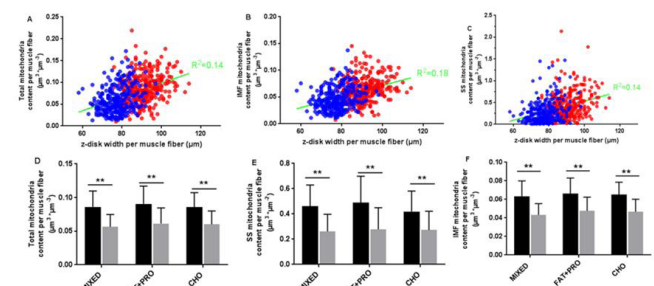


Figure. Association between mitochondrial z-disk width and subcellular specific and total mitochondrial contents. A, B and C, blue spots are type2 and red spots are type1. IMF mitochondrial content is a better predictor for z-disk width than SS (P<.001, R² = .42, R² = .18, P<.001, R² = .37, R² = .14, respectively). D, E, F the horizontal line means mean mitochondrial content of all subjects in each diet and fiber type. Black dots are type1 and grey dots are type2. ** Different between two fiber types (P<.001).

3351 Board #172 May 29 1:30 PM - 3:00 PM
Abstract Withdrawn

3352 Board #173 May 29 1:30 PM - 3:00 PM
Effects Of Adipose Mesenchymal Stem Cells Injected Intramuscularly On Myostatin Signaling Skeletal Muscle In Rats After Eccentric Exercise

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(No relevant relationships reported)

PURPOSE: To observe the effect of adipose mesenchymal stem cells (ASCs) on myostatin signal of skeletal muscle in rats at different time points after eccentric exercise, and to explore the mechanism of ASCs injection on skeletal muscle injury and repair after eccentric exercise. **METHODS:** Phosphate buffer saline (PBS) were injected into the gastrocnemius muscle in the left leg, and ASCs were injected into

the gastrocnemius muscle of the right leg of SD rats after eccentric exercise. The rats were randomly divided into four groups: one day D1, three days D3, seven days W1 and fourteen days W2 after exercise. Skeletal muscle ultrastructure was observed by electron microscopic. The content of serum creatine kinase (CK), skeletal muscle troponin I (sTnI), myostatin (MSTN), follistatin (FST) were measured by ELISA. Real-time PCR was used to detect the expressions of MSTN, ACVR2B, FST mRNA in skeletal muscle. The expression of MSTN, ACVR2B, FST, p-Smad2/3 were detected by Western Blot.

RESULTS: Compared with group PBS, adipose mesenchymal stem cell injection significantly promoted the repair of muscle fibers. Compared with group D1, the level of CK in group W2 was significantly decreased, the content of sTnI level in group D3 and group W1 were remarkably increased, the serum MSTN contents in group W1 were significantly decreased, which in group W2 was remarkably increased. Compared with group PBS, the relative expression quantities of MSTN mRNA were significantly decreased at time point D3 and which were extremely significantly down-regulated at time point W2. Compared with group PBS, the expression of MSTN protein were significantly decreased at time point D3, the expression of ACVR2B protein were remarkably increased at time point D1, D3 and W1, however, which was significantly decreased at time point W2. Compared with group PBS, the phosphorylation of Smad2/3 shown significantly decreased at the time point W2 of group ASCs.

CONCLUSIONS: After eccentric exercise, allogeneic adipose mesenchymal stem cells injected intramuscularly can decreased the transcription of MSTN in skeletal muscle. Adipose mesenchymal stem cells injected intramuscularly may improve the regeneration and repair of skeletal muscle after eccentric exercise through affecting the downstream signaling pathway of MSTN.

3353 Board #174 May 29 1:30 PM - 3:00 PM

Bioinformatics Analysis Of MicroRNA In Skeletal Muscle Of Mice Related To Aerobic Exercise

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(No relevant relationships reported)

MicroRNAs (miRNAs) are increasingly being studied as regulators for biological processes in skeletal muscle. However, little information relating to biological process regulated by aerobic exercise-affected miRNA is available. Bioinformatics analysis provides a perspective on the direction of future research.

PURPOSE: To analyze the functions of miRNAs which were affected by 8-week aerobic exercise in skeletal muscle of mice. **METHODS:** Twenty C57BL/6J mice were randomly divided into exercise (E) and control (C) groups. The E group were trained on a treadmill with a program of slope 0°, 12m/min, 60min/day, and 5 days/week. The C group lived normally without training. After 8-week of training, skeletal muscles were harvested for RNA extraction. Subsequently, miScript miRNA PCR Arrays was conducted to identify the differentially expressed miRNAs between two groups. Target gene prediction was performed by using TargetScan and microT-CDS tools. Gene Ontology analysis (GO) on the target gene was performed with Cytoscape Bingo. MirPath v.3 from the DIANA tools was used to execute the Kyoto Encyclopedia of Genes and Genomes (KEGG) analyses. **RESULTS:** 44 miRNAs were upregulated (Fold Change \geq 2.0, P<0.05) and 14 miRNAs were downregulated (Fold Change \leq -2.0, P<0.05) after the aerobic exercise. Prediction of target genes showed that there were a total of 9122 target genes (Ptpn9, Gria3, Zfp219, etc.) for the up-regulated miRNAs, while 3636 target genes (Nrf1, Lmbr11, Zbp1, etc.) for the down-regulated miRNAs. GO analysis revealed that the differentially expressed miRNAs participated in a variety of molecular functions and biological processes including nucleic acid binding, protein binding, regulation of gene expression, macromolecule metabolic process and others. KEGG analysis showed that the up-regulated miRNAs were significantly enriched in MAPK, Wnt and mTOR signaling pathway. The down-regulated miRNAs were mainly enriched in MAPK, Wnt signaling pathway. **CONCLUSION:** MiRNAs induced by aerobic exercise potentially regulate the biological processes of skeletal muscle mainly through MAPK and Wnt signaling pathways.

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3354 Board #175 May 29 1:30 PM - 3:00 PM

Aerobic Training Activates Nrf₂-mediated Anti-oxidative Effect Of Ampk On Mouse Skeletal Muscle

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(No relevant relationships reported)

PURPOSE: To study the antioxidative effect of AMPK activated by aerobic training on Nrf₂ mediated skeletal muscle in mice. **METHODS:** 8-week-old AMPK α_2 transgenic mice (TG mice), AMPK α_2 knockout mice (KO mice) and wild-type mice

(WT mice) were randomly divided into two groups: the quiet group and the training group, with 10 mice in each group. In the training group, 6 days a week, aerobic training was conducted on the running platform with a gradient of 0 and a speed of 12 m / min for 1 hour every day for 4 weeks. The level of ROS in skeletal muscle was detected by fluorescence colorimetry. Rc-per was used to detect the level of antioxidant enzyme mRNA in skeletal muscle of mice in each group. Western blot method was used to detect the expression of AMPK α_2 , AMPK α , Nrf₂, pnr_f, and antioxidant enzyme protein. **RESULTS:** after 4 weeks of aerobic training (3) the expression of pnr_f protein in skeletal muscle of wild mice and AMPK α_2 transgenic mice increased significantly. (4) compared with the wild mice, the expression of AMPK α_2 gene knockout mice skeletal muscle catm_rna, nqo-1m_rna, ho-1m_rna, gp_x-1m_rna and sod1m_rna decreased significantly. (5) the expression of cat, GSR, HO-1 and SOD1 protein in the skeletal muscle of wild mice increased significantly. The expression of AMPK α_2 in transgenic mice was high, and the expression of protein (cat, GPx-1, nqo-1) and protein (GCLC, GSR, HO-1, SOD1, SOD2) in the skeletal muscle of wild mice increased significantly. Compared with the wild mice in the training group, the expression of AMPK α_2 in transgenic mice was high (GPx-1, GSR, HO-1, nqo-1, SOD1), SOD2) and GCLC protein expression increased significantly. Compared with the wild mice in the training group, AMPK α_2 knockout mice showed a significant decrease in the expression of protein (HO-1 and SOD2) in skeletal muscle tissue. (6) there was no significant difference in ROS level in skeletal muscle of wild mice, AMPK α_2 transgenic mice and AMPK α_2 knockout mice before and after training. **CONCLUSIONS:** the activation of AMPK by aerobic training can promote the expression of pnr_f in skeletal muscle, then increase the expression of antioxidant enzymes and improve the antioxidant capacity of the body.

3355 Board #176 May 29 1:30 PM - 3:00 PM

Effects Of Mild Hypoxic Conditions On Mrna Expression Of Spinal Cord In The Young And Old Mouse

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(No relevant relationships reported)

We have developed a method to evaluate motoneuron plasticity by real-time RT-PCR analysis for whole spinal cord. **PURPOSE:** In this study, we examined effects of mild hypoxic conditions on mRNA expression of spinal cord as well as skeletal muscle in young and old mouse. **METHODS:** Young (12-week old, n=16) and old (20-month old, n=17) mice were divided into three groups of control, continuous hypoxia, and intermittent hypoxia. Both hypoxic groups were subjected to exposure for 5 days under oxygen concentration of 16%. The intermittent hypoxic group was exposed six times to an oxygen concentration of 16% intermittently every hour for 12 hours of the light day of the day. Immediately after completion of the exposure, the spinal cord (Cervical 3 - 6 and Lumber 2 - 5) as well as muscles (diaphragm and gastrocnemius muscles) were removed and mRNA expression levels were investigated using real time RT-PCR system. **RESULTS:** Although the mRNA expression levels of PGC1 α and VEGF-A were significantly (P < 0.05) higher in diaphragm than gastrocnemius muscles, these mRNA expressions levels were not affected by hypoxic stimulation. While, the mRNA expression levels of muscle remodeling factors (Pax7, MyoD, BDNF, and MHCe) were significantly (P < 0.05) higher in hypoxic condition than control group. Compared with young mice, the expression levels of inflammatory cytokine receptor (IL-6R α) and neurotrophic factors (BDNF, VEGF-A) of muscles increased in old mice. The increased expressions may be considered to be an indispensable adaptive change for age-related changes in skeletal muscle including neuromuscular junction. In the both hypoxia groups, the mRNA expression level of neurotrophic factors (VEGF-A, FGF2) significantly (P < 0.05) increased in the cervical, but not in the lumbar spinal cord. **CONCLUSIONS:** We concluded that the mRNA expressions of trophic factor were changed by hypoxic stimulation not only in the muscle but also in the cervical spinal cord.

3356 Board #177 May 29 1:30 PM - 3:00 PM

Effect Of Phb1 On F₀F₁-atpase And Mitochondrial Function In Energy Metabolism

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(No relevant relationships reported)

PURPOSE: To investigate the mechanism of PHB1 on F₀F₁-ATPase and its effect on exercise capacity, and whether PHB1 can be used as a scientific basis for regulating energy metabolism. **METHODS:** An animal model of moderate-intensity exercise and exhaustive exercise and a complete C2C12 cell line culture system, PHB1 overexpression and RNA interference in adenovirus vectors were established. 32 8-week-old healthy male SD rats were randomly divided into three groups: normal

control(NC),moderate intensity exercise(MIE)and acute exhaustive exercise(AEE) groups.NC and AEE:routinely raised. MIE:Rats were run at 15m/min per day for 60min until the end of the 8th week.Slope:10%.AEE:The rats were subjected to acute exhaustive exercise after 8 weeks.They were sacrificed 48h after the last experiment. PHB1 expression,ATP content, F_oF_1 -ATPase,oxidative stress (ROS),cellular oxygen consumption rate (OCR),and mitochondrial respiratory function(RCR)in skeletal muscle were measured by animal and cell experiments.**RESULTS:**Compared with NC,MIE group RCR(+73%, $p<0.001$),ATP content (+48%, $p<0.05$), F_oF_1 -ATPase activity(+79%, $p<0.05$),PHB1 expression(+42%, $p<0.01$),ROS level(-75%, $p<0.001$) decreased;AEE group RCR(-58%, $p<0.05$),ATP content (-55%, $p<0.05$), F_oF_1 -ATPase activity(-56%, $p<0.001$),PHB1 expression(-31%, $p<0.01$)decreased,and ROS(+79%, $p<0.05$)increased.In C2C12 cells,PHB1 overexpression group,ATP content(+86%, $p<0.01$), F_oF_1 -ATPase mRNA level(+59%, $p<0.05$), F_oF_1 -ATPase protein expression level(+69%, $p<0.05$), F_oF_1 -ATPase activity(+226%, $p<0.01$),and OCR(+256%, $p<0.01$),ROS level(-74%, $p<0.01$),significant enhancement of cellular respiratory function.In the low expression group of PHB1,ATP content(-21%, $p<0.01$), F_oF_1 -ATPase mRNA level(-64%, $p<0.05$), F_oF_1 -ATPase protein expression level(-89%, $p<0.05$), F_oF_1 -ATPase activity(-93%, $p<0.01$),and OCR(-190%, $p<0.01$),ROS production was significantly increased(+104%, $p<0.01$),and cellular respiratory function was significantly reduced.**CONCLUSION:**In energy metabolism,PHB1 may play a role in stabilizing the mitochondrial structure and positively regulating F_oF_1 -ATPase activity,thereby enhance mitochondrial function and promoting energy metabolism.Supported by NSFC(No.31470061)

3357 Board #178 May 29 1:30 PM - 3:00 PM

Combined Effects Of Unloading And Radiation On Skeletal Muscle In Mice

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In preparation for upcoming space missions to the Moon and Mars, there is a need to understand how space stressors (e.g. microgravity, radiation) affect different physiological systems. As skeletal muscle is a critical organ, not only for locomotion but also for overall body homeostasis, defining the molecular impact of microgravity and radiation on this tissue will help developing new, or fine-tuning current countermeasures to maintain health and physiological function of space travellers. **PURPOSE:** To investigate the effects of combined radiation and unloading on anabolic/catabolic and immune/inflammatory processes on skeletal muscle in mice. **METHODS:** Ten C57/BL6J mice were subjected to 14-d hind-limb unloading by tail suspension with an acute radiation session (dose=25 mGy, X-ray) on day 7 of unloading (HLUR). Ten mice were used as control (CTRL; similar cages, sham radiation). Mice were sacrificed and soleus muscle was immediately dissected, weighed and frozen. Then, RNA was extracted and converted to cDNA. Gene expression of anabolic/catabolic (i.e. myostatin, MuRF-1, Atrogin-1, PGC-1 α) and immune/inflammatory markers (i.e. CD4, CD8, IFN γ , CD11b, MHCII, TNF, IL-6) was assessed by RT-PCR. Independent t-tests were used to compare HLUR vs. CTRL. **RESULTS:** Soleus muscle weight was ~30% lower in HLUR vs. CTRL ($P<0.001$). Myostatin expression was greater in HLUR vs. CTRL (1.8-fold, $P=0.014$). MHCII expression was higher in HLUR vs. CTRL (2.4-fold, $P<0.001$). There was a trend for group differences ($P<0.08$) in CD11b and TNF mRNA content with HLUR showing greater values than CTRL. Gene expression of CD4, CD8 and IFN γ was barely detected in either group. **CONCLUSIONS:** The combination of unloading and radiation has a major impact on skeletal muscle. Apart from inducing muscle atrophy, as indicated by the decreased muscle weight and increased myostatin levels, these two space stressors altered the immune profile within the muscle. The increased gene expression of MHCII and CD11b indicates that the myeloid component of the immune system is activated upon unloading and radiation in skeletal muscle. In contrast, the almost undetected mRNA levels of CD4, CD8 and IFN γ may imply that unloading and acute radiation have little impact on the lymphoid component. These findings should be followed up with immunohistochemical analysis.

3358 Board #179 May 29 1:30 PM - 3:00 PM
Role Of The Mct-1 T1470a Polymorphism (rs1049434) In The Uptake Of Lactate In Females Following 30 Second Wingate Test

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(No relevant relationships reported)

PURPOSE: The purpose of this investigation was to examine the role of the MCT-1 T1470A single nucleotide polymorphism on blood lactate clearance rates in females following a 30 second Wingate test. **METHODS:** Lactate was measured before the test, immediately following the test and -10, -20, -30 and -40 minutes post. Lactate

decreases were calculated for each 10-minute period. Participants were divided into three groups based on their T1470A genotype (TT, TA, AA). **RESULTS:** There was no significant interaction between genotype and lactate clearance ($p=0.123$), however the TT genotype group had significantly higher clearance rates when collapsed across time points ($p=0.003$). Lactate clearance was higher in the TT genotype when compared to both the TA genotype ($p=0.002$) and the AA genotype ($p=0.009$). This effect was caused by significantly higher lactate accumulation in TT genotype subjects immediately following the Wingate test when compared to TA ($p=0.001$) and AA ($p=0.003$) subjects. **CONCLUSION:** To our knowledge, our investigation is the first that demonstrates that the MCT-1 genotype effects lactate clearance in women. Our findings differ from the body of literature carried out using male participants, which suggests that the T allele adversely effects lactate clearance. Further, our findings indicate that peak lactate clearance occurs earlier in the TT group compared to the TA and AA group in resistance trained females. Future research should continue to examine the MCT-1 polymorphism in woman and how this genetic information can be integrated into exercise prescription protocols.

F-58 Free Communication/Poster - Blood Flow Restriction

Friday, May 29, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

3359 Board #180 May 29 1:30 PM - 3:00 PM

Effects Of Blood Flow Restriction With Eccentric Exercise On Muscle Adaptation

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(No relevant relationships reported)

Purpose: BFR during RT has been reported clinically to rehabilitate/prevent injury in healthy people and people with orthopedic conditions. Further, subjective accounts of minimal muscle soreness post-training suggest a reduction in exercise induced muscle damage compared to traditional RT. We sought to compare the effects of BFR eccentric RT at low loads on muscle performance to traditional eccentric resistance training at high loads, and to explore the feasibility of multifrequency bioelectric impedance analysis (BIA) to assess muscle damage and hypertrophy. **Methods:** 25 healthy young adults 25 ± 5 yo (11 female, 14 male) were randomized into two groups (BFR L, BFR R and trained 2x/wk for 6 wks. The contralateral leg was trained traditionally to serve as the control (TC) after baseline testing (single-leg vertical jump, Nordbord bilateral eccentric hamstring strength, legcurl bilateral 1RM, legcurl hamstring endurance)At the conclusion, participants re-tested. BIA data was collected pre (0, 24, 48hrs) and post (0, 24, 48hrs). Pre-post paired t-tests and coefficient of determination were used for analysis. **Results:** There was 96% compliance. There were no significant changes in single leg vertical jump (left: $p=0.14$, right: $p=0.26$), hamstring strength (left: $p=0.17$, right: $p=0.38$), or hamstring endurance in either leg (left: $p=0.95$, right: $p=0.12$) or condition. There were significant increases (7.5-9.5%) in hamstring 1RM in both legs (left: $p<0.01$, right: $p<0.01$) and both training conditions (BFR: $p<0.01$, TC: $p<0.01$). There was low correlation between phase angle and participant perceived soreness ($r^2=0.15$), but scores were significantly lower in BFR leg immediately ($p=0.04$) and 24hr ($p=0.04$) post training. **Conclusions:** Eccentric BFR resistance training exhibited similar outcomes to traditional training with less reported soreness. However, interpretation of these data are limited by methodologic approach.

3360 Board #181 May 29 1:30 PM - 3:00 PM

Acute Cardiovascular And Muscular Response To No-load Exercise With And Without Blood Flow Restriction

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(No relevant relationships reported)

PURPOSE: To examine acute changes in muscle thickness, isometric strength, and arterial occlusion pressure (AOP) following NO LOAD exercise with and without the application of blood flow restriction (BFR) in the upper body. **METHODS:** Changes in muscle thickness, isometric strength and AOP were examined following four sets of twenty repetitions of unilateral elbow flexion exercise. Participants performed maximal muscle contractions with no external load throughout a full range of motion with and without the application of a moderate BFR (40% of AOP). Results are displayed as mean (SD). **RESULTS:** 39 resistance-trained males and females completed the study. For isometric torque there was a condition x time interaction ($p=0.012$). The BFR condition had lower isometric torque immediately following exercise [56.07 (17.78) Nm] compared to the control group [58.67 (19.06) Nm]. In addition, both

the BFR and control conditions demonstrated a decrease in torque immediately following exercise [mean change = 4.5 (4.5) and 1.82 (4.5) Nm for BFR and control conditions respectively], which remained decreased below baseline 15 minutes post exercise [mean change 2.39 (5.5) and 2.28 (3.19) Nm for BFR and control conditions respectively]. For muscle thickness, there was a main effect for time ($p < 0.001$). Muscle thickness increased from pre [3.52 (.78) cm] to post [3.68 (.81) cm] exercise and remained increased above baseline 15 min post exercise [3.6 (.80) cm]. For AOP, there was a group x time interaction ($p = 0.027$). The change in AOP was greater in the BFR group [16.6 (13.42) mmHg] compared to the control group [11.1 (11.84) mmHg]. **CONCLUSIONS:** NO LOAD exercise with the application of BFR led to greater reductions in isometric torque compared to NO LOAD exercise without the application of BFR. In addition, the application of BFR led to an exaggerated cardiovascular response compared to NO LOAD exercise alone. There were no differences in acute muscle swelling between NO LOAD exercise with and without BFR. These results suggest that the application of BFR to NO LOAD exercise may lead to a greater level of muscle fatigue when performing four sets of twenty maximal repetitions. This is accompanied with an exaggerated cardiovascular response.

3361 Board #182 May 29 1:30 PM - 3:00 PM
The Acute Muscular Response To Passive Movement And Blood Flow Restriction

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 (No relevant relationships reported)

In immobilized patients, passive movement (PM) with blood flow restriction (BFR) reduces atrophy over PM alone; whether these effects are greater than BFR alone is uncertain. **PURPOSE:** To determine if acute muscular responses are unique when combining BFR and PM compared to PM alone or BFR alone. **METHODS:** 20 participants performed four conditions (randomized order): time control (TC), PM, BFR, and PM combined with BFR (PM+BFR) over two visits (one condition each leg, per visit). For PM, a dynamometer moved (45°/second) the leg through 3 sets of 15 knee extensions/flexions (90°). For BFR, a cuff was inflated to 80% arterial occlusion pressure on the proximal portion of the leg. Muscle thickness (MT) was measured at 60% and 70% of the anterior upper leg before, immediately after, five minutes after, and ten minutes after each condition. Oxygenated, deoxygenated (HHb), and total (tHb) hemoglobin of the vastus lateralis were monitored throughout conditions via near-infrared spectroscopy. Ratings of perceived effort (RPE-E) and discomfort (RPE-D) were reported before conditions and after each set. Data [presented as mean (SD)] were analyzed using Bayesian RMANOVA. **RESULTS:** 60% MT [Δ before to immediately after: TC = 0.04 (0.09), PM = -0.01 (0.15), BFR = -0.00 (0.11), PM+BFR = 0.01 (0.22) cm] and 70% MT [Δ before to immediately after: TC = 0.01 (0.09), PM = -0.01 (0.15), BFR = 0.02 (0.11), PM+BFR = -0.03 (0.22) cm] did not change ($BF_{10} = 0.014$ and 0.015 , respectively). HHb and tHb changes were generally greater with BFR and PM+BFR [i.e. channel 2 HHb: Δ start set 1 to end set 3: TC = 1.07 (1.21), PM = -1.23 (1.86), BFR = 9.58 (2.81), PM+BFR = 10.11 (3.16) μ m]. RPE-E increased with time and condition ($BF_{10} = 2.882e+8$), [Δ before to end set 3: TC = 0.0 (0.2), PM = 0.7 (1.0), BFR = 0.9 (2.1), PM+BFR = 1.3 (1.7)]. RPE-D changes were greater for BFR and PM+BFR ($BF_{10} = 1.877e+13$), [Δ before to end set 3: TC = 0.0 (0.2), PM = 0.4 (1.1), BFR = 3.2 (1.8), PM+BFR = 2.6 (1.5)]. **CONCLUSION:** PM and/or BFR alone are not sufficient to acutely increase MT (generally associated with a hypertrophic stimulus) in healthy people. Changes in tissue oxygenation seem to be driven by BFR rather than a unique effect of combining PM with BFR. The extent of this effect and what it would mean for adaptation in either healthy or bed-ridden patients warrants further investigation.

3362 Board #183 May 29 1:30 PM - 3:00 PM
Muscle Swelling Following Low Load Blood Flow Restriction Exercise Does Not Differ Between Cuff Widths In The Lower Body

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Acute muscle swelling is a purported mechanism for muscle hypertrophy following blood flow restriction (BFR) training. Currently there are numerous cuff widths used within the lower body BFR literature. However, studies suggest that growth may be attenuated with a wider cuff. Whether this is related to a differential acute swelling response has not been previously shown. **PURPOSE:** To examine the acute changes in muscle swelling following low load BFR exercise in the lower body, in response to different cuff widths inflated to the same relative pressure. **METHODS:** Ninety-six (43

men, 53 women) participants completed two conditions (one each leg). Participants completed four sets of unilateral knee extension exercise to failure using 30% of their one repetition maximum (1RM) with BFR applied with either a narrow (5 cm) or a wide (12 cm) cuff inflated to 40% of their arterial occlusion pressure. Muscle thickness and echo intensity were measured at two sites (proximal and distal) before and after each exercise bout as surrogate markers of swelling. A repeated measures analysis with a between subject factor of sex was used to assess changes. Bayes Factors (BF_{10}) were used to quantify evidence. **RESULTS:** The difference in acute changes in muscle thickness (BF_{10} : 0.43) and echo intensity (BF_{10} : 0.87) between cuff widths was not different between the proximal (i.e. wide cuff covered this site) and distal (no cuff was over this site) location. Further, changes in muscle thickness at the proximal [5cm: 0.58 cm vs. 12 cm: 0.57 cm; median difference (95% credible interval) of 0.009 (-0.04, 0.06) cm] and distal [5 cm: 0.63 cm vs. 12 cm: 0.63 cm; median difference (95% credible interval) of 0.00002 (-0.03, 0.04) cm] site did not differ based on cuff width or sex (Men: 0.58 cm vs. Women: 0.58 cm and Men: 0.64 cm vs. Women: 0.63 cm for proximal and distal sites, respectively). Echo intensity appeared to decrease at the proximal and distal sites with no differences between cuff widths. However, there was some evidence that this change at the distal site may be different between sexes [BF_{10} : 49.8; Men: -1.9 vs. Women: -4.2 AU]. **CONCLUSIONS:** Acute muscle swelling occurs in men and women, even when using a wider cuff. Thus, if there is to be attenuation in growth with a wider cuff, it is unlikely to be due to differences in acute swelling.

3363 Board #184 May 29 1:30 PM - 3:00 PM
Examination Of High-velocity Blood Flow Restricted Resistance Exercise Versus High-load Resistance Exercise

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Muscle strength gains following blood flow restricted (BFR) resistance training are consistently lower than those observed after HL training and this may be due to differences in neuromuscular activation. Integrating high-velocity muscle contractions and BFR resistance exercise may increase neuromuscular activation. **PURPOSE:** To compare torque and neuromuscular activation before and after sessions of HL knee extension exercise and high-velocity BFR knee extension exercise in young and older adults. **METHODS:** Ten young males and females (20.3 \pm 1.5 years, 1.73 \pm 0.06 m, 69.2 \pm 10.4 kg) and 10 older males and females (72.6 \pm 4.7 years, 1.70 \pm 12 m, 74.3 \pm 14.6 kg) performed randomized sessions of HL (80% 1-RM for 3 sets of 10 isotonic knee extension repetitions) and low-load, high-velocity BFR (30% 1-RM coupled with a vascular restriction for one set of 30 knee extension repetitions and 3 sets of 15 repetitions completed as quickly as possible). Knee extension isometric torque was assessed before and after each session of exercise and neuromuscular activation of the vastus lateralis (VL) was quantified with surface electromyography (EMG). **RESULTS:** The young participants had higher isometric torque than the older participants (213.4 \pm 54.8 vs 160.1 \pm 56.3 Nm; $P=0.01$). There was an average decrement in torque of 31.4 \pm 9.2% among all participants from baseline to post exercise ($P<0.01$). The magnitude of this decrement was similar between conditions ($P=0.19$), age ($P=0.12$), and the interaction of time, condition and age ($P=0.16$). EMG amplitude normalized to pre isometric torque in the first 5 knee extension repetitions of the HL condition averaged 106 \pm 57% and 90 \pm 33% in the BFR high-velocity condition. In the last 5 repetitions, EMG amplitude averaged 117 \pm 56% and 113 \pm 46 in the HL and BFR conditions respectively. This was a significant increase in EMG amplitude ($P<0.01$) but there were no interactions or main effects of condition or age ($P>0.05$). **CONCLUSION:** Combining high-velocity contractions with BFR resistance exercise results in decrements in torque and heightened neuromuscular activation similar to HL exercise in both young and older adults. Future studies should evaluate the training adaptations from high-velocity BFR resistance training. Supported by University of New Hampshire Grimes Family Fund.

F-59 Free Communication/Poster - Cellular and Molecular

Friday, May 29, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

3364 Board #185 May 29 1:30 PM - 3:00 PM

Proposal Of A New In Vitro Exercise Model For Cartilage Regeneration

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Tissue Engineering and Regenerative Medicine are promising interdisciplinary fields regarding tissue and/or organ repair and regeneration. Due to the extremely high incidence of osteoarthritis in such an aging population, it is critical to put all efforts in developing a successful implant for osteochondral tissue regeneration; although there has been a huge amount of work aiming to regenerate it, a tailored construct has not been achieved yet. **PURPOSE:** to develop a 3D in vitro model and bioreactor system to evaluate osteochondral regeneration, as well as cell-material interaction and material induced cell migration and differentiation, under physiological conditions in a bioreactor system with the ability of providing mechanical and electrical stimuli. **METHODS:** Multiphysics computer simulations were performed to explore which combination of stimuli facilitate cells adhesion, proliferation, viability and differentiation. A suite of new mathematical models were developed and validated, together with robust and efficient computational tools that allow simulation of chondral regeneration in vitro and in vivo. **RESULTS:** An automated integrated smart system for the assembly and in vitro culture process of the osteochondral constructs was designed. The platform integrate two distinct zones: the multi-material bioprinter and the custom-designed bioreactor. Due to different environmental conditions (temperature, humidity and PCO₂) that must be ensured in the fabrication and culture areas, a custom-made incubator with two separate areas and differential environmental control were developed. **CONCLUSION:** The integrated assembly system was validated by comparing the biological and mechanical properties of the produced constructs. Preliminary results have demonstrated both adequate mechanical and biological properties of the 3D constructs, using Poly(glycerol-sebacate) and graphene.

3365 Board #186 May 29 1:30 PM - 3:00 PM

Therapeutic Potential Of Different Pericyte Populations In The Recovery Of Skeletal Muscle Mass Following Disuse

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Significant loss in skeletal muscle mass and function can occur following periods of extended bed rest or immobilization. Physical therapy is recommended, but recovery may be incomplete in special populations due to injury and functional limitations. Our lab recently demonstrated the capacity for pericytes, or vascular stromal cells, to accelerate recovery of skeletal muscle following disuse in a mouse model. Different pericyte populations exist in skeletal muscle based on localization and unique cell surface markers, yet the most therapeutic population has not been identified. **PURPOSE:** To identify the pericyte population with the greatest therapeutic benefit when transplanted into muscle following a period of disuse. **METHODS:** Twenty-four 4-month old C57BL/6 mice were randomly divided into four groups (n=6/group). Mice hindlimbs were immobilized in full dorsiflexion via a surgical staple inserted through the center of the foot and body of the gastrocnemius for 2 weeks. At 2 weeks post immobilization, staples were removed and either pericytes (CD146⁺Lin⁻, CD146⁺NG2⁺Lin⁻, NG2⁺Lin⁻) or saline (control) were injected into the tibialis anterior (TA) muscle. TA muscles were excised for analysis after 2 weeks of remobilization and the extent of recovery was assessed. One-way ANOVA was used to compare the extent of improvement between treatment groups. **RESULTS:** There was no significant improvement in TA muscle weight or myofiber CSA with pericyte transplantation in the current study (p>0.05). However, a trend toward significant improvement in myofiber CSA was noted for fibers ranging 2000-3000 μm² in mice receiving CD146⁺NG2⁺Lin⁻ pericytes (p=0.072). Significant improvements in capillarization and collagen remodeling were detected in mice receiving CD146⁺NG2⁺Lin⁻ (p<0.05) and CD146⁺Lin⁻ (p<0.05) pericytes compared to controls. **CONCLUSION:** CD146⁺Lin⁻ pericyte transplantation effectively recovered capillary quantity and collagen remodeling following a period disuse compared to controls, whereas NG2⁺Lin⁻ pericytes did not demonstrate similar capacity for recovery. Supported by NIH Grant NIAMS R01 AR072735 to MDB.

3366 Board #187 May 29 1:30 PM - 3:00 PM

A Novel Umbilical Cord Derived Wharton's Jelly Formulation For Regenerative Medicine Applications

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Reported Relationships: **A. Gupta:** Salary; BioIntegrate LLC.
 Ownership/interest/stock; Right Mechanics Inc..

PURPOSE: Musculoskeletal injuries have traditionally been treated with activity-modification, physical therapy, pharmacological agents and surgical procedures. These modalities have limitations, as well as potential side-effects. Over the last decade, there has been an increased interest in the use of biologics for regenerative medicine applications (RMA), including umbilical cord (UC) derived Wharton's Jelly (WJ). Despite this increase, there is insufficient literature assessing the amount of growth factors, cytokines, hyaluronic acid (HA) and extracellular vesicles (EV) including exosomes in these products. The purpose of this study was to develop a novel WJ formulation and evaluate the presence of growth factors, cytokines, HA and EV including exosomes.

METHODS: WJ was isolated from human-UC obtained from consenting C-section donors and formulated into an injectable form. Randomly selected samples from different batches were analyzed for sterility testing and quantified for presence of growth factors, cytokines, HA and particles in EV size range.

RESULTS: The results showed all samples passed the sterility test. Growth factors including IGFBP 1, 2, 3, 4 and 6, TGF-α, PDGF-AA were detected. Expression of several immunomodulatory cytokines, RANTES, IL-6R, IL-16, were also detected. Expression of pro-inflammatory cytokines MCSFR, MIP-1a; anti-inflammatory cytokines TNF-RI, TNF-RII, IL-1RA; and homeostatic cytokines TIMP-1 and TIMP-2 were observed. Cytokines associated with wound-healing, ICAM-1, G-CSF, GDF-15, and regenerative properties, GH were also expressed. High concentrations of HA were observed. Particles in the EV size range (30-150nm) were detected and were enclosed by the membrane, indicative of true EV.

CONCLUSIONS: Our results confirmed the presence of numerous growth factors, cytokines, HA and EV in the WJ formulation. More studies are underway to confirm the presence of exosomes in detected EV using exosome-specific markers. We believe the presence of multiple factors within one WJ formulation may play a role in reducing inflammation, pain and augment healing of musculoskeletal injuries. This offers a potential expanded use for RMA.

3367 Board #188 May 29 1:30 PM - 3:00 PM

Overexpression Of PGC-1α In Human Primary Myotubes Increases Regulators Of Exosome Biogenesis And Secretion

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(No relevant relationships reported)

Skeletal muscle functions as an endocrine organ. Exosomes, small vesicles containing mRNAs, miRNAs, and proteins, are secreted from muscle cells and facilitate cell-to-cell communication. Our recent work found greater exosome release from oxidative compared to glycolytic muscle. Peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1α) is a key driver of mitochondrial biogenesis, a characteristic of oxidative muscle. It was hypothesized that PGC-1α regulates exosome biogenesis and secretion in skeletal muscle. **PURPOSE:** To determine if PGC-1α regulates skeletal muscle exosome biogenesis and secretion. **METHODS:** On day 4 of differentiation, primary myotubes from vastus lateralis biopsies from lean donors (BMI < 25.0 kg/m²) were exposed to adenovirus encoding human PGC-1α or GFP control. On day 6 of differentiation, culture media was replaced with exosome-free media. On day 8, cells were collected for mRNA and protein analysis. **RESULTS:** Overexpression of PGC-1α increases regulators of exosome biogenesis in the endosomal sorting complexes required for transport (ESCRT) pathway: Alix (GFP: 2.9 ± 1.0 vs. PGC-1α: 7.6 ± 1.4), TSG-101 (GFP: 1.8 ± 0.1 vs. PGC-1α: 7.3 ± 2.1), CD63 (GFP: 2.6 ± 0.3 vs. PGC-1α: 3.7 ± 0.4), Clathrin (GFP: 3.5 ± 0.1 vs. PGC-1α: 11.6 ± 2.5), and the secretion pathway: Rab27b (GFP: 2.6 ± 0.7; PGC-1α: 3.2 ± 0.3). **CONCLUSION:** Overexpression of PGC-1α increases gene expression of regulators of exosome biogenesis and secretion in human primary myotubes.

3368 Board #189 May 29 1:30 PM - 3:00 PM
Effects Of Obesity On Cardiotoxin Induced Damage And Regeneration Of Lean And Obese Human Myotubes

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Obesity increases the susceptibility of skeletal muscle to damage and impairs the regenerative response following muscle damage. Obesity is associated with an increase in ectopic lipid accumulation and inflammatory cell infiltration in skeletal muscle. It is unclear if the impairments in skeletal muscle regeneration and increased susceptibility to damage is due to these factors or if defects in integrity and repair are inherent to muscle of obese subjects. **PURPOSE:** To investigate if myotubes isolated from obese donors are (1) more susceptible to damage and (2) have a blunted regeneration response. **METHODS:** Differentiated myotubes from lean (LN) and obese (OB) donors were treated with 0.5 μ M of cardiotoxin (CTX) for 1 hr. Cells were allowed to recover in skeletal muscle growth media for 3 days and then differentiation media for 2 days. Cells were isolated immediately (ImPost), 3 and 5 days following CTX treatment. **RESULTS:** CTX significantly reduced the fusion index of differentiated cells, but there were no differences between LN and OB at ImPost (no-CTX: LN 28% vs. OB 28%; CTX: LN 15% vs. OB 12%), 3 Days (no-CTX: LN 38% vs. OB 38.0%; CTX: LN 30% vs. OB 29%), or 5 Days (no-CTX: LN 41% vs. OB 39%; CTX: LN 37% vs. OB 34%). CTX significantly reduced cell viability assessed via MTT but no differences were observed between LN and OB at ImPost (no-CTX: LN 0.20 au vs. OB 0.21 au; CTX LN 0.11 au vs. OB 0.14 au), 3 days (no-CTX: LN 0.37 au vs. OB 0.37 au; CTX LN 0.08 au vs. OB 0.12 au), or 5 days (no-CTX: LN 0.34 au vs. OB 0.34 au; CTX LN 0.19 au vs. OB 0.22 au). No differences were observed in the expression of key metabolic proteins PFK-1, Citrate Synthase, or β -Had following CTX administration in LN or OB. **CONCLUSION:** When cultured under identical conditions, myotubes isolated from young, healthy obese donors demonstrate similar damage following CTX treatment and similar regenerative responses compared to myotubes from lean donors.

3369 Board #190 May 29 1:30 PM - 3:00 PM
Single-cell RNA Sequencing Of Human Skeletal Muscle Reveals Novel Progenitor Populations

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INTRODUCTION: Skeletal muscle contains numerous stem and progenitor cell populations that reside within the interstitium between myofibres. These cells directly and indirectly support muscle repair; however, the identities and functions of these cells remain poorly characterized in human muscle. **PURPOSE:** To apply a novel genetic tool, single cell RNA sequencing (scRNAseq), to identify progenitor cell populations within uninjured human skeletal muscle. **METHODS:** Total mononuclear cells were isolated from the hamstrings of n=5 orthopedic surgery patients (2 males, 3 females, mean age ~23.4) and combined for droplet based scRNAseq using the 10x Chromium Controller. Bioinformatic analysis was conducted using R package Seurat V3.0, which computed principal components for projecting cells in two dimensions and employed unsupervised graph-based clustering using uniform manifold approximation and projection (UMAP). **RESULTS:** Following quality control, a total of 2736 cells were analyzed at a read depth of ~41,000 reads per cell with an average of 1255 genes detected per cell. Analysis of differentially expressed genes identified 8 distinct cell clusters which corresponded to the expected cell populations of satellite cells, endothelial/vascular related cells, mesenchymal/fibroblastic cells, T-cells, macrophages, as well as type I and type II muscle cells. Interestingly, the analysis also revealed two poorly characterized populations. The first expressed both mesenchymal and smooth muscle-related genes and displayed a similar transcriptional profile to "smooth muscle mesenchymal cells" (SMMCs) recently described in rodents. The second was typified by the expression of the transcription factor *Twist-2* suggesting they may be analogous to a newly defined muscle stem cell population responsible for the growth of type-II fibres. In addition to the primary clusters, analysis also identified numerous "sub-clusters" of cells providing insight into previously undescribed cellular heterogeneity, the function of which remains unknown. **CONCLUSION:** scRNAseq is an effective tool to define and transcriptionally characterize cell populations within human skeletal muscle. Ongoing analysis is examining the function of SMMCs and *Twist-2*-positive cells in response to exercise.

3370 Board #191 May 29 1:30 PM - 3:00 PM
Regulation Of Myokine Expression In Exosome-like Vesicles By Electric Pulse Stimulation Of C2C12 Myotubes

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Physical exercise (PE) is a well-known non-pharmacological intervention to overcome chronic low-graded inflammation-induced sarcopenia through humoral factors. However, it is not fully elucidated whether PE-induced maintenance of muscle homeostasis against inflammation is associated with muscle cell-derived myokines and extracellular vesicles. **PURPOSE:** To determine the effects of inflammation of muscle cell on the myokine expression in exosome-like vesicles (ELVs), and the effects of electric pulse stimulation (EPS), as an exercise mimetic on the myokine expression using C2C12 myotubes.

METHODS: Inflammation of C2C12 was induced by treatment of a cytokine mixture (CM, TNF- α +INF- γ), and insulin resistance was induced by palmitate (0.75 mM) for 24 hrs. ELVs were enriched from conditioned media by differential ultracentrifugation. EPS was set as 11.5V, 2m/s, 2Hz for 24 hrs. We considered $P < 0.05$ as significant, using GraphPad Prism ver 2.0 program.

RESULTS: Treatment of C2C12 by CM significantly inhibited the expression of myogenic regulators (myogenic transcription factors, myogenic myokine, and signaling proteins), while induced the expression of atrophic factors (atrogin-1, myostatin and signaling proteins). In addition, the inflamed C2C12 myotubes released anti-myogenic ELVs which contain abundant myostatin and scanty level of decorin, comparing with control ELVs. When we stimulated C2C12 myotubes by EPS system, levels of myogenic regulators (MyoD and myogenin), myogenic myokines (FDNCS, decorin, FGF21 and cathepsin B), and metabolic function of myotubes were significantly increased, however the levels of myostatin and atrogin-1 were down-regulated. Furthermore, EPS increased the mitochondrial activity and activated mitochondrial biogenesis pathways.

CONCLUSIONS: Inflammation, expression of anti-myogenic regulators and mitochondrial dysfunction are major contributors in metabolic diseases- or aging-induced sarcopenia. Therefore, our results suggested that activation of anti-myogenic activity in muscle cells by contraction (i.e., EPS in vitro and skeletal muscle contraction during PE in vivo) through myokine-containing ELVs may be a mechanism of beneficial effects of PE against sarcopenic factors.

3371 Board #192 May 29 1:30 PM - 3:00 PM
Effects Of Electrical Pulse Stimulation On Mitochondrial Dynamics In Myotubes From Lean And Severely Obese Humans

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Exercise/contractile activity improves skeletal muscle mitochondrial dynamics and insulin sensitivity. However, the adaptations in mitochondrial dynamics in response to exercise/contractile activity between lean and severely obese humans have not been directly compared. Electrical pulse stimulation (EPS) has been used in human skeletal muscle cells (HSkMCs) as an *in vitro* exercise model and can produce physiological adaptations similar to exercise/exercise training.

PURPOSE: The purpose of the study was to compare the effects of EPS on mitochondrial network structure and expression of regulatory proteins in mitochondrial dynamics processes in cultured myotubes derived from lean and severely obese humans.

METHODS: HSkMCs isolated from muscle biopsies from lean (n=8, BMI = 23.8 \pm 1.1 kg/m²) and severely obese humans (n=8, BMI = 45.5 \pm 1.5 kg/m²) were differentiated to mature myotubes and electrically stimulated for 24 hours by applying an electrical pulse at 11.5V, 1Hz and 2ms. Four-hours after EPS, mitochondrial network structure was determined in live cells via confocal microscopy and protein markers of mitochondrial dynamics were measured by immunoblotting.

RESULTS: Mitochondrial content was significantly lower in myotubes from severely obese humans when compared to the leans (Total MitoTracker Intensity: 376.0 \pm 36.1 vs. 224.8 \pm 15.1, $P < 0.05$) and EPS had no effect on mitochondrial content. Myotubes from severely obese humans also exhibited more fragmented mitochondrial networks when compared to the leans (Number of Non-Networked Individual Mitochondria: 2.6 \pm 0.4 vs. 1.9 \pm 0.2, $P < 0.05$). Interestingly, EPS improves mitochondrial network structure by enhancing mitochondrial network size in both groups (Mitochondrial Network Size: 7.2 \pm 0.3 vs. 8.7 \pm 0.6, $P < 0.05$). Consistently, mitochondrial fission

protein Drp1 ser⁶¹⁶ phosphorylation was significantly reduced following EPS in both groups (1.09 ± 0.07 vs. 0.95 ± 0.06 , $P < 0.05$). No differences of mitochondrial fusion proteins were found between any groups.

CONCLUSIONS: Our data reveal that EPS induces similar intrinsic adaptations in mitochondrial dynamics in cultured myotubes derived from lean and severely obese humans.

3372 Board #193 May 29 1:30 PM - 3:00 PM
Gene Expression Responses Of Skeletal Myotubes To Mechanical Loading In Vitro

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(No relevant relationships reported)

Skeletal muscle can adapt to mechanical loading by changing its mass and overall contractile phenotype via the activation of mechanotransduction and intracellular signaling mechanisms. In vitro mechanical loading of differentiated myoblasts (myotubes) has been utilized for mimicking the mechanical loading conditions of skeletal muscle in vivo. **PURPOSE:** This study investigated the effects of mechanical loading of myotubes on their gene expression responses associated with various aspects of cellular function, such as differentiation, hypertrophy and apoptosis. **METHODS:** C2C12 myoblasts were cultured on elastic membranes up to day 9 of their differentiation and then underwent a passive, cyclic stretching (15% elongation, at a frequency of 0.25 Hz, for 12 hours). Myotubes were harvested and lysed 12 hours after the completion of the stretching protocol. Real Time-PCR was utilized to measure changes in mRNA expression levels of myogenic regulatory factors (MRFs: MyoD, Myogenin, MRF4), as well as growth (IGF-1 isoforms: IGF-1Ea, IGF-1Eb), atrophy (Murfl, Atrogin, Myostatin), apoptotic (Foxo, Fuca, p53) and inflammatory factors (IL-6, IL-1b) in response to mechanical loading of the differentiated myoblasts. **RESULTS:** Mechanical loading of the myotubes resulted in increased expression of MyoD (1.5-fold; $p < 0.05$) and MRF4 (2.0-fold; $p < 0.05$) while Myogenin expression decreased by 0.4-fold ($p < 0.05$). Expression of muscle atrophy factors Atrogin (0.5-fold), Myostatin (0.4-fold), and Murfl (0.4-fold), and of the inflammatory factor IL-1b (0.5-fold) was significantly decreased ($p < 0.05$). No significant changes were revealed in the expression levels of IGF-1 isoforms (IGF-1Ea: 0.9-fold, IGF-1Eb: 1.1-fold) and apoptotic factors (Foxo: 0.8-fold, Fuca: 1.1-fold, p53: 1.0-fold), as well as of IL-6 (0.8-fold) in response to the selected stretching protocol of the differentiated myoblasts. **CONCLUSIONS:** These findings suggest that the specific mechanical loading protocol can further affect the myogenic differentiation program and protein synthesis of skeletal myotubes by influencing the expression of myogenic factors and downregulating muscle atrophy genes.

3373 Board #194 May 29 1:30 PM - 3:00 PM
Novel Method To Visualize AMPK Protein Localization In Single Human Muscle Fibers Via Confocal Microscopy

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(No relevant relationships reported)

Purpose: AMP-activated protein kinase (AMPK) is the energy regulator of skeletal muscle cells. Current methods can identify the magnitude of AMPK expression in skeletal muscle cells via Western blotting and Capillary Nano-Immunoassay (CNIA); however, these methods lack the ability to visually identify AMPK localization within single muscle fibers. Identifying AMPK in human muscle is important because it is involved in various exercise training adaptations such as mitochondrial biogenesis and glucose transport. Therefore, we aimed to develop a novel confocal microscopy method to identify AMPK protein expression (relative intensity) and localization within human single muscle fibers. **Methods:** A *vastus lateralis* muscle biopsy was obtained from a healthy male and immediately fixed (4% PFA). Twenty fibers were isolated, placed on microscope slides, incubated in 0.1% Triton (15min), then incubated in 5% normal goat serum (blocking solution; 4h). This was followed by exposure to a 1 antibody (Ab) (anti-AMPK α 2) in 5% bovine serum albumin (14h at 4°C). Fibers were then exposed to a 2 Ab (anti-rabbit IgG conjugated w/ AlexaFluor 488) and phalloidin (AlexaFluor 568) to label actin (2h). Finally, fibers were mounted under coverslips with AntiFade Gold w/DAPI for myonuclei detection. Confocal microscopy imaging was conducted using a Zeiss LSM 710 with 63x plan apochromatic objective (oil emersion). Images were processed via ImageJ. **Results:** Muscle fiber contractile proteins (actin: red), myonuclei (blue), and AMPK proteins (green) were successfully visually identified at rest (AMPK fluorescence intensity = 1199.64 ± 630 AU). To ensure that no auto-fluorescence or non-specific binding was observed, images were compared to control slides: 1) DAPI only, 2) 1 Ab only, 3)

2 Ab only, and 4) no staining. **Conclusion:** These methods allow for the successful visualization (relative intensity) and localization of AMPK proteins within single human muscle fibers. This method could be used in future research to investigate the response and myonuclear co-localization of AMPK following exercise in human skeletal muscle to elucidate how they may play a role in these physiological processes.

F-60 Free Communication/Poster - Exercise
Training Responses and Muscle Damage

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

3374 Board #195 May 29 1:30 PM - 3:00 PM
An Examination Of The Nonlocal Repeated Bout Effect Of The Elbow Flexor Muscles

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(No relevant relationships reported)

Unaccustomed eccentric exercises usually result in muscle damage. It has been well documented that the magnitude of muscle damage can be attenuated in the subsequent bouts of the similar exercise, which is known as the repeated bout effect (RBE). The potential nonlocal RBE (e.g., from the upper limb to lower limb or vice versa), however, has not been examined yet. **PURPOSE:** To examine whether performing an initial bout of eccentric damaging exercise (EDE) on the elbow flexor muscles could induce any RBE against the muscle damage from the subsequent identical EDE performed on the knee flexors. **METHODS:** Six healthy men (Age: 24 ± 4 yrs; Weight: 84.3 ± 15.2 kg; Height: 174.3 ± 9.2 cm) and nine women (Age: 21.1 ± 1 yrs; Weight: 65.5 ± 13.4 kg; Height: 162.8 ± 3.5 cm) participated in this study. The participants performed the baseline bout of knee flexion (KF) EDE on one randomly chosen thigh. After a washout period, the participants performed the elbow flexion (EF) EDE on a randomly chosen arm. Lastly, the second bout of EDE was performed on the contralateral leg one week after the EF EDE. All EDE protocols consisted of six sets of 10 eccentric contractions with the load equivalent to 150% of the concentric 1-repetition maximum of the leg curl or arm curl exercise. Range of motion (ROM) at the knee joint, muscle soreness, and the relative KF isometric strength were taken before, after, one day (1D), two days (2D), and seven days (7D) after the EDE protocols. Separate three-way (bout [baseline, second] \times group [dominant, non-dominant] \times time [Pre, Post, 1D, 2D, 7D]) repeated measures ANOVAs were used to examine the changes in dependent variables. **RESULTS:** The ROM did not show any 3-way or 2-way interactions, but a main effect for time ($p < 0.001$). There was a significant bout \times time interaction ($p = 0.042$) for the relative isometric strength, and the follow-up paired t-tests indicated a significant difference at the Post-testing time point (baseline bout vs. second bout: $80.5 \pm 10.4\%$ vs. $87.5 \pm 13.0\%$, $p = 0.046$). The muscle soreness only showed significant main effects for bout ($p = 0.034$) and time ($p < 0.001$), with the pairwise comparison showing significantly smaller value for the second bout when compared to that for the baseline bout. **CONCLUSIONS:** This preliminary study showed potential nonlocal RBE between the upper and lower body muscles.

3375 Board #196 May 29 1:30 PM - 3:00 PM
Hyperbaric Oxygen Therapy Promotes Muscle Recovery After Contusion Injury Via Angiogenesis By Reactive Nitrogen Species

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(No relevant relationships reported)

Background: Muscle contusion is a common sports injury, but delayed return to competition may negatively influence athlete's careers. Recently, hyperbaric oxygen (HBO) treatment promoted early recovery from muscle injury with reduction of soft tissue swelling. Increased reactive oxygen species (ROS) and reactive nitrogen oxide species (RNS) is a key mechanism of HBO, which supplies abundant oxygen due to increased dissolved oxygen at high pressure, and a high O₂ content in tissues. RNS generally stimulate vascular endothelial growth factor (VEGF) secretion from endothelial cells, which then induces angiogenesis. **Purpose:** To investigate whether HBO could promote angiogenesis with induction of ROS /RNS and induce muscle regeneration after contusion injury in rats. **Methods:** Muscle contusion was induced

by the mass-drop method on the right calf muscle of rats. After the injury, the rats were divided into non-treated (NT) and HBO-treated groups. The HBO protocol consisted of 100% oxygen inhalation at 2.5ATA for 120 minutes once a day for 5 consecutive days. We measured VEGF levels and histologically evaluated blood vessel formation and muscle regeneration in the contused muscles. In a functional analysis, we measured the tensile strength of the calf muscles at the final observation point. We also evaluated the effects of a ROS/RNS inhibitor (NAC) or RNS specific inhibitor (L-NAME) in the HBO group. **Results:** HBO significantly increased VEGF levels at 3 hours (NT group: 311.2 ± 58.2 pg/ml, HBO group: 827.5 ± 83.8 pg/ml) and promoted blood vessel formation at 3-7 days after contusion (3 days: NT group: 0.04 ± 0.02 /HPF, HBO group: 0.4 ± 0.1 /HPF, 5 days: NT group: 0.82 ± 0.2 /HPF, HBO group: 2.14 ± 0.7 /HPF, 7 days: NT group: 2.8 ± 0.8 /HPF, HBO group: 5.9 ± 0.9 /HPF). Administration of both NAC and L-NAME before HBO suppressed angiogenesis (7 days: NAC + HBO group: 3.4 ± 0.8 /HPF, L-NAME + HBO group: 2.9 ± 0.6 /HPF) and muscle regeneration (NT group: 20.22 ± 2.2 /HPF, HBO group: 34.6 ± 3.2 /HPF, NAC + HBO group: 20.0 ± 2.4 /HPF, LNAME + HBO group: 19.4 ± 1.5 /HPF) even after HBO. RNS inhibition is more important for the effects of HBO. **Conclusions:** HBO increased angiogenesis mainly through generation of RNS in the early phase and promoted muscle regeneration after muscle contusion injury.

3376 Board #197 May 29 1:30 PM - 3:00 PM
Changes In Paraspinal Muscle T2 Times And Creatine Kinase After A Bout Of Eccentric Exercise

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(No relevant relationships reported)

Eccentric (ECC) exercises might cause muscle damage, characterized by delayed-onset muscle soreness, elevated creatine kinase (CK) levels and local muscle oedema, shown by elevated T2 times in magnet resonance imaging (MRI) scans. Previous research suggests a high inter-individual difference regarding these systemic and local responses to eccentric workload. **PURPOSE:** To analyze ECC exercise-induced muscle damage in lumbar paraspinal muscles assessed via MRI.

METHODS: Ten participants (3f/7m; 33±6y; 174±8cm; 71±12kg) were included in the study. Quantitative paraspinal muscle constitution of M. erector spinae and M. multifidus were assessed in supine position before and 72h after an intense eccentric trunk exercise bout in a mobile 1.5 tesla MRI device. MRI scans were recorded on spinal level L3 (T2-weighted TSE echo sequences, 11 slices, 2mm slice thickness, 3mm gap, echo times: 20, 40, 60, 80, 100ms, TR time: 2500ms). Muscle T2 times were calculated for manually traced regions of interest of the respective muscles with an imaging software. The exercise protocol was performed in an isokinetic device and consisted of 120sec alternating ECC trunk flexion-extension with maximal effort. Venous blood samples were taken before and 72h after the ECC exercise. Descriptive statistics (mean±SD) and t-testing for pre-post ECC exercises were performed.

RESULTS: T2 times increased from pre- to post-ECC MRI measurements from 55±3ms to 79±28ms in M. erector spinae and from 62±5ms to 78±24ms in M. multifidus ($p < 0.001$). CK increased from 126±97 U/L to 1447±20579 U/L. High SDs of T2 time and CK in post-ECC measures could be due to inter-individual reactions to ECC exercises. 3 participants showed high local and systemic reactions (HR) with T2 time increases of 120±24% (M. erector spinae) and 73±50% (M. multifidus). In comparison, the remaining 7 participants showed increases of 11±12% (M. erector spinae) and 7±9% (M. multifidus) in T2 time. Mean CK increased 9.5-fold in the 3 HR subjects compared with the remaining 7 subjects.

CONCLUSIONS: The 120sec maximal ECC trunk flexion-extension protocol induced high amounts of muscle damage in 3 participants. Moderate to low responses were found in the remaining 7 subjects, assuming that inter-individual predictors play a role regarding physiological responses to ECC workload.

3377 Board #198 May 29 1:30 PM - 3:00 PM
Relationship Of Baseball Pitching Volume To Performance, Biometrics, And Reactive Hyperemia: A Pilot Study

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(No relevant relationships reported)

We recently demonstrated body fat %, fast ball velocity, and RPE were significant predictors of valgus torque in NCAA baseball pitchers. Even though changes in hyperemic-induced limb volume are associated with acute, repetitive pitching

performance, possibly indicating approaching dominant elbow soft-tissue risk, no investigation, to our knowledge, has examined relationships between performance, biometric, and throwing-limb volume in collegiate pitchers.

PURPOSE: To quantify the relationship between pitching performance, subject biometrics, and hyperemic-induced changes in collegiate baseball pitchers during game-simulated pitching sessions of 40, 80, or 120 pitches.

METHODS: Following informed consent, 5 male subjects (\bar{x} age = 18.8 ± 0.8 years; \bar{x} BMI = 27.6 ± 1.8 ; \bar{x} body fat % = 22.9 ± 6.2 ; \bar{x} throwing velocity = 80.4 ± 1.8 mph) were block-assigned to groups of 40, 80, or 120 pitches. Bouts consisted of 10 pitches (~20s between pitches) delivered from an artificial mound with 1-2 mins rest between bouts. HR and RPE were recorded immediately following each 10-pitch bout. A MOTUS sensor and compression sleeve measured elbow valgus torque. A Stalker Sport II Radar Gun measured fastball velocity. Pre-test and post-test upper- and lower-extremity limb girths were measured, signifying reactive hyperemia. Wilcoxon non-parametric testing determined pre- to post-test differences. Pearson correlation identified relationships between variables. Alpha was set at $p \leq 0.05$.

RESULTS: No group differences were found on any performance, biometric, demographic, or hemodynamic variable. HR (72.6 ± 8.3 bpm vs. 97.6 ± 10.0 bpm, $p = 0.02$) and dominant forearm limb girth (29.4 ± 1.5 cm vs. 30.9 ± 1.5 cm, $p = 0.04$) increased from pre-test to post-test for subjects combined. Significant correlations were found for: pitching volume & post-test HR ($r = 0.90$, $p = 0.039$); post-test dominant upper arm circumference & RPE ($r = 0.89$, $p = 0.042$), and; valgus torque % change & pitching volume ($r = 0.91$, $p = 0.031$).

CONCLUSIONS: Forearm limb girth increased for subjects combined, and; given this metric's indication of reactive hyperemia, future research focused on elucidating and quantifying the biological components of the tissue (compartments), as well as their contribution to performance- and/or injury-specific outcomes, is warranted.

3378 Board #199 May 29 1:30 PM - 3:00 PM
Comparison Of Flat, Uphill And Downhill High Intensity Interval Training On Performance And Skeletal Muscle

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(No relevant relationships reported)

Skeletal muscle and exercise performance adapt to high intensity interval training (HIIT). Downhill running is an eccentric-biased exercise modality whereas uphill running is concentric-biased and flat running has aspects of both. Therefore, variation in adaptation may differ with HIIT done on flat (F) or uphill (UH) or downhill (DH) gradients. **PURPOSE:** To compare the training effect of three modes of HIIT on laboratory and outdoor performance and muscle cross-sectional area (CSA) and satellite cell number per fiber (SC). **METHODS:** 17 fit, but not elite, young adult male runners volunteered for HIIT: 6 sets of 3 minutes and 1-minute rest between, for 10 sessions over 4 weeks. Gradients were flat, +5% or -10% and running speeds 85%, 80% or 90% of peak treadmill speed (PTS) respectively. Performance tests included PTS (0% gradient), maximum isometric quadriceps force (Iso) and 5 km road time trial (TT). Muscle biopsies were taken at baseline and 6 hours after the 10th session. Data analyzed using mixed models ANOVA, presented as mean ± SD. **RESULTS:** HIIT improved PTS (km/h) in F (pre: 17.7 ± 1.3 , post: 18.9 ± 1.5 ; $P < 0.05$) and UH (pre: 17.6 ± 0.8 , post: 18.7 ± 0.8 $P < 0.01$), but not DH (pre: 17.8 ± 1.3 , post: 18.0 ± 1.3), whereas only DH significantly increased Iso strength (25% $P < 0.05$ compared to F: -1% and UH: -4.4%). Similarly, only DH increased muscle fiber cross-sectional area (CSA) (31% $P < 0.05$ compared to F: -5% and UH: 10%). DH increased muscle SC number/fiber highly significantly (pre: 0.097 ± 0.01 post: 0.297 ± 0.04 $P < 0.0001$). Interestingly, UH HIIT group did not change SC content (pre: 0.102 ± 0.018 , post: 0.106 ± 0.02), but flat HIIT increased significantly (pre: 0.115 ± 0.01 , post: 0.148 ± 0.01 $P < 0.01$), although not nearly as much as DH HIIT (F: 30%, DH: 208%). 5 km TT improved in all groups (F: 3%; UH: 3.5% and DH: 3.5%; all $P < 0.05$). **CONCLUSION:** Muscle adapted differently in response to the different gradients of HIIT. Neither SC number/fiber nor CSA changed with UH HIIT. CSA also did not change with F HIIT, although SC number/fiber increased. DH HIIT increased both CSA and SC number/fiber to a greater extent. Although laboratory performance test changes differed between groups, all 3 groups improved outdoor TT performance. Therefore, different training specific adaptations in skeletal muscle conferred similar race performance improvements.

3379 Board #200 May 29 1:30 PM - 3:00 PM
Effects Of Repeated Bout Of Eccentric Exercise On Muscle Stiffness In Elbow Flexors

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(No relevant relationships reported)

Up to now, maximal voluntary isometric contraction (MVIC), range of motion (ROM), and serum creatine kinase (CK) have been used for studying exercise-induced muscle

damage (EIMD) with single- and repeated bout effect following eccentric contraction (EC). However, it is unknown whether muscle stiffness reflecting the mechanical properties would be a competent parameter for detecting EIMD following EC in elbow flexors. **PURPOSE:** This study was conducted to examine changes of EIMD indices through repeated bout EC and to investigate the correlation between EIMD markers and mechanical properties in elbow flexors. **METHODS:** Thirteen healthy males performed 6 x 5 sets of maximal EC at 90°/sec angular velocity on non-dominant elbow flexors using isokinetic dynamometer. Three weeks washout period were given between the first- (ECC1) and second eccentric exercise session (ECC2). To evaluate EIMD symptoms, MVIC, ROM, muscle swelling, soreness, and serum CK activity were measured. Echo intensity (EI) on *brachialis* and *biceps brachii* m. was obtained using ImageJ software. Moreover, muscle fatigue as measured by electromyography and mechanical properties as measured by myotonometer were assessed for each session. All parameters were obtained at post-exercise 24, 48, 72, and 96 hours, including before and immediately after EC. **RESULTS:** There were significant differences from those of baseline in MVIC, ROM, muscle swelling, soreness, fatigue, and stiffness at each session. Moreover, muscle swelling and stiffness in *biceps brachii* m. had statistical differences between sessions. Although CK and EI had no significant differences in ECC2, there were significant differences from those of baseline in ECC1. Also, there were statistical differences between sessions in CK and EI. Additionally, stiffness in *biceps brachii* m., but not *brachialis* and ROM had significantly negative correlations in each session at 48 and 72 hours, respectively. **CONCLUSIONS:** Taken together, these data revealed that muscle stiffness, except for CK and EI, in elbow flexors were not shown adaptation after repeated bout EC. As shown by the relationship between the stiffness and ROM, the stiffness as a mechanical property can be used as an indicator of muscle damage. Supported by the National Research Foundation of Korea Grant (NRF-2017R1C1B1006196).

3380 Board #201 May 29 1:30 PM - 3:00 PM
Abstract Withdrawn

3381 Board #202 May 29 1:30 PM - 3:00 PM
Effect Of Low Intensity Eccentric Exercise Training On Maximal Eccentric Exercise induced Muscle Damage
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(No relevant relationships reported)

PURPOSE: The aim of this study was to investigate the effects of low-intensity eccentric exercise performed before maximal eccentric exercise which causes muscle damage and oxidative stress on muscle injury markers and oxidative stress. **METHODS:** The study was carried out with 22 male Wistar albino rats obtained from Experimental Animal Research and Application Center of Selcuk University. Rats were randomly divided into 3 groups. Rats in the control group (K, n: 6) were not given any exercise protocol. The maximal eccentric exercise protocol was applied to the rats in the maximal eccentric exercise group (M, n: 8) only one at rate of 20 m / min, at -15° inclination for 90 min. Low intensity eccentric exercise protocol, which does not cause muscle damage was applied to the rats in the low intensity eccentric exercise + maximal eccentric exercise group (DY+M, n: 8) at 10 m / min, at -15° inclination, 30 min / day for one week and maximal eccentric exercise protocol was applied 24 hours after this exercise. Blood and muscle tissue samples were taken 24 hours after the last exercise session and creatine kinase (CK), lactate dehydrogenase (LDH) and superoxide dismutase (SOD1) activities and myoglobin (Mg), malondialdehyde (MDA) and glutathione (GSH) levels were measured. **RESULTS:** Serum Mg level was higher in the M group compared to the DY+M and the K groups. Serum CK and LDH activities were higher in the DY+M and the M groups compared to the K group. MDA level was higher in M group compared to K and DY+M groups in vastus intermedius muscle, in M group compared to the K group in gastrocnemius muscle and in the DY+M and the M groups compared to the K group in plasma. GSH level in the vastus intermedius muscle and plasma was higher in the DY+M group compared to the M group. GSH level in gastrocnemius muscle was not different between groups. SOD1 activity was higher in the DY+M group compared to the K group in the vastus intermedius muscle, in the DY+M group compared to the K and the M groups in the gastrocnemius muscle. SOD1 activity in plasma was not different between groups. **CONCLUSIONS:** Low intensity eccentric exercise training applied before the maximal eccentric exercise has a partial protective effect against muscle damage, especially in the vastus intermedius muscle prevents the formation of oxidative stress and strengthens the antioxidant defense.

3382 Board #203 May 29 1:30 PM - 3:00 PM
The Effects Of A 50k Ultramarathon On Plasma IL-6 And Rectus Femoris Muscle Thickness
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PURPOSE: to assess plasma IL-6 concentrations and muscle thickness (MT) using ultrasound imaging throughout and after a 50-kilometer race and to determine the relationship between changes in IL-6 and changes in MT. **METHODS:** Men and women (n=11) age 39 ± 7 years participated in a 50k trail race consisting of five 10k laps. Ultrasound imaging was performed on the rectus femoris at rest (passive) and during isometric contraction before the race, within 60 minutes of completing the race, and 24-hrs post-race. To maintain consistent ultrasound probe placement, the probe was outlined at baseline testing. Images were analyzed using ImageJ, and the % change in MT from passive to isometric contraction was calculated. Blood was drawn 30 minutes following consumption of a pre-race meal, 10k into the race, within 60 minutes of completion of the race and 24 hrs post-race. Plasma IL-6 was assessed using an enzyme-linked immunosorbent assay (ELISA). **RESULTS:** Change in MT from passive to isometric contraction increased from a pre-race value of 9.1 ± 2.7% to 14.1 ± 2.6% post-race although this did not reach statistical significance (P=0.256). Compared to pre-race values, change in MT increased significantly 24 hrs post-race (9.1 ± 2.7% vs. 17.8 ± 1.7%; P=0.021). IL-6 concentrations increased from pre-race levels of 0.37 ± 0.25 pg/mL to 3.1 ± 0.86 pg/ml at 10k (P=0.008) and to 29 ± 3.3 pg/mL post-race (P<0.001). Twenty-four-hour follow-up testing revealed a return of IL-6 levels to pre-race values (0.59 ± 0.3 pg/mL; P=0.488). The mean change (post-pre) in IL-6 inversely correlated with the mean change in MT (r= -0.685, P=0.02). **CONCLUSIONS:** Ultramarathon running leads to an acute but substantial increase in plasma IL-6 which precedes changes in MT. The relationship between changes in IL-6 and MT pre- and post-race indicates a potential role for IL-6 in the delayed exercise-induced inflammatory response with prolonged running. Supported by Towson University Summer Undergraduate Research Institute, University of Maryland College Park, and the Baltimore Veterans Affairs Medical Center

3383 Board #204 May 29 1:30 PM - 3:00 PM
The Efficacy Of Protein Supplementation On Attenuating Muscle Atrophy Following Disuse
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PURPOSE
The purpose of this study was to determine the effects of protein supplementation during muscular disuse in maintaining muscle cross-sectional area, lean mass, strength, and jump force in the collegiate population.

METHODS
Two groups of healthy collegiate participants (n=14) underwent two weeks of unilateral lower limb suspension (ULLS), during which the control group consumed a normal diet (CON) and the treatment group (PRO) received an additional 75g/day of supplemental protein. Outcome measures included lean mass (LM) measured using DXA, muscle area (MA) of the lower leg using pQCT, isokinetic torque measurements using a Biodex ergometer, and force production during jumping using a portable force platform. Differences in the change of these outcome measurements from baseline to follow-up were compared between the treatment and control groups (group * time interaction, controlling for baseline measurement).

RESULTS
Daily protein intake for the treatment group (2.6±1.0 g/kg/d) was greater than the control group (1.5±1.1 g/kg/d). Daily caloric intake was not different between groups (3015±1098 kcal/day; Treatment 2772±432 kcal/day). MA decreased in both groups following ULLS with no differences between groups measured. However, there was a moderate difference in change between groups with the PRO maintaining their total LM (group*time interaction, p=0.08) and leg LM (group*time interaction, p=0.1) when compared to the CON.

CONCLUSION
This study demonstrates a universal loss in lower leg muscle area muscle during a relatively short period of disuse. Additionally, there was evidence of a trend toward a positive effect of protein supplementation on lean mass maintenance during disuse. The results of this study serve as an important first step of identifying nutritional interventions to augment rehabilitation.

3384 Board #205 May 29 1:30 PM - 3:00 PM
ACUTE ANDROGEN AND GLUCOCORTICOID RECEPTOR RESPONSE FOLLOWING A MODERATE INTENSITY RESISTANCE EXERCISE BOUT
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 (No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the acute androgen receptor (AR) and glucocorticoid receptor (GR) response to a moderate intensity resistance exercise bout in resistance trained (RT) and untrained men (UT).
METHODS: RT men (n = 10; X ± SD, age = 21.3 ± 1.7 yrs, height = 175.8 ± 6.8 cm, body mass = 84.5 ± 13.5 kg, back squat 1RM = 154.3 ± 19.3 kg, training history = 5.4 ± 2.0 yrs) and UT men (n = 9; X ± SD, age = 20.8 ± 3.1 yrs, height = 178.7 ± 8.9 cm, body mass = 81.0 ± 14.0 kg, squat 1RM = 108.1 ± 13.7 kg, training history = 0.7 ± 1.7 yrs) volunteered for this study. Prior to the RE bout, subjects were strength tested for back squat (BS) and leg extension (LE). Subjects returned 4-7 days later between 10am-2pm, and completed a RE bout consisting of 6 sets of 10 repetitions of BS at 75% 1RM, immediately followed by 4 sets of 10 repetitions of LE at 75% 1RM with 1.5 min rest between all sets. Muscle samples were collected from the *vastus lateralis* prior to exercise (PRE) and 10 min (10P), 30 min (30P), 60 min (60P), and 180 min (180P) post exercise. Total AR and GR expression was determined via western blotting. Receptor data were not normally distributed, thus all receptor data were analyzed using Mann-Whitney U test, Friedman test, and Wilcoxon signed-rank test.
RESULTS: For total AR expression, there were no differences between time points within the RT group (p > .05); however, there were differences between time points within the UT group (p = .016). In the UT group, total AR expression significantly decreased at 30P (-19%Δ, z = -2.192, p = .027) and 60P (-11%Δ, z = -2.192, p = .027) post exercise, but returned to baseline values by 180P (z = -.178, p > .05). For Total GR content, there were no differences between time points within the RT or UT groups (p > .05). Total GR content was significantly greater in the RT group compared to the UT group at 10P (Mann-Whitney U = 19, z = -2.123, p = .035).
CONCLUSIONS: While no changes were observed for AR expression in the RT group, the UT subjects experienced a significant decrease in AR expression at 30P and 60P suggesting acute AR responses vary depending on training status. No differences were seen across time for the GR in either group; however, RT and UT subjects were different from each other at 10P. It is unclear if these responses are related to the acute hormonal response; therefore, future research will address this.

3385 Board #206 May 29 1:30 PM - 3:00 PM
Abstract Withdrawn

3386 Board #207 May 29 1:30 PM - 3:00 PM
Fiber Type Profile and Its Relation To Wilks Coefficient In Both Male And Female Powerlifters
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PURPOSE: Strikingly little data exist on powerlifter fiber type distributions, and none elucidate differences between genders in powerlifting. Past research established powerlifters have relatively higher fast-twitch fiber proportions versus sedentary and aerobic demographics, but it is unknown if fast-twitch content is predictive of performance. Furthermore, the Wilks Coefficient is a common means to normalize powerlifting performance relative to bodyweight in competition. Therefore, the purpose of this study was to 1) compare the myosin heavy chain fiber (MHC) fiber type profiles between powerlifters and sedentary controls of men and women, and 2) determine if fast-twitch fiber content predicts powerlifter Wilks coefficient.
METHODS: Twelve actively competing powerlifters (PL; n = 6M/6F) and ten sedentary controls (CON; n = 5M/5F) were recruited for this cross-sectional analysis. Subjects underwent a percutaneous muscle biopsy from the *vastus lateralis* using fine needle aspiration. Samples were analyzed MHC isoform content via mixed homogenate SDS-PAGE. MHC isoforms (MHC I, IIa, and IIx) were analyzed via multiple 2x2 (group x gender) analysis of variance (ANOVA) at a significance level of p<0.05. MHC IIa content was compared to Wilks coefficient using a Pearson correlation coefficient at p<0.05.

RESULTS: There were significant group differences for all MHC isoforms, where PL had a higher proportion of MHC I (p<.001) and IIa (p = .010) content relative to CON. Conversely, PL a significantly lower proportion of MHC IIx content versus CON (p<.001). There was a significant gender effect for MHC IIa fibers, where females had a higher proportion versus males (p=.021). Lastly, Pearson correlation analysis revealed a non-significant, low correlation between MHC IIa content and Wilks coefficient (r = -.288; p=.364).
CONCLUSIONS: These results illustrate that powerlifting-style training may result in higher proportions of MHC I and IIa fibers, as well as losses in MHC IIx content. Contrary to previous literature, our data also show a higher proportion of fast-twitch MHC IIa fibers in females versus males. Overall, MHC IIa content is not a significant predictor of powerlifting performance as per Wilks coefficient, suggesting other biochemical markers and/or neural efficiency underline variations in skill.

F-61 Free Communication/Poster - Skeletal Muscle Fatigue
 Friday, May 29, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

3387 Board #208 May 29 1:30 PM - 3:00 PM
Do Decreases In Voluntary Activation Account For Fatigability Differently In Males And Females?
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Muscular fatigue has been reported to have varying effects depending on sex. Both males and females incur deficits in strength resulting from strenuous activity but males suffer greater relative deficits. Similarly, in a fatigued state, males may be relatively less able to activate muscles. **PURPOSE:** We sought to determine whether the decrease in strength that males and females suffer is related to changes in their voluntary activation (%VA). **METHODS:** Twenty-two untrained, college-aged, males (11) and females (11) participated. Subject's dominant lower leg was strapped to an attachment set at an angle of 110° (180° = full extension) for isometric knee extensions. At pretesting, subjects performed maximal voluntary contractions (MVC) and the interpolated twitch technique was applied to assess %VA. Following initial testing, a fatiguing protocol was performed which consisted of 20 six-second MVCs with 3 seconds in between. In the fatigued state, subjects again performed an MVC and %VA was assessed. Linear regression was performed to determine if the variance in fatigability, as measured by change in MVC, can be accounted for by changes in %VA for each sex. **RESULTS:** Regression showed that 15.3% and 1.1% of the variance in force loss could be explained by changes in %VA in males and females, respectively. However, neither of these models were significant (p = 0.233 and p = 0.760). The results are shown in the figure below for both males (circles) and females (triangles). A 2-way mixed-factorial ANOVA showed neither a group × time interaction (p = 0.296), nor a main effect for time (p = 0.288) for %VA. **CONCLUSIONS:** The findings suggest that voluntary activation was not responsible for the force loss with fatigue in either males or females. For the females, this could be partially due to the fact that many of them had minimal changes in MVC from the fatigue protocol, whereas all of the males showed at least a 10% deficit. However, there were no differences in %VA between males and females.

3388 Board #209 May 29 1:30 PM - 3:00 PM
The Characters And Mechanisms Of Bioelectricity And NIRS In Low Intensity Sustained Muscle Fatigue Contraction
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The central and peripheral fatigues induced by sustained muscle contraction remain debatable. The neuromuscular and muscle oxygenation (SmO2) and perfusion ([tHb]) have obvious changes in active and antagonistic muscles when enduring low intensity sustained muscle fatigue contraction.
PURPOSE: Characteristics and mechanisms of surface electromyography (sEMG), SmO2 and [tHb] in active and antagonistic muscles induced by elbow flexor fatigue.
METHODS: Twelve healthy male participants (25.3±4.8 years old) performed isometric elbow flexion at 20% of their maximum voluntary contraction (MVC) force for fatigue. The EMG signals were recorded from the biceps brachii (BB) and triceps brachii (TB) muscles using linear electrode arrays composed of sixteen electrodes (10mm inter-electrode distance). The monopolar EMG signals were amplified

(Sessantaquattro, OT Bioelettronica) and sampled at 2000Hz. Muscle fiber conduction velocity (MFCV), mean power frequency (MPF) and median frequency (MF) were calculated by OT BioLab software. SmO₂ and [tHb] of BB and TB muscles were recorded with a MOXY near-infrared spectroscopy (NIRS) device (MOXY-5, Fortiori Design LLC).

RESULTS: Compared to the initial stage, the fatigue stage of BB muscle had a significantly decrease in MFCV (4.50±0.28 m/s VS 3.96±0.21 m/s, p<0.05), MPF (68.90±7.44 Hz VS 55.80±8.97 Hz p<0.05) and MF (64.60±5.88 Hz VS 48.93±5.27 Hz, p<0.05). SmO₂ of BB muscle reduced to the minimum at nearly half stage (ΔSmO₂: 65±9%), but the [tHb] increased (Δ[tHb]: 0.48±0.13 g/dl). Fatigue stage of TB muscle had a decline in MPF (68.90±7.44 Hz VS 63.32±3.81 Hz p<0.05), MF (62.71±6.12 Hz VS 53.03±5.69 Hz, p<0.05). And SmO₂ and [tHb] of TB muscle had a slightly increase (ΔSmO₂: 10±2%, Δ[tHb]: 0.29±0.08 g/dl).

CONCLUSIONS: In low intensity sustained muscle fatigue contraction, myoelectric central and peripheral fatigues induced active muscle fatigue. Meanwhile, antagonistic muscle has much oxygen and perfusion and central nerve may lead to fatigue.

3389 Board #210 May 29 1:30 PM - 3:00 PM
Neuromuscular Electrical Stimulation At Long Pulse Duration Is Associated With Higher Muscle Oxygen Utilization

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Conventionally Neuromuscular Electrical Stimulation (NMES), delivered on the muscle belly at low frequency and short pulse duration, is used in rehabilitation protocols to prevent muscle atrophy. However, conventional NMES causes rapid on-set of fatigue and possibly activates muscle fibers in a synchronous, spatially fixed order (i.e. reverse of the size principle). To overcome these limitations, in the past years, a novel approach that utilizes both high frequency (100Hz) and long pulse duration (1000μs) (Wide Pulse High Frequency Stimulation, WPHF) was proposed. During WPHF NMES muscle contraction is achieved via afferent nerve fibers, allowing the reflexive discharge of motor units, with the contribution of spinal circuitries, and mimic the recruitment order of a voluntary effort (i.e. first type I fibers).

PURPOSE: Evaluating muscle oxygen consumption via Near-Infrared Spectroscopy (NIRS) technique during two NMES bouts at fixed frequency (100Hz), applying Short (200μs) and Long (1000μs) Pulse duration, while concurrently matching the external force output. **METHODS:** Two 5 minutes intermittent (1 sec on - 3 sec off) NMES bouts at Short and Long pulse duration were delivered on the right quadricep muscle of 14 healthy subjects while sitting on an isometric chair. NIRS recorded oxygen extraction (i.e. Deoxygenated Hemoglobin - Myoglobin) from the vastus lateralis of the stimulated limb. Equal muscle force between protocols was achieved by carefully selecting the individual stimulation intensity. **RESULTS:** We selected 10 consecutive contractions for Short and Long Pulse NMES in order to have equal muscle output and evaluate the corresponding oxygen consumption. In the selected contractions, Peak Force was 15.3 ± 5.7 and 15.4 ± 5.6 % (p: ns) of the Maximal Voluntary Contraction while Force Time Integral was 1522.6 ± 593.4 and 1539.4 ± 597.3 Nm*s (p: ns) for Short and Long Pulse respectively. At the same force output, Long Pulse NMES exhibited higher oxygen consumption, in percentage of the physiological calibration, than Short Pulse NMES (36.71 ± 11.82 % vs 28.79 ± 17.07 %, p:0.041). **CONCLUSION:** Applying Long Pulse NMES can elicit higher muscle oxygen utilization compared to Short Pulse duration, suggesting preferential recruitment of oxidative, type I muscle fibers, likewise to a voluntary contraction.

3390 Board #211 May 29 1:30 PM - 3:00 PM
Electrical Stimulation-induced Fatigue In The Contralateral Leg Impairs Endurance Exercise Performance

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During fatiguing exercise, the development of peripheral fatigue and the associated increased firing of group III/IV afferent fibres, promote central fatigue. **PURPOSE:** The aim of this study was to assess whether peripheral fatigue in the contralateral leg induced by electrical quadriceps stimulation to bypass central command, would impair endurance performance of the subsequently exercising ipsilateral leg. **METHODS:** Eight young healthy males were recruited for this study. After completing an incremental test to exhaustion on a single-leg knee extensor ergometer, the subjects performed two tests on separate days. On the first day, they performed a time-to-

exhaustion test at 85% of their maximal power output (No-PreF trial). Exercise-induced quadriceps muscle fatigue was assessed by supramaximal electrical femoral nerve stimulation evaluating changes in the potentiated resting twitch force (Q_{tw,pot}), maximal voluntary contraction (MVC) and voluntary activation (VA) from pre to post exercise. On the second day, the same exercise bout was preceded by the induction of fatigue in the contralateral quadriceps through electrical stimulation (PreF trial). The pre-fatiguing protocol was terminated once the subjects reached the maximum tolerance score on a 1-10 visual analogue scale (duration: 6.6 ± 0.9 min). Integrated electromyography (iEMG) was recorded and used to estimate spinal motoneuronal output. **RESULTS:** Time to exhaustion in the PreF trial was reduced by 41% (9.1 ± 1.5 to 5.4 ± 1.2 min, p < 0.05). The reduction in MVC (-36 ± 8 vs -23 ± 10%, p < 0.05) and Q_{tw,pot} (-53 ± 3 to -39 ± 9% p < 0.05) was more accentuated in the No-PreF trial compared to PreF. Conversely, VA was more affected in PreF than in No-PreF (-20 ± 7 vs -14 ± 5%, p < 0.05). At every submaximal time point, iEMG was significantly higher in PreF compared to No-PreF, while at exhaustion it was higher in the latter (p<0.05). **CONCLUSIONS:** Pre-induced muscle fatigue in the contralateral limb impairs endurance performance of the exercising ipsilateral limb. This cross-over effect of fatigue is likely mediated by the inhibitory influence associated with group III/IV muscle afferent feedback and not related to changes associated with central command. Funding: No funding was received for this study

3391 Board #212 May 29 1:30 PM - 3:00 PM
The Effects Of 50k Ultramarathon Running On Quadriceps Torque And Circulating Inflammatory Calprotectin.

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Ultramarathon running has increased in popularity over the past decade. However, the effects of prolonged running on novel circulating inflammatory factors, such as calprotectin, and their relationship to muscle strength are not completely understood.

Purpose: Determine the effects of prolonged running on quadriceps strength and plasma calprotectin levels and examine the relationship between these two factors. **Methods:** Trained men and women (n=11) age 39 ± 7 years participated in a 50-kilometer(k) trail run consisting of five 10k laps. Seated knee extensor force was measured before the race, after each lap, immediately post-race and 24h post-race using a hand-held dynamometer. Quadriceps torque (N.m.) was calculated by multiplying tibial length by force. Blood was drawn 30 minutes after participants finished eating their pre-race meal, after the first lap (10k), within 60 minutes of finishing the race and 24h post-race. Plasma calprotectin was measured using an enzyme-linked immunosorbent assay (ELISA). **Results:** Quadriceps torque did not significantly change from pre-race to lap 1 (P=0.64), but significantly declined post-race (-10%; P=0.047) and returned to pre-race values by 24h post-race (P=0.1). Compared with lap 1, quadriceps torque declined significantly by lap 2 (-9%; P=0.024) but remained unchanged from lap 2 through post-race (between -10 and -8% from lap 2 through post-race; P>0.05 for each timepoint). Plasma calprotectin increased 63% at lap 1 (P=0.003), 83% post-race (P=0.001), and returned to pre-race values 24h post-race (P=0.66). Pre-race calprotectin levels directly correlated with quadriceps torque at lap 1 (r=0.627, P=0.023), post-race (r=0.771, P=0.005) and 24h post-race (r=0.767, P=0.006). Plasma calprotectin levels 24h post-race directly correlated with 24h post-race quadriceps torque (r=0.604; P=0.04). **Conclusion:** Athletes participating in a 50k ultramarathon experienced an acute decline in quadriceps torque that coincided with an acute increase in plasma calprotectin concentrations. Both torque and plasma calprotectin returned to pre-race values after 24h. The relationships between calprotectin levels and muscle torque before, during, and after the race suggest a potential novel role for calprotectin in muscle recovery from an ultramarathon.

3392 Board #213 May 29 1:30 PM - 3:00 PM
Fatigue Etiology At Exhaustion When Cycling Above Vs At Or Below Maximal Lactate Steady-state Threshold.

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Exercising above maximal lactate steady state (MLSS) has detrimental effects compared to exercising at MLSS. However, neuromuscular fatigue (NMF) to exercise above MLSS is unknown. **PURPOSE:** To evaluate NMF during exercise slightly below, at and above MLSS. **METHODS:** Nine men (24±3 yrs.; 76±7 kg; VO_{2max}, 3.55±0.19 L·min⁻¹) exercised to exhaustion at MLSS, 10 W below (-10W) and above

(+10W) MLSS. NMF was evaluated before (B), at min 10 (10'), 30 (30') and at exhaustion, by maximal voluntary contractions (MVC). Voluntary activation (VA) and contractile function of knee extensors [peak twitch torque (TwPt)] were tested using electrically-evoked contractions. Oxygen uptake ($\dot{V}O_2$) and blood lactate concentration ([Lac]) were measured. **RESULTS:** Time to exhaustion (TTE) for -10W (66±14 min) and +10W (44±8 min) were longer and shorter than MLSS (53±9 min) ($p<0.05$). $\dot{V}O_2$ was stable for -10W (10', 2.9±0.19; 30', 2.9±0.28; TTE, 2.9±0.25 L·min⁻¹) and MLSS (10', 3.0±0.21; 30', 3.0±0.29; TTE, 3.1±0.23 L·min⁻¹) ($p>0.05$), but increased at +10W (10', 3.0±0.21; 30', 3.2±0.32; TTE, 3.3±0.39 L·min⁻¹; $p<0.05$). [Lac] was stable for -10W (10', 4.1±1.1; 30', 4.4±1.2; TTE, 4.0±1.0 mM; $p>0.05$). MLSS showed an increase at TTE (10', 5.3±1.4; 30', 5.8±1.4; TTE, 6.1±1.8 mM; $p<0.05$). +10W showed a constant increase (10', 5.3±1.2; 30', 8.0±1.6; TTE, 8.6±1.6 mM; $p<0.05$). MVC dropped from baseline for -10W (B, 561±178; 10', 436±128; 30', 420±131; TTE, 395±120 N; $p<0.05$), MLSS (B, 518±130; 10', 405±96; 30', 361±75; TTE, 344±73 N; $p<0.05$) and +10W (B, 517±172; 10', 392±124; 30', 384±146; TTE, 349±88 N; $p<0.05$), and was not different amongst conditions. VA dropped from baseline for -10W (B, 98±2; 10', 90±6; 30', 89±6; TTE, 89±6 %; $p<0.05$), MLSS (B, 97±2; 10', 91±5; 30', 91±5; TTE, 88±5 N; $p<0.05$) and +10W (B, 98±2; 10', 94±5; 30', 90±7; TTE, 87±7 %; $p<0.05$), and was not different amongst conditions. TwPt dropped from baseline for -10W (B, 173±30; 10', 129±22; 30', 119±17; TTE, 112±17 N; $p<0.05$), MLSS (B, 172±31; 10', 129±28; 30', 119±24; TTE, 111±22 N; $p<0.05$) and +10W (B, 167±33; 10', 113±25; 30', 103±27; TTE, 97±26 N; $p<0.05$). +10W showed greater decline throughout the bout compared to the other conditions. **CONCLUSION:** Despite different TTE amongst conditions, peripheral NMF was only different exercising slightly above MLSS compared to the other conditions.

3393 Board #214 May 29 1:30 PM - 3:00 PM

Fatigue-induced Changes In Neuromuscular Responses During Maximal Bilateral Leg Extensions

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(No relevant relationships reported)

Purpose: The purpose of the present study was to compare the fatigue-induced changes in neuromuscular responses from both vastus lateralis (VL) muscles during maximal, bilateral isokinetic leg extensions. **Methods:** Fourteen men (22.6 ± 4 yr) performed consecutive, maximal, bilateral, concentric isokinetic leg extensions at 180 °·s⁻¹ until their peak torque was reduced by 70% (67 ± 19 repetitions). The amplitude (root mean square = RMS) and frequency (mean power frequency = MPF) contents of the electromyographic (EMG) and mechanomyographic (MMG) signals from the VL muscles of both legs were recorded simultaneously during each repetition of the fatiguing bout. The EMG RMS, EMG MPF, MMG RMS, MMG MPF and torque values were normalized to the values corresponding to 10% of the total number of repetitions completed and statistically compared at 5% intervals. Four, 2 (right and left VL) x 19 (10-100% of the total repetitions) repeated measures ANOVAs were used to determine mean differences for each neuromuscular parameter. A 1 x 19 repeated measures ANOVA was used to analyze torque changes across repetitions. Pairwise comparisons were used to identify when the neuromuscular and torque values changed from the values at 10% of the total repetitions. **Results:** The results indicated no significant interactions involving the right and left VL of any of the neuromuscular parameters. There were, however, significant main effects for repetitions collapsed across the muscles for both MMG RMS ($p = 0.03$; $\eta^2 = 0.147$) and EMG MPF ($p < 0.01$; $\eta^2 = 0.376$). Bilateral peak torque (271.1 ± 44.6 N·m) decreased significantly ($p < 0.01$; $\eta^2 = 0.695$) from 40-100% of the total repetitions. **Conclusion:** The results of this study revealed no differences between the right and left VL muscles for the patterns of neuromuscular responses during the fatiguing bilateral leg extensions. Peak torque decreased by 40.3% across all repetitions and was dissociated from the patterns of responses for EMG RMS and MMG MPF. The decreases across repetitions for EMG MPF and MMG RMS suggested that the fatigue-induced decrease in torque was due to excitation-contraction coupling failure secondary to an increase in metabolic byproducts.

3394 Board #215 May 29 1:30 PM - 3:00 PM

The Comparison Of Contralateral Repeated Bout Effects On Arm Muscle And Hand Muscle

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Purpose: To compare the potential contralateral repeated bout effect (conRBE) in both biceps brachii and first dorsal interosseus (FDI) muscles.

Method: Fifteen adults (Age: 25.2 ± 4.4 years; Weight: 76.0 ± 11.4 kg; Height: 177.1 ± 7.3 cm) participated in this study. Participants were randomly assigned into either arm (n = 8) or hand group (n = 7). After the first visit as the familiarization, Visit 2 was the eccentric exercise visit, during which the participants performed 6 sets of 10 repetitions eccentric exercise at 50% maximal voluntary isometric contraction (MVIC) in the designated muscle group (randomly chosen between dominant and non-dominant sides). Before (pre) and after (post) exercise, MVIC, submaximal isometric trapezoid contraction task, range of motion (ROM), and delayed-onset muscle soreness (DOMS) were measured. Specifically, the trapezoid contraction task required the participants to gradually increase the force from 0 to 30% MVIC in 3 seconds, held it for 10 seconds, and then gradually decreased the force to 0% in 3 seconds. During the Visits 3 and 4 (24-hour post- and 48-hour post-exercise), all measurements were collected. One week after Visit 2, the exact same exercise was performed and the measurements were obtained for the contralateral muscle. Surface EMG signals from the biceps brachii or FDI muscles were collected, and separate three-way [group (arm vs. hand) × bout (bout 1 vs. 2) × time (pre vs. post vs. 24 post vs. 48 post)] repeated measures analysis of variances (ANOVAs) were used to examine the mean differences in dependent variables.

Results: For the biceps brachii muscle, the pre to 24 post change (delta) in ROM showed a significant difference between first bout and second bout (first vs. second bout: 27.01 ± 11.84 vs. 16.81 ± 9.88, $p = 0.042$). There were significant differences between first bout and second bout at 24 post (55.06 ± 11.44 vs. 37.38 ± 12.67, $p = 0.006$) and 48 post (65.38 ± 10.00 vs. 47.44 ± 14.99, $p = 0.007$) for DOMS. In addition, normalized EMG amplitude showed a significant difference between first bout and second bout at post (69.87 ± 25.41% vs. 41.37 ± 17.13%, $p = 0.009$). However, there was no conRBE in all dependent variables on FDI muscle.

Conclusion: The elbow flexor muscles showed conRBE, but hand muscle did not have any protective effect. Therefore, conRBE seems to be muscle specific.

3395 Board #216 May 29 1:30 PM - 3:00 PM

Abstract Withdrawn

F-62 Free Communication/Poster - Biomechanical Measurement Equipment

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

3396 Board #217 May 29 2:30 PM - 4:00 PM

Quantitative Measure Of Force Output Across Various Biomechanical Support Devices At The Knee

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(No relevant relationships reported)

Introduction: The capacity to transfer high amounts of motor force against extreme resistances is desirable for recreational and competitive athletes alike. Due to this, the popularity of polymer-based wraps and sleeves has been increasing due to their known ability to aid in the increase of force output. However, the discrete force quantity (carryover value) has been largely overlooked in research. In the present study, passive force is measured in order to eliminate voluntary motor activation and to collect values representing ergogenic aid alone. **Purpose:** To quantify the force produced by the resistance-induced stretching of various ergogenic aids. **Methods:** 9 adult males (22.1±4.3yrs) underwent a series of passive force measurements, taken in duplicate, on a HUMAC NORM Isokinetic Dynamometer. Duplicate measures for each treatment were taken in three separate sessions. In each session, subjects were treated with no wrap (RAW), a knee sleeve (KS), or a manually wrapped "X" pattern knee wrap (KW) treatment. Peak torque was measured at 9 angles (70°, 75°, 80°, 85°, 90°, 95°, 100°, 105°, and 110°) for each treatment. Average force through full ROM was calculated for each subject. One-tail paired *t*-tests were ran ($\alpha=0.05$) at all angles between all treatments and also between mean torque values. One-way ANOVA test was also ran for mean torque of all treatments ($\alpha=0.05$). **Results:** Average force output for RAW tests was (3.72±4.64 N·m), (7.38±8.04 N·m) for KS and (12.64±11.55 N·m) for KW. One-tailed paired *t*-test for RAW vs KW yielded a ($t=5.86$) and ($p \leq 0.05$). One-tail paired *t*-test for RAW vs KS yielded ($t=3.31$) and a ($p \leq 0.05$). KS vs. KW yielded ($t=3.01$) and a ($p \leq 0.05$). Paired one-tail *t*-tests yielded significant differences ($p \leq 0.05$) between every condition at every angle except for 70° ($p=0.0813$) and 75° ($p=0.360$) between RAW and KS. One-way ANOVA between average of torque production showed significant results, p -value: (≤ 0.05), ($f=18.35$). **Conclusion:** Data indicates the use of ergogenic aid in passive force tests significantly increased passive torque production. KW condition resulted in the greatest torque production. KS showed less passive torque production than KW, but more than RAW.

3397 Board #218 May 29 2:30 PM - 4:00 PM
Quantification Of On-ice Figure Skating Jumps Using Data From A Wearable Device

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The number of jumps figure skaters perform daily has never been formally quantified, though it has been suggested that skaters perform 50-100 jumps per training day. The magnitude of force, high loading rates, and frequent repetitions likely contribute to the high injury rate of competitive skaters. Monitoring the number of jumps performed may help decrease risk of injury, similar to the institution of pitch counts in youth baseball.

Activity monitors that are commonly used for activities such as walking and running record many false positives during figure skating jump quantification due to the variety of skating movements that generate similar acceleration profiles. Previously, we developed an algorithm that successfully counted 39 of 40 jumps performed during the competitive routines of 7 local skaters whose isolated jumps were used to create the algorithm.

Purpose: To test the performance of the algorithm on an independent sample of skaters of varying skill levels.

Methods: 18 healthy competitive figure skaters participated in this study (ages 8-26y, 12 female). Each skater wore an IMU affixed to the lower back while they performed a variety of jumps, spins, and footwork. A high speed video camera recorded all trials for validation purposes. Custom software was used to analyze the IMU data to quantify the number of jumps performed with >1 rotation.

Results: Analysis of the videos showed that we recorded a total of 200 jumps with >1 rotation. The algorithm correctly quantified 94.5% of the jumps in this dataset (189 successful jumps). It also identified 11 jumps with ≤1 rotation.

Conclusions: These results show that this algorithm can be successfully applied to a unique dataset. Many of the jumps with ≤1 rotation that were counted were “popped” jumps, where a skater intends to perform a multi-revolution jump prior to take-off, but perform a single instead. Multi-revolution jumps that were not counted included falls and those with too much rotation that occurs on the ice prior to take-off. Finally, this dataset showed that the algorithm may need to be customized for smaller and/or low-level skaters as it failed to identify 7 of 12 jumps performed by a small, beginning level skater (8y, 122cm, 23.6 kg). Further improvements may be made by using machine learning algorithms to differentiate types of jumps as well as jump count.

3398 Board #219 May 29 2:30 PM - 4:00 PM
Reliability Of Quantitative Kinematics From A Portable Hand-held Device

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The current gold standard for assessing kinematics is three-dimensional (3D) motion analysis. However, the equipment required to accomplish this is not generally available in sport or clinical settings. Portable handheld devices (PD) are available that synchronize multiple two-dimensional video views to qualitatively evaluate complex sport skills. However, the use of quantitative kinematic analysis on PD compared to standard computer software (CS) has not been investigated. **PURPOSE:** To investigate the intra- and inter-rater reliability of PD compared to an open source CS. **METHODS:** Twenty-seven collegiate male soccer players (height: 179.8±5.6cm, mass: 75.9±6.9kg) were analyzed (120 Hz) during a drop vertical jump from a 30-cm box. PD and CS were separately used to 1) select a single frame from the frontal plane view when both knees were visually the most medial during landing and 2) digitize and record the frontal plane knee angle from hip, knee and ankle joint centers to estimate lower extremity valgus. Reliability between systems and reliability between testers were established with intra-class correlations (ICC_{2,k}, ICC_{3,k}, respectively). Precision was calculated with standard error of measurement (SEM). **RESULTS:** Intra-rater reliability was 0.993 [95% CI 0.985, 0.997] with SEM of 1.09 on the right, and 0.971 [95% CI 0.938, 0.987] SEM of 2.69 on the left limb. Inter-rater reliability on the right side was 0.979 [95% CI 0.954, 0.990] with SEM of 1.97 for the right limb and 0.978 [95% CI 0.943, 0.990] with SEM of 2.37 on the left, respectively. **CONCLUSION:** In collegiate male soccer players, PD exhibited excellent intra- and inter-rater reliability. The data indicates that it might be a useful tool to integrate into a screening protocol to quickly estimate lower extremity valgus. However, future analyses should compare traditional 3D motion analysis to determine validity.

3399 Board #220 May 29 2:30 PM - 4:00 PM
Reliability Of IMU Derived Kinematic Measures During The Forward Lunge

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The integration of inertial sensor data into the clinical environment and beyond, demonstrates the potential of improved clinical interpretation of an individual's functional movement capacity. Previously this has only been possible through the use of expensive laboratory-based motion capture systems. The forward lunge, a lower limb functional movement which exaggerates the gait cycle is commonly used by clinicians to assess lower limb strength, flexibility and balance. Combining Inertial measurement units with the forward lunge exercise could provide a quantified measure which was previously not possible in the clinical setting. **Purpose:** To determine the intrasession-reliability of kinetic measures derived from shank based inertial sensors during a forward lunge. **Methods:** Twenty-three healthy participants took part in the study (12 Male, 11 Female, 30.8 ± 8.6yrs, 1.7 ± 0.9m, 65.3 ± 10.8kg). Each participant performed 3 sets of 5 lunges bilaterally, each with a 10 min rest period adequate to establish intra-session reliability. Lunge distance and stance was set as 100% of leg length and hip width respectively (± 5%). IMUs were worn on the lateral aspect of each shank. The lunge was segmented into initiation, initial contact, mid-point, and termination. Peak & root mean squared (RMS) of total acceleration signals of the shank based IMU were taken for all lunges. Intraclass correlation coefficients (ICCs) were calculated based on a mean rating (k=3), absolute agreement two-way mixed effects model. Intra-session reliability was defined as poor (ICC<0.5), moderate (0.5-0.75), good (0.75-0.9) or excellent (>0.9). **Results:** ICC values ranged from 0.916 to 0.981 for left limb peak acceleration and 0.903 to 0.978 for right limb peak acceleration. ICCs for RMS of left and right limb ranged from 0.908 to 0.979 and 0.899 to 0.977 respectively. **Conclusions:** The IMUs showed good to excellent reliability for both peak and RMS total acceleration across both limbs during the forward lunge. This demonstrated the potential for their integration as a clinical tool to provide quantified measures of an individual's forward lunge performance.

3400 Board #221 May 29 2:30 PM - 4:00 PM
Test-retest Reliability And Concurrent Validity Of An In-shoe Pressure System During Two Landing Maneuvers

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In-shoe pressure sensor systems have been used to measure vertical ground reaction forces (GRFs) during functional tasks in clinical settings. However, no study has evaluated their reliability and validity during functional tasks in healthy soccer players.

PURPOSE: To determine the test-retest reliability of the peak plantar pressure measured by an in-shoe pressure system during landing from long-jump (LLJ) and landing from heading-jump (LHJ) performed by healthy soccer players. A second purpose was to evaluate the concurrent validity of the peak plantar pressure in relation to the peak vertical GRFs obtained using a force plates system as a criterion reference during both landing maneuvers.

METHODS: Ten healthy soccer players (age: 25.6 ± 2.67; BMI: 22.74 ± 2.33) participated in this study. LLJ included jumping forward and landing on the force plates, whereas LHJ included jumping forward to head a soccer ball and landing on the force plates. Each participant performed five trials of each landing maneuver. Within three days from initial testing, participants were asked to perform the same five trials of each landing task. Peak plantar pressure and peak vertical GRFs were measured during the landing phase (from initial contact to maximum bilateral knee flexion). Intra-class correlation coefficients [ICC (3,2)] were used to determine test-retest reliability. Pearson product-moment coefficient of correlations (r) were calculated to compare the peak plantar pressure with the peak vertical GRFs.

RESULTS: Test-retest reliability exhibited good reliability for peak pressure during LLJ (ICC = 0.96) and LHJ (ICC = 0.89). Peak plantar pressure and peak vertical GRFs showed a significant good-to-excellent positive correlation (r = 0.80, p < 0.001) during the LLJ, whereas a significant moderate-to-good positive correlation (r = 0.67, p = 0.03) was observed during the LHJ.

CONCLUSION: The present findings indicate that the in-shoe pressure system is reliable and valid during both landing maneuvers in healthy soccer players. Therefore, this system could be a useful tool to evaluate vertical GRFs in field and laboratory settings since it does not restrict participants to step or land on the force plates, thus allowing them to perform a more natural functional task.

3401 Board #222 May 29 2:30 PM - 4:00 PM

Reliability Of Inertial Sensor Derived Knee Joint Angular Velocity During A Forward LungeSarah Ward¹, James Davenport², Cathy Goulding², Brian Caulfield². ¹University of Otago, Dunedin, New Zealand. ²University College Dublin, Dublin, Ireland.
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Incorporating inertial measurement units (IMU) into screening tools affords the ability to 'quantify' commonly used functional tasks using angular velocity and acceleration as an outcome variable. These 'quantified' tasks have may have greater depth, accuracy and sensitivity than that achieved with standard clinical evaluation tools. Angular velocity can quantify how fast a segment or joint rotates, and provide a preliminary understanding of neuromuscular control during dynamic tasks including a forward lunge. **PURPOSE:** To determine the reliability of IMU-derived knee joint angular velocity during a forward lunge. **METHODS:** Twenty-three healthy individuals participated in this study (12M/11F, 30.8 ± 8.6 years, 1.7 ± 0.9 cm, 65.3 ± 10.8 kg). Participants performed a set of 5 lunges on the right limb and 5 on the left limb, repeated 3 times separated by 10 minute rest periods. Lunge distance was normalized to 100% (±5%) of leg length. IMUs were worn on the lateral thigh and shank of each limb. The following anchor points were defined for segmentation: initiation, initial contact 1 (IC₁), midpoint and initial contact 2 (IC₂)/termination. Peak and average thigh and shank angular velocity were extracted from the z-axis gyroscope signal for each lunge segment and for a 50ms window either side of IC₁. Peak and average knee joint angular velocity in each segment was calculated from thigh and shank data. Intraclass correlation coefficients (ICCs) were calculated based on a mean rating (*k*=3), absolute agreement, 2-way mixed-effects model. Intra-session reliability was defined as poor (ICC < 0.5), moderate (0.5-0.75), good (0.75-0.9) or excellent (>0.9). **RESULTS:** ICC values ranged from 0.841 to 0.911 for peak left knee joint angular velocity and 0.760 to 0.939 for peak right knee joint angular velocity. Average left knee joint velocity had ICCs ranging from 0.912 to 0.972, and 0.922 to 0.965 for average right knee joint angular velocity. **CONCLUSIONS:** IMU-derived knee joint angular velocity had good to excellent intra-session reliability during a forward lunge and demonstrate good potential for providing objective quantified data on forward lunge performance. IMUs may provide a more accessible alternative to 3D motion analysis or screening tools for lower limb function and neuromuscular control in a clinical setting.

3402 Board #223 May 29 2:30 PM - 4:00 PM

Validity And Reliability Of A Mobile App For Measuring Bar Velocity In The Bench Press ExerciseDaniel Boulosa¹, Alejandro Pérez-Castilla², Amador García-Ramos³. ¹Federal University of Mato Grosso do Sul, Campo Grande, Brazil. ²University of Granada, Granada, Spain. ³Universidad Católica de la Santísima Concepción, Concepción, Chile. (Sponsor: Carl Foster, FACSM)
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Velocity based-training (VBT) has been demonstrated to be a valid and useful approach to promote greater neuromuscular adaptations in resistance training (RT). This approach typically requires velocity monitoring during RT sessions for appropriate adaptations. The validity and reliability of a chronometer-based mobile App for RT monitoring in the half-squat exercise have been previously shown with a 10 repetition maximum (RM) load, when compared to a linear encoder. However, no data exist with other exercises and different loads. **PURPOSE:** To determine the validity and reliability of a chronometer-based mobile App for velocity monitoring in the bench press exercise with different loads. **METHODS:** Twenty handball players (23.0 ± 2.6 yrs, 1.76 ± 0.06 m, 79.6 ± 13.0 kg) completed, after 1RM determination, 5 repetitions with the 25, 40, 55 and 70% of 1RM in the bench press exercise, with the maximal intended velocity, in 2 days separated by 48-72 hrs. Bar velocity (m·s⁻¹) was monitored simultaneously by means of a linear encoder with a sampling rate of 1,000 Hz (reference method), and a chronometer-based mobile App. Validity was examined through paired samples *t*-test, the Hedge's effect size (ES), the Pearson's correlation coefficient (*r*), and the standard error of estimate (SEE). Reliability was assessed by the coefficient of variation (CV) and the standard error of measurement (SEM). **RESULTS:** Regarding validity, all relative loads evaluated demonstrated significant differences (*P* < 0.05) and small to moderate ES (range: 0.31-1.19) between devices, with the mobile App exhibiting greater bar velocities than the linear encoder. However, bar velocities measured with both devices were highly correlated (*r* ≥ 0.74) with a very low SEE (≤ 0.09 m·s⁻¹). The App exhibited for all loads a low SEM (≤ 0.11 m·s⁻¹), and acceptable CV (< 10%) with the exception of the highest load (70%1RM) (CV = 12.1%). **CONCLUSIONS:** A chronometer-based mobile App may be considered a valid and reliable method for VBT monitoring in the bench press exercise.

3403 Board #224 May 29 2:30 PM - 4:00 PM

The Validity Of A Smartphone-based Seated Postural Control Assessment In Non-ambulatory AdultsMikaela L. Frechette, Libak Abou, Laura A. Rice, Jacob J. Sosnoff. University of Illinois at Urbana-Champaign, Champaign, IL.
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Individuals who rely on wheeled mobility have unique fall risk factors (e.g. seated postural control) but recommended fall risk screening tools are predominately designed for ambulatory individuals. Consequently, most non-ambulatory adults do not undergo comprehensive fall risk screening or receive targeted fall prevention strategies.

PURPOSE: To examine the validity of smartphone-based postural control assessments in non-ambulatory adults. **METHODS:** Eleven participants (age: 35.4 ± 17.9) completed three clinical tests: The Trunk Control Test, Function in Sitting Test (FIST), and Tee-Shirt Test, as well as, four instrumented balance tasks in a standardized order: eyes open, eyes closed, functional reach, and functional stability boundary. During the balance tasks, participants held a smartphone and research-grade accelerometer to their chest. These devices measured root mean square (RMS) acceleration in the medial-lateral (ML), anterior-posterior, and vertical axes during all tasks. A median split of FIST scores differentiated participants with better and worse postural control. Spearman rank-order correlations between the two devices' measurements were conducted, and receiver operating characteristic (ROC) and the area under the curves (AUC) were constructed to distinguish participants with better and worse postural control. **RESULTS:** Participant scores from the FIST differed between those with better and worse postural control (*p* = 0.020). There were significant moderate to strong correlations between measures derived from the smartphone and measures derived from the research-grade accelerometer during the balance tasks (*p* = 0.636-1.000; *p* < 0.01-0.035). The AUC for ROC plots were significant for RMS ML sway during the eyes open task and functional stability boundary (*p* = 0.045 and 0.018, respectively). **CONCLUSION:** This pilot study illustrated that smartphone technology may be able to provide a valid assessment of seated postural control and have the ability to distinguish between those with better and worse postural control in the ML direction. Leveraging this form of technology could provide easily accessible and objective fall risk assessments for non-ambulatory adults.

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3404 Board #225 May 29 2:30 PM - 4:00 PM

Validation Of A Wearable Inertial Sensor Unit To Measure Balance And Sway During Postural TasksJason M. Avedesian, Mathew Sunil Varre, Ryan Tingle, Janet S. Dufek, FACSM. University of Nevada, Las Vegas, Las Vegas, NV. (Sponsor: Janet S. Dufek, FACSM)
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Current postural control tests for baseline concussion analysis and return to play decision making are of moderate reliability, attributed to subjective scoring. A recently developed inertial measurement unit (IMU) may offer clinicians a feasible, objective tool for postural control analysis surrounding a concussive event. **PURPOSE:** To assess the validity of a wearable IMU against a force platform (FP) during postural control tasks in adults. **METHODS:** Twenty-four participants completed three trials of four stance conditions (double-leg, tandem, left leg, and right leg) with eyes open (EO) and eyes closed (EC). Concurrent measures of postural control (anterior-posterior and medial-lateral sway, path length, and sway area) during each stance were collected as participants stood on a single FP while wearing the IMU on the sternum. Statistical analyses were conducted on mean percentage change (MPC) from EO to EC for sway parameters from the FP and IMU during the four stance conditions. Multiple multivariate analyses of variances were conducted to determine whether statistical differences existed between instruments (*α* = 0.05). **RESULTS:** The differences in MPC when comparing the IMU to the FP were 5-33% for double-leg stance, 8-130% for tandem stance, 0-82% for left leg stance, and 12-178% for right leg stance across postural control measures. Significant multivariate differences were found for double-leg [*F* = 12.233, *p* < .001], tandem [*F* = 15.927, *p* < .001], left leg [*F* = 3.725, *p* = .011], and right leg [*F* = 4.031, *p* = .007] stance. Pairwise comparisons indicated significant differences for anterior-posterior sway (*p* = .010) and path length (*p* < .001) during double-leg stance and path length (*p* = .005) during tandem stance. **CONCLUSIONS:** Preliminary results indicate large differences in postural control when utilizing this IMU versus a FP for assessing sway in direct comparisons. It must be noted that sway from this IMU is projected from its center of mass. Thus, direct comparison may be misleading. Further study is suggested to incorporate the IMU projection algorithm, in order to make more appropriate direct comparisons between instruments. It is important for researchers to understand algorithms that are implemented in IMU software to determine reliability of measurement, prior to stating experimental outcomes.

3405 Board #226 May 29 2:30 PM - 4:00 PM

Validation Of Step Length Between An Anti-Gravity Treadmill And A 2-Dimensional Camera System

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(No relevant relationships reported)

Lower body positive pressure treadmills (LBPTT) allow patients to walk in a gravity reduced environment of their total body weight with new embedded gait analysis module capable of documenting gait outcomes. **PURPOSE:** To validate step length (SL) measurement calculated by the LBPTT against a two-dimensional camera system. **METHODS:** Nine participants (5 male and 4 females; mean age 30.8 years) walked and ran for five minutes at 3mph, 4mph, 5mph, and 6mph on a lower body positive pressure treadmill (LBPTT). At each speed the subjects were unweighted at 80%, 60%, 40% and 20% of their total body weight (BW). A side camera view was employed to record step length. Five SL measurements from the middle minute were taken from each video from heel to heel and averaged to represent SL for each BW and speed. The right and left SL measurements from the treadmill were averaged as a composite SL measurement for analysis. Intraclass correlation coefficients were estimated for the average of five trials of the video data. Pearson correlations were calculated between step length from the treadmill and video. Correlations were considered significant at alpha .05.

RESULTS: All speeds and body weight conditions exhibited excellent reliability (ICC > 0.90) for the average of five trials for the video analysis. The correlations between the treadmill and video analysis for the speeds of 3 and 4 mph showed varied correlations fluctuating from poor to good ($r=-.21-.98$) with correlations greater than $r=.85$ showing statistical significance. The correlations between treadmill and cameras for the 5 and 6 mph speeds showed no statistically significant correlations ranging from $r=-.02-.69$.

CONCLUSIONS: The gait analysis module of the LBPTT does not measure direct step length from the instrumented belt after the transition from walking to running. The LBPTT might be using an algorithm to extrapolate the anticipated step length if the subject were not on the treadmill.

3406 Board #227 May 29 2:30 PM - 4:00 PM

Testing The Performance Of An Innovative Video-based Technique For Gait Analysis

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Gait abnormalities such as high stride frequency (SF) and stride variability (SV) may increase the risk of overuse injuries and/or be a sentinel of medical conditions. Low-cost and time-efficient alternatives to traditional stereophotogrammetry would allow the applicability of gait analysis on a large scale for early diagnosis/longitudinal monitoring.

Purpose: test the performance of an innovative video-based gait analysis technique in healthy individuals.

Methods: 37 healthy individuals (29±16 yrs) performed a 90°, test on treadmill at self-selected walking speed. We measured SF by an optical sensor platform; then we calculated average ± SD and within-subject coefficient of variation as an index of SV. We also recorded a 60 fps video of the subject (posterior view). With a custom designed web-based video analysis software we performed a spectral analysis of the brightness over time for each pixel of the image, that reinstated the frequency contents of the videos. The main frequency content (F1) from this analysis should reflect the forcing/dominant variable, i.e. SF. Then, an harmonic index (HI) was calculated, that reflects the proportion of the pixels of the image that move consistently with F1 or its supraharmonics. The higher the HI value, the less variable is gait. The correspondence between SF and F1 was evaluated by paired t-Test and correlation and between SV and HI by correlation.

Results: Subjects walked at a self-selected speed of $1.1±0.2$ m·s⁻¹. SF was not significantly different from and highly correlated with F1 ($0.88±0.07$ vs $0.89±0.08$ Hz, $p=0.06$, $r^2=0.98$). The SV was $1.93±0.81\%$ and it was significantly and moderately correlated with HI ($0.084±0.033$, $p=0.006$, $r=-0.45$).

Conclusions: The innovative video-based technique of global gait analysis proposed in our study accurately identifies the main frequency content and the variability of gait in healthy individuals thus providing a time-efficient, low-cost means to study human locomotion.

3407 Board #228 May 29 2:30 PM - 4:00 PM

Best Practice Use Of Wearable Accelerometers In Gait Biomechanics

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Advances in wearable technology provide opportunities to collect biomechanical data in real time and non-lab settings. However, there are currently no standards for best practice use of wearable sensors for gait applications. **PURPOSE:** Provide best practice recommendations for use of wearable accelerometers (WA) in gait biomechanics. **METHODS:** Literature was reviewed to determine appropriate WA range for gait biomechanics and establish procedures for calibrating and processing WA data for gait applications. Drop tests of three, simultaneously initialized, commercially available WAs were performed to determine signal time synchronization and 1 g acceleration accuracy. WAs were secured to different lower limb locations (pelvis, knee, ankle) and walking and running trials performed. Peak acceleration magnitude and timing were compared within and among WAs by location and gait type. Vertical ground reaction force (GRFvert) was estimated using a regression model, developed based on pelvis acceleration data, to determine the sensitivity of the GRFvert estimates to WA placement. **RESULTS:** Peak lower limb accelerations can exceed 25 g during running. WAs initialized at the same time had significant temporal differences (up to 1.06 s). Accelerations during freefall were within 17 % of 1 g. After synchronizing WA signals based on the drop test results, there were no significant differences in WA magnitude and timing among three WAs located around the right iliac crest, but there were significant acceleration differences among WAs located at the right iliac crest, knee, and ankle. Walking and running peak GRFvert estimates based on accelerations of the iliac crest differed from estimates based on accelerations of the knee ($-5 ± 28$ N and $-142 ± 80$ N, respectively) and ankle ($261 ± 28$ N and $-274 ± 66$ N, respectively). **CONCLUSIONS:** WAs should be: (1) selected to measure a range greater than 25 g, (2) calibrated to ensure accuracy, (3) manually time synched if using multiple sensors, (4) placed carefully though exact placement is not critical to anatomical site acceleration estimates near the hip, and (5) located at the same anatomical site that was used to develop an acceleration-dependent model if the goal is to use that model to estimate a particular quantity (i.e. GRFvert).

3408 Board #229 May 29 2:30 PM - 4:00 PM

Comparison Of Ground Reaction Forces Derived From Force Plate And Motion Capture Systems During Vertical Jumps

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PURPOSES: This investigation compared the ground reaction forces (GRFs) between a force plate and GRF derived from a markerless motion capture system (MCS) during a counter-movement vertical jump (CMVJ). **METHODS:** Healthy, recreationally active men ($n=10$; $±SD$; age= $22.5±2.1$ yrs, height= $180.8±4.6$ cm, weight= $80.8±7.5$ kg) and women ($n=8$; age= $20.5±0.8$ yrs, height= $171.7±5.7$ cm, weight= $68.1±7.2$ kg) volunteered to perform 3 CMVJs separated by 30 seconds of rest. A 3-D markerless motion capture system (MCS; DARI Motion, Scientific Analytics, Lincoln, NE) was sampled at 50 Hz, while a uni-axial force plate (Rice Lake Weighing Systems, Rice Lake, WI) and a data acquisition system (Biopac, Goleta, CA) sampling at 1000 Hz was used and resampled to 50 Hz for analysis. Participants begin the CMVJ standing on the force plate while in the MCS capture area. Ground reaction peak force (PF) was determined as the max force before takeoff, and ground reaction mean force (MF) was determined across the entire CMVJ from start of the motion to takeoff. Linear regressions were performed to compare MF and PF between the two devices (i.e. MCS vs. force plate) with the Pearson correlation (r), coefficient of determination (r^2), and standard error of the measurement (SEM) calculated. Paired samples t -tests (MCS vs. force plate; $p≤0.05$) were performed on the MF and PF. **RESULTS:** Mean ± SD and results are shown in table 1. Paired samples t -tests indicated significant differences (<0.01) for MF and PF. Linear regression analysis indicated excellent agreement between MCS and force plate for MF ($r=0.97$, $r^2=0.93$, SEM= 13.99 N) and PF ($r=0.92$, $r^2=0.84$, SEM= 35.72 N), respectively. **CONCLUSION:** Although significant differences were indicated, the linear regression analysis indicated that GRF can be accurately derived from a MCS without the use of a force plate. Furthermore, the intricate kinetic characteristics of human motion can be validly determined without being restricted to performing on a force plate.

Table 1. Comparison of ground reaction forces from force plate and motion capture system (MCS) during counter-movement vertical jumps

	Force Plate (N)	MCS (N)	r	r ²	SEM
Mean Force	887.9±131.0	972.9±147.8*	0.97	0.93	13.99
Peak Force	1662.0±368.6	1823.9±355.5*	0.92	0.84	35.72

(n=54); ($\bar{X} \pm SD$); * indicates significant difference ($p < 0.01$)

3409 Board #230 May 29 2:30 PM - 4:00 PM
Measuring A Rider's Centre Of Mass Displacement During Non-seated Cycling Using A Single Inertial Measurement Unit

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Instantaneous power output measured at the cranks when cycling in a non-seated posture is not equivalent to the instantaneous joint power produced by the rider. This discrepancy is due to additional power that is generated on, and by, the rider's centre of mass (CoM). Capturing CoM motion in a laboratory setting is relatively straight forward; however, an accurate and reliable method for measuring this in the field remains elusive.

PURPOSE: To test whether a single Inertial Measurement Unit (IMU) placed on the torso of the rider at L4-5 can provide an accurate and precise measure of vertical CoM displacement during non-seated cycling.

METHODS: We first assessed whether the IMU could track its own vertical displacement by comparing it to an attached marker cluster tracked using three-dimensional motion capture. We then compared vertical displacement of the IMU to a kinematic estimate of vertical CoM displacement using a full body musculoskeletal model. IMU (100 Hz) and motion capture (200 Hz) data was collected synchronously for 10-s on seven participants while they cycled on an ergometer in a non-seated posture at three different power outputs and at two different cadences (70 rpm and 120 rpm). Sensor performance was quantified as the dynamic root mean square (RMS) error of yaw, pitch, and roll components of angular velocity. An agreement analysis corrected for repeated measures was also performed, which encompassed the limits of agreement, accuracy, precision, average error, and maximum error between each method.

RESULTS: In all trials, the IMU performed well with a dynamic RMS error of 0.17 ± 0.04 radians/s across all orientation components. The IMU measured vertical displacement of the marker cluster with high accuracy (0.002 ± 0.002 m) and precision (0.009 ± 0.005 m) with an average error of 1.7% and 5% at 70 rpm and 120 rpm, respectively. Agreement between the IMU and the kinematic prediction of CoM displacement was lower with an accuracy of 0.016 ± 0.003 m and precision of 0.010 ± 0.004 m.

CONCLUSIONS: These results suggest that a single IMU can provide a highly accurate and precise measure of its own orientation and amplitude of vertical displacement. Further research is required to test whether agreement between the IMU and the model's CoM can be improved by placing the IMU in different positions on the torso.

F-63 Free Communication/Poster - Motor Control

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

3410 Board #231 May 29 2:30 PM - 4:00 PM
The Role Of Dopaminergic Synapse And D2DR In Movement Control

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Exercise fatigue is a common physiological phenomenon in sports. The central nervous system (CNS) has important regulating effect on exercise fatigue. The basal ganglia are involved in motor function regulation through direct and indirect pathways. Striatum is the main input nucleus of basal ganglia and plays an important role in movement

control. **PURPOSE:** Explore the role of dopaminergic synapse and D2 dopamine receptors (D2DR) in movement control by investigating synaptic ultrastructural change of the dorsolateral striatum (DLS) and D2DR antagonist/agonist effect on autonomic activity in exercise-induced fatigue rats. **METHODS:** Male Wistar rats were randomly divided into either the sham control group (SCG), 1-day fatigue group (1FG), 3-day fatigue group (3FG), 7-day fatigue group (7FG), 24-hour recovery group (24RG) or 48-hour recovery group (48RG). The synaptic ultrastructure was observed by transmission electron microscopy. Further a D2DR antagonist and agonist were used to interfere with the autonomic exercise of rats with Open Field Test. **RESULTS:** We found that: (1) The proportion of asymmetrical synapse of DLS (SCG: $41 \pm 2\%$), 7FG: $28 \pm 4\%$, $p < 0.05$), number of presynaptic vesicles (SCG: 13.35 ± 4.58 (number/ μm^2), 7FG: 5.92 ± 2.7 (number/ μm^2), $p < 0.05$), number of synaptic terminal mitochondria (SCG: 0.19 ± 0.18 (number/ μm^2), 7FG: 0.15 ± 0.1 (number/ μm^2), $p < 0.05$), and the area of synaptic terminals (SCG: 123925.64 ± 54773.42 (μm^2), 7FG: 84447.16 ± 29495.42 (μm^2), $p < 0.05$), decreased with the increase of exercise days. (2) The total exercise distance of each group decreased gradually with the increase of exercise intensity ($p < 0.05$). Additional rat's exhaustion time was also significantly shortened after injection of the D2DR antagonist (before: 147.33 ± 5.63 , after: 103 ± 4.14 , $p < 0.01$). **CONCLUSIONS:** The activity of synapses in the dorsolateral striatum of rats decreased with the increase of exercise fatigue. Exercise fatigue reduced the autonomic activity of rats, which was further enhanced by D2DR antagonist intervention. This indicates that the regulatory role of D2DR in motion may be related to synaptic plasticity of dopaminergic in substantia nigra and striatum, suggesting that D2DR can be used as an important target to address exercise fatigue.

3411 Board #232 May 29 2:30 PM - 4:00 PM
ARE MOTOR UNIT FIRING PROPERTIES CONTROLLED WITHIN DISTINCT REGIONS OF A MUSCLE

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Previous findings have suggested that the distribution of motor units within a muscle may display region-specific muscle activation. Consequently, if regionalization of motor units indeed exists, then force generating capacities would be highly task and joint dependent. **PURPOSE:** To examine for regional motor unit control from proximal and distal locations of biarticular [rectus femoris (RF)] and monoarticular [vastus lateralis (VL)] muscles during low-force knee extensions. **METHODS:** Following 2 maximal voluntary contractions (MVC), eighteen resistance-trained men ($n = 9$, age = 23 ± 3 yrs) and women ($n = 9$, 22 ± 2 yrs) performed a 10 sec isometric ramp contraction up to 30% MVC. On two separate occasions, surface electromyographic (EMG) signals were collected from proximal and distal locations of either the VL or RF. These were used to record EMG amplitude and were also decomposed into the constituent motor unit action potentials. The slope and intercept values were calculated across the motor units for relationships between mean firing rate, recruitment threshold, and action potential size for each subject. Paired samples *t*-tests were used to compare regression coefficients and EMG amplitude between proximal and distal locations of the RF and the VL separately. **RESULTS:** There were no differences in EMG amplitude between locations in the RF ($p = 0.31$, $d = 0.39$), however, amplitude in the distal location of the VL was greater than the proximal ($p < 0.05$; $d = 0.64$). There were no significant differences in slope or intercept coefficients for any of the motor unit relationships (see Table 1) ($p = 0.08 - 0.91$, $d = 0.01 - 0.64$). **CONCLUSION:** Although there was a regional difference in the activation across the VL, there were no region-specific differences in the motor unit firing properties. The differences in amplitude were likely due to other factors that affect EMG signals, such as the underlying morphology (muscle size, subcutaneous fat thickness, etc.).

Table 1. Mean slope and intercept coefficients for relationships between motor unit firing properties

Mean Firing Rate vs. Recruitment Threshold				
			p-value	
Regression Equation			Slope	Intercept
VL	Proximal	$y = -0.667x + 23.49$	0.46	0.77
	Distal	$y = -0.753x + 22.90$		
RF	Proximal	$y = -0.384x + 22.34$	0.59	0.51
	Distal	$y = -0.343x + 32.85$		
Mean Firing Rate vs. Action Potential Size				
VL	Proximal	$y = -95.79x + 25.54$	0.08	0.25
	Distal	$y = -72.28x + 23.51$		
RF	Proximal	$y = -74.623x + 22.92$	0.77	0.20
	Distal	$y = -78.683x + 24.57$		
Action Potential Size vs. Recruitment Threshold				
VL	Proximal	$y = 0.011x + 0.013$	0.59	0.75
	Distal	$y = 0.009x + 0.019$		
RF	Proximal	$y = 0.013x + 0.056$	0.17	0.55
	Distal	$y = 0.019x + 0.055$		

3412 Board #233 May 29 2:30 PM - 4:00 PM
EFFECTS OF CONTINUOUS CYCLING TRAINING ON MOTOR UNIT BEHAVIOR AND MUSCLE ACTIVATION DURING REPETITIVE CONTRACTIONS
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PURPOSE: To examine the effects of 10 weeks of continuous cycling training on maximal aerobic capacity (VO_{2MAX}), maximal strength (MVC) of the knee extensors, and motor unit (MU) behavior of the vastus lateralis (VL) in sedentary males.
METHODS: Nine males completed 40 supervised training sessions. Pre- and post-intervention, participants performed a cycling VO_{2MAX} test and MVCs on an isokinetic dynamometer followed by two consecutive submaximal (40% relative to pre-training MVC) contractions of the right knee extensors. Surface electromyographic (EMG) decomposition assessed recruitment thresholds (RT), action potential amplitudes ($MUAP_{AMP}$) and mean firing rates (MFR) for each observed MU from the VL for the 40% MVCs and linear regressions determined the y-intercepts (y-ints) and slopes for the MFR and $MUAP_{AMP}$ vs. RT relationships. EMG amplitude for the 40% MVCs was normalized (N-EMG) to the MVC for the current visit. Separate paired samples *t*-tests examined VO_{2MAX} and MVC. Separate two-way ANOVAs (time x repetition [rep]) examined N-EMG and the y-ints and slopes for the MFR and $MUAP_{AMP}$ vs. RT relationships. Alpha was 0.05.
RESULTS: Ten weeks of training resulted in significant increases in VO_{2MAX} (3.4 ± 0.6 vs. 3.8 ± 0.5 L/min; $P = 0.005$) while MVC was unchanged (212.7 ± 34.3 vs. 201.4 ± 32.1 Nm; $P = 0.056$). For the slopes and y-ints from the MFR and $MUAP_{AMP}$ vs. RT relationships, there were no significant two-way interactions ($P = 0.152 - 0.669$) or main effects for time ($P = 0.213 - 0.753$) or repetition ($P = 0.313 - 0.639$). For N-EMG, there was no significant two-way interaction ($P = 0.485$). There were main effects for time (37.3 ± 7.0 vs. $47.6 \pm 14.2\%$; $P = 0.035$) and rep (41.2 ± 11.9 vs. $43.7 \pm 12.7\%$; $P = 0.044$). N-EMG was greater for post-training and repetition 2 when collapsed across time and repetition.
CONCLUSIONS: Continuous cycling increased maximal aerobic capacity, whereas maximal strength of the knee extensors and motor unit firing rates and action potential amplitudes in relation to recruitment thresholds for the VL were unchanged. Although aerobic training is believed to improve endurance, participants exhibited greater muscle activation when completing a contraction at pre-training torque levels and similar increases in muscle activation when completing the ensuing contraction.

3413 Board #234 May 29 2:30 PM - 4:00 PM
Physiological Determinants Of The Rate Of Torque Development In Older Men: A Pilot Study

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In young, healthy adults, early phase (i.e., 0-50 ms) rate of torque development (RTD) is primarily determined by neural characteristics. However, it is unclear if this remains the case in older adults. **PURPOSE:** To examine the physiological characteristics of early phase RTD in older men. **METHODS:** Seventeen older males (age = 73 ± 6 y) completed 2 maximal (MVIC) and 2 rapid (rMVIC) isometric knee extensions. Early phase RTD values were calculated from the first 50 ms ($aRTD_{50}$) of the rapid contractions and normalized ($nRTD_{50}$) to maximal torque (%MVIC/s). Muscle activation amplitude (EMG) was calculated during the first 50 ms ($nEMG_{50}$) of EMG onset and was normalized to the peak-to-peak M-wave amplitude (% M_{pp}) of the vastus lateralis (VL), vastus medialis (VM), and rectus femoris (RF). Evoked peak twitch torque (τ_{TT}) was determined as the maximal torque (Nm) produced from a single electrical stimulus. Motor unit number estimation (MUNE) was calculated as a ratio of the ensemble average of the single MU potential amplitude to the compound muscle action potential amplitude and was corrected for alteration. Muscle quality (MQ) was determined by examining the average muscle cross-sectional area relative to the average muscle echo intensity for each muscle using an ultrasound. Relationships between the predictor variables ($nEMG_{50}$, MUNE, τ_{TT} , MQ) and RTD ($aRTD_{50}$ and $nRTD_{50}$) were analyzed via Pearson's correlation coefficients. Stepwise multiple regression was used to examine the amount of variance in $aRTD_{50}$ and $nRTD_{50}$ accounted for by each of the predictor variables. **RESULTS:** $aRTD_{50}$ (577.8 ± 241.0 Nm/s¹) was related to MUNE (144.1 ± 47.1 , $r = .549$, $p = .023$), $nEMG_{50}$ (137.5 ± 97.7 % M_{pp} , $r = .673$, $p = .003$), and τ_{TT} (20.34 ± 12.5 Nm, $r = .504$, $p = .039$). $nRTD_{50}$ (433.2 ± 175.4 %MVIC/s) was related to MUNE ($r = .531$, $p = .028$) and $nEMG_{50}$ ($r = .604$, $p = .010$). $nEMG_{50}$ and τ_{TT} were significant determinants ($p = .001$) that accounted for 45.3% and 15.5% of the variance in $aRTD_{50}$, respectively. $nEMG_{50}$ was the only significant predictor ($p = .01$), explaining 36.4% of the variance in $nRTD_{50}$. **CONCLUSIONS:** These pilot data support the notion that early phase RTD is primarily determined by neural factors, even in older adults. These data also suggest that possessing a higher number of viable MUs may influence early phase absolute RTD in older men.

3414 Board #235 May 29 2:30 PM - 4:00 PM
Lower Extremity Neuromuscular Alteration During Dual Cognitive Standing Balance Tasks In Adults Diagnosed With HIV
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Individuals diagnosed with human immunodeficiency virus (HIV) often present with impaired postural control as a consequence of proprioceptive alteration, due to secondary effects of prescription medication. **PURPOSE:** This study seeks to evaluate lower extremity neuromuscular activation during dual postural control tasks in individuals living with HIV.
METHODS: Twenty-three participants of Hispanic-latino origin diagnosed with HIV (18 male and 5 female, average age 55 ± 1.7 years) with an average CD4 count of 698.8 (22 years of HIV diagnosis) enrolled in this study. Surface electromyography (EMG) on the tibialis anterior (TA) and gastrocnemius (GA) muscles was used on the participant's dominant leg. Each task took approximately 15 seconds to finish. Each participant was instructed to quietly stand in a bi-pedal posture on a balance foam. Four single balance and dual cognitive-balance tasks (count backwards from 100 in increments of 3) were performed on the balance foam.
RESULTS: The variables of interest in this study were 1) time to peak, 2) decay and 3) duration of muscle activation for TA and GA. A repeated measure ANOVA analysis was used to compare all variables of interest. No significant difference is indicated between duration and decay of muscle activation for TA and GA across the various tasks assessed. Throughout the cognitive balance task, GA time to peak activation was slower ($P < 0.001$) during eyes closed (EC) head movements (HUD) (7.7 ± 0.7 seconds) when compared to HUD with eyes open (EO) (0.3 ± 0.2 secs) and, eyes open (EO) (0.5 ± 0.2 secs).
CONCLUSIONS: As the GA plays a major role in static balance, an increased fall risk could be resultant of this delay in time to peak onset. As such, our research recommends lower extremity electromyography and strength assessment in this population to forestall or decrease fall hazards.

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Baseline Performance May Alter Feedback Effectiveness Of Single And Dual Task Landings

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Anterior cruciate ligament (ACL) injuries are common in female athletes. Performance-based feedback (FB) may alter landing mechanics. **PURPOSE:** To provide peak vertical ground reaction force (PvGRF), loading asymmetry (LA), and frontal-plane (FP) video as post-trial landing FB to evaluate and train female collegiate athletes during single- and dual-task (ST and DT) drop landing. **METHODS:** 88 athletes performed both ST and DT (with/without jumping for a suspended ball) landings onto custom, portable force plates sampled at 2000 Hz. FP video showing knee-to-ankle (K:A) ratio, a surrogate for knee valgus, was recorded at 100 Hz. Performance trials were conducted in blocks of 3 ST and 6 DT pre-tests, 6 ST and 6 DT with post-trial visual FB (PvGRF in body weight (BW), LA, and FP video), and 3 ST and 6 DT post-tests. **RESULTS:** Quartiles were determined from PreST PvGRF to determine groups (Grp 1 < 3.45 BW; Grp 2: between 3.45-4.01 BW; Grp 3: between 4.01-4.72 BW; Grp 4 > 4.72 BW). PvGRF and K:A ratio between task (ST or DT) and over time (pre-test, post-test) were compared using a two-way repeated measures ANOVA where a group*time interaction was observed ($p < 0.05$). Follow-up tests revealed that Grp 3 and 4 improved PvGRF and K:A ratio from PreST to PostST that were maintained in PostDT (PvGRF: PreST to PostST Grp 3 = -20.6%, Grp 4 = -32.2%, PostST to PostDT Grp 3 = 5.0%, Grp 4 = 5.2%; K:A ratio: PreST to PostST Grp 3 = 4.1%, Grp 4 = 11.0%, PostST to PostDT Grp 3 = 0%, Grp 4 = 1.0%). Grp 1 and 2 demonstrated no change in K:A ratio despite the reduced PvGRF from PreST to PostST. These changes were not maintained during PostDT (PreST to PostST Grp 1 = -11.2%, Grp 2 = -18.3%, PostST to PostDT Grp 1 = 7.8%, Grp 2 = 2.3%). **CONCLUSIONS:** Collegiate athletes with PreST PvGRF > 4.01 BW may benefit more from performance-based landing FB that are maintained during DT scenarios.

3416 Board #237 May 29 2:30 PM - 4:00 PM

The Effect Of Responsive Equine Simulator Therapy Device On Biomechanics Of Sitting

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A responsive equine simulator therapy (REST) system is a sitting device replicating motions experienced during horse riding. The mild motion introduced by the REST could promote a more active sitting experience to users. Although the REST system could potentially provide the benefits associated with active sitting, the effect of a REST system on trunk motion, trunk and leg muscle activations over that of sitting on a normal chair has yet to be examined. **Purpose:** To quantify trunk motion patterns and trunk and leg muscle activity during sitting on a REST system compared to an office chair. **Methods:** 20 healthy participants (22 ± 2 yr, 75 ± 10 kg, 1.71 ± 7.9 m) sat on the REST device and an office chair for 20 minutes in randomized order. Electromyography (EMG) sensors were placed bilaterally on the external oblique, rectus abdominis, erector spinae, adductor longus, soleus, and tibialis anterior. 3D Motion capture was conducted while participants performed the two sitting conditions. One way repeated measures ANOVA was used to determine differences in trunk motion and root mean square (RMS) EMG between the two sitting conditions. **Results:** For any given 10-sec sitting interval, the trunk center of mass traveled a greater distance during the REST condition (25.4 ± 7.9 cm) over that of the Chair condition (3.6 ± 1.5 cm) ($p < 0.001$). Also, mean angular speeds of the trunk during sitting on the REST was greater in the sagittal plane (0.20 ± 0.12 deg/s vs. 0.07 ± 0.06 deg/s) ($p < 0.001$) and in the transverse plane (0.11 ± 0.04 deg/s vs. 0.05 ± 0.09 deg/s) ($p = 0.011$) than those of the Chair condition. Furthermore, average RMS EMGs of the external oblique (6.13 ± 0.34 mv vs. 5.95 ± 0.30 mv) ($p = 0.037$), tibialis anterior (18.96 ± 0.37 mv vs. 18.73 ± 0.30 mv) ($p = 0.007$), and soleus (9.58 ± 0.65 mv vs. 8.70 ± 1.10 mv) ($p = 0.018$) were significantly higher in the REST condition than those in the Chair condition during a 10-sec interval. **Conclusion:** Using a REST device resulted in a significant increase in trunk motion. The elevated activities in trunk and leg muscles serve to maintain and control upper body posture. These biomechanical responses imply that people could assist in helping to establish an active lifestyle by using the REST device on a regular basis.

3417 Board #238 May 29 2:30 PM - 4:00 PM

The Influence Of Apoe Genotype On Motor Cortex Function Following Mtbi

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Approximately 10-15% of individuals diagnosed with mild traumatic brain injury (mTBI) continue to experience symptoms beyond 3 months post-injury. Although the underlying physiology of these prolonged symptoms remains unknown, numerous factors have been suggested to contribute to recovery from mild traumatic brain injury (mTBI). Among the most extensively studied is the influence of the ApoE4 allele. **PURPOSE:** The purpose of this study was to examine the potential influence of APOE genotype on neurophysiological recovery from mTBI in individuals with chronic symptoms. **METHODS:** Twenty seven participants provided a saliva sample for APOE genotyping and were categorized into one of two groups: (i) with history of mTBI and no remaining symptoms ($n = 21$, Control), and (ii) with chronic symptoms from mTBI, lasting at least 3 months post-injury ($n = 6$, Chronic). Measures of glutamate and GABA concentrations in the primary motor cortex were obtained using proton magnetic resonance spectroscopy (¹H-MRS). Transcranial magnetic stimulation (TMS) was used to assess corticomotor excitability with the amplitude of the motor evoked potential (MEP_{amp}), and intracortical inhibition through the duration of the cortical silent period (CSP). **RESULTS:** Glutamate ($p = 0.55$) and GABA ($p = 0.73$) concentrations in M1, as well as MEP_{amp} ($p = 0.20$) and CSP duration ($p = 0.47$), did not differ between mTBI groups. There were no differences in these measures between ε4 carriers and non-carriers ($p \geq 0.50$) and no significant interactions between mTBI group and ε4 carrier status for any of the four measures ($p \geq 0.07$). **CONCLUSION:** The lack of differences in glutamate, GABA, and corticomotor excitability and inhibition across groups suggests that motor cortex function may not explain the physiology underlying differences in symptom recovery post-mTBI. While the apoε4 allele has been associated with differences in outcome following mTBI, it did not seem to affect the function of the human motor cortex in this group of participants.

3418 Board #239 May 29 2:30 PM - 4:00 PM

Does Ipsilateral Motor Cortex Activity During Unilateral Fatigue Explain The Deficits In The Non-fatigued Limb?

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Performing unilateral contractions to exhaustion has been shown to lead to force deficits of both the exercised and unexercised limbs. Although limb muscles are controlled by the contralateral hemisphere of the brain, neuroimaging studies have also shown slight activation of the ipsilateral motor cortex during unilateral tasks. However, whether cortical activity of the ipsilateral hemisphere might, in part, be responsible for the force decrements in the non-fatigued limb remains unknown. **PURPOSE:** To quantify the relationship between changes in maximal voluntary contraction (MVC) of the non-fatigued limb, and oxyhemoglobin (HbO) changes in the ipsilateral motor cortex during a fatiguing task. **METHODS:** Eleven subjects ($M \pm SD$ 20.8 ± 1.14 yrs.) performed two maximal voluntary isometric knee extensions of the left leg before (MVC_{pre}) and after fatiguing protocol (MVC_{post}). The fatiguing protocol consisted of repeated, 50-second long isometric knee extensions with the right leg at 30% MVC until failure. During the fatigue protocol, hemodynamic responses of the motor cortex were recorded at a sampling rate of 5.81 HZ using a continuous-wave functional near infrared spectroscopy system (fNIRS). Raw fNIRS signals were processed and converted to hemoglobin concentrations using an open-source software (HomER2), and the peak HbO (HbO_{peak}) was obtained from the final contraction before failure. MVC_{pre} and MVC_{post} were used to calculate the percentage of change in maximal force from the fatiguing task (MVC_{diff}). A Pearson's correlation between HbO_{peak} and MVC_{diff} was calculated using a commercial software. **RESULTS:** Paired samples t-test showed a significant difference ($p < 0.05$) between MVC_{pre} (828.34 ± 238.8 N) and MVC_{post} (743.99 ± 227.56 N). Pearson's correlation between HbO_{peak} ($2.93 \pm 1.86E-8$) of the ipsilateral motor cortex and MVC_{diff} (-9.86 ± 12.11 %) of the unexercised leg was not statistically significant ($R = -0.368$, $p = .265$). **CONCLUSIONS:** We hypothesized that peaks in oxyhemoglobin on the ipsilateral motor cortex during a fatiguing task would explain, to some extent, the force deficits in the unexercised leg. It is worth noting that this study was underpowered for a correlation. However, it is also possible that if the contralateral force deficit is indeed due to neural factors, that it is not cortical in origin.

3419 Board #240 May 29 2:30 PM - 4:00 PM
External Resistance Is Imperative For Training-induced Efferent Neural Drive Enhancement In Older Individuals

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Strength training performed with heavy loads and maximal intended velocity is documented to enhance efferent neural drive in older individuals. However, it remains unclear whether the neural plasticity following training result from motor skill learning or if external resistance is a prerequisite.

PURPOSE: To investigate the importance of external resistance on neural plasticity in older individuals.

METHODS: Electrically evoked potentials (H-reflex and V-waves normalized to maximal M-wave) and voluntary activation (VA) were assessed in 36 older individuals (73±4 years). Participants were randomized to 3 weeks of plantar flexion strength training, with (maximal strength training; MST) or without (unloaded ballistic training; UBT) heavy external loading (90% of one repetition maximum), or a control group. Both training groups aimed to execute the concentric phase of movement as fast and forcefully as possible.

RESULTS: The MST group improved maximal voluntary contraction (MVC) and rate of force development (RFD) by 18±13% (p<0.01) and 35±17% (p<0.01), respectively, and this was different (p<0.01) from the UBT group which exhibited a 7±8% (p<0.05) increase in MVC (p<0.05) and a tendency of an increase in RFD (p=0.12). Concomitant improvements in efferent neural drive, evident as a 79±80% increase in V/M-ratio (p<0.01) and a tendency towards increased VA (p=0.11), were only apparent after MST. No changes were observed in H/M-ratio for any of the groups. **CONCLUSION:** External loading following exercise training appears to be a prerequisite for efferent neural drive enhancement in older individuals, and advocates that heavy resistance training should be recommended to counteract the typically observed age-related decline in motoneuron firing frequency and recruitment.

3420 Board #241 May 29 2:30 PM - 4:00 PM
Performance Fatigability And Neuromuscular Patterns Of Responses For Bilateral Versus Unilateral Leg Extensions In Men.

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Purpose: The purpose of the present study was to examine performance fatigability and patterns of neuromuscular responses for electromyographic (EMG) and mechanomyographic (MMG) amplitude (AMP) and mean power frequency (MPF) of the vastus lateralis (VL) during bilateral (BL) and unilateral (UL) maximal, concentric, isokinetic leg extensions. **Methods:** Eleven men (Mean ± SD; age = 22.9 ± 3.7 years; height = 177.8 ± 6.7 cm; weight = 80.4 ± 7.9 kg) performed 50 BL and UL maximal, concentric, isokinetic leg extensions at 60°·s⁻¹ on separate days. The EMG and MMG from the non-dominant VL were recorded. The EMG AMP, EMG MPF, MMG AMP, MMG MPF and isokinetic peak torque were normalized to their corresponding maximal voluntary isometric contraction values. Every five of the 50 repetitions were averaged together to produce a total of 10 repetitions throughout the fatiguing task. Five separate 2 (Condition [BL and UL]) × 10 (Repetitions [5-50]) repeated measures ANOVAs were performed to examine the normalized EMG AMP, EMG MPF, MMG AMP, MMG MPF, and isokinetic torque. **Results:** The 2 × 10 repeated measures ANOVA for normalized isokinetic torque demonstrated a significant Condition by Repetition Interaction (p < 0.001, η²_p = 0.594). Follow up 1-way ANOVAs demonstrated that for the BL and UL conditions, repetition 5 was significantly greater than repetitions 15-50. There were no interactions, but significant main effects for Repetition with an increase in EMG AMP (p < 0.001; η²_p = 0.255) and decreases in EMG MPF (p < 0.001; η²_p = 0.650), MMG AMP (p < 0.001; η²_p = 0.402), and MMG MPF (p < 0.001; η²_p = 0.796). Additionally, EMG MPF and MMG AMP demonstrated significant main effects for Condition (p = 0.031; η²_p = 0.387 and p = 0.002; η²_p = 0.64, respectively), with BL exhibiting greater values in both parameters. **Conclusion:** The findings of the present study suggested there was greater performance fatigability during UL versus BL leg extensions. Both modalities demonstrated similar patterns of neuromuscular responses, however, the BL condition exhibited a lower decline in action potential conduction velocity (EMG MPF) and lower increases in muscle

stiffness (MMG AMP) than the UL condition. These findings suggested the greater performance fatigability during UL muscle actions may be attributable to peripheral mechanisms of fatigue.

3421 Board #242 May 29 2:30 PM - 4:00 PM
Impact Of Mental Fatigue On Force Control And Muscle Activation

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Mental fatigue (MF) leads to performance declines in tasks requiring force control. However, the neuromuscular mechanisms leading to these declines are not well understood. **PURPOSE:** To determine the effect of MF on the ability to match a target force and identify associated changes in muscle activation in males and females. **METHODS:** Nineteen participants (10 female) performed one 10-s isometric dorsiflexion contraction at 20 and 50% maximum voluntary contraction (MVC) before and after completing 20 min of the psychomotor vigilance task (PVT). The PVT is a sustained attention reaction time (RT) task known to induce MF. Force, indwelling and surface electromyography (sEMG) of the tibialis anterior were measured prior to and immediately following the PVT. **RESULTS:** Mean values for all variables can be found in Table 1. PVT RT and subjective fatigue increased similarly in males and females over time, indicating successful induction of MF. Mean absolute force produced at 20% and 50% MVC increased in males and females from pre- to post-PVT. However, there were no significant changes in the root mean square error of force at either contraction intensity. sEMG amplitude declined after the PVT in the 20% MVC condition with a trend towards declining at 50% MVC in both males and females. This was accompanied by a slowing of motor unit discharge rate after the PVT at 20% MVC in both sexes, but only in males at 50% MVC. **CONCLUSION:** Inducing MF led to changes in mean force of submaximal isometric contractions. This was accompanied by a decline in agonist muscle activity, suggesting alterations to motor control in the presence of MF.

Table 1. Impact of PVT

	Pre-PVT		Post-PVT	
	Female	Male	Female	Male
Reaction time (ms)*	281.31 ± 32.07	270.40 ± 31.79	312.62 ± 37.33	315.85 ± 40.38
Subjective fatigue*	3.50 ± 1.18	2.44 ± 1.01	5.40 ± 1.65	4.44 ± 2.01
Mean force (N)				
20% MVC*	41.37 ± 7.62	45.76 ± 13.19	41.52 ± 8.08	47.09 ± 13.36
50% MVC*	94.36 ± 19.41	105.60 ± 31.01	95.39 ± 19.72	107.59 ± 31.70
RMSE force (%)				
20% MVC	2.32 ± 1.48	2.61 ± 1.46	3.25 ± 2.92	3.27 ± 1.34
50% MVC	6.25 ± 2.61	7.76 ± 4.98	5.78 ± 4.18	5.58 ± 3.27
sEMG (mV)				
20% MVC*	0.41 ± 0.10	0.46 ± 0.09	0.39 ± 0.08	0.43 ± 0.09
50% MVC	0.74 ± 0.36	0.84 ± 0.37	0.66 ± 0.23	0.75 ± 0.31
MUDR (Hz)				
20% MVC*†	15.84 ± 3.20	13.62 ± 2.92	14.60 ± 1.94	11.06 ± 1.66
50% MVC#	18.46 ± 3.03	18.65 ± 5.21	19.56 ± 4.05	15.03 ± 2.60

*main effect of time (p<0.03); †main effect of sex (p=0.01); #interaction (p=0.02). RMSE = root mean square error; sEMG = surface electromyography; MUDR = motor unit discharge rate

3422 Board #243 May 29 2:30 PM - 4:00 PM
Sex Differences In Neuromuscular Fatigue Effects On Intermuscular Control Patterns In Leg Extensors

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Muscles in females tend to be less fatigable than in males. This may be because females have a higher proportion of Type I muscle fibers. It is also possible that females could employ different synergistic activation patterns during sustained

fatiguing contractions. Sex differences in intermuscular control pattern changes following fatigue have not yet been investigated. **Purpose:** To investigate differences in VMO-VL activation level changes *pre-, during and post-fatigue* between females and males. **Method:** Five healthy females and 5 healthy males performed 5 trials of step-up before and after a sustained fatiguing isometric leg extension task of 20% maximal voluntary contraction (MVC). VMO and VL EMG signals were recorded and normalized to percent maximum. **Results:** Males took longer to perform the step-up than females ($P < 0.05$), but the speeds did not change with fatigue. With sexes pooled, the activation levels of both the VMO and the VL during step-up were lowered following fatigue (*pre- vs. post-fatigue*, VMO: 21.2% vs. 16.7% EMG_{max}, VL: 28.3% vs. 21.7% EMG_{max}; both $P < 0.05$). Normalized *pre-fatigue* VL activation levels were lower in males than in females (11.6% vs. 45.0% respectively, $P < 0.05$), whereas *pre-fatigue* VMO levels were similar between the sexes (males: 13.1% vs. females: 29.4% EMG_{max}). After fatigue, there was no difference in VMO and VL activation levels between the sexes, indicating greater fatigue in the VL relative to the VMO in females (activation %_{post} - %_{pre}, female VL vs. VMO: -11% vs. -5%, $P < 0.05$). In males, the VMO and VL fatigued to a similar degree (VL vs. VMO: -2.5% vs. -3.3%). During the sustained isometric fatiguing contraction, the female VL tended to be activated to a greater degree than the VMO, whereas males activated both muscles more equally (VL/VMO activation ratio, 1.55 vs. 0.86, females vs. males, $p = 0.084$). **Conclusion:** Our results show that males and females exhibit different relative VMO-VL neuromuscular fatigue patterns. Females tend to rely more on the VL than the VMO during fatigue while males tend to use both muscles equally.

3423 Board #244 May 29 2:30 PM - 4:00 PM
Quadriceps Function In Chronic Anterior Knee Pain With Or Without A History Of Knee Surgery
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 (No relevant relationships reported)

It is unclear if a history of knee surgery additively affects quadriceps dysfunction in patients with chronic anterior knee pain (AKP). **PURPOSE:** To compare quadriceps function (strength, activation, and power) in chronic AKP patients with or without a history of knee surgery, to matched healthy controls. **METHODS:** Twenty-eight chronic AKP patients with (n=14; ACL reconstruction=5, meniscectomy=4, and both combined=5) or without (n=14) a history of knee surgery, and 20 matched (age, height, mass, BMI, thigh circumference, and physical activity) healthy controls participated in this cross-sectional study (average values of all three groups in the order of demographics listed above: 22 years, 173 cm, 76 kg, 25 kg/m², 57 cm, 235 min/week). Perception and duration of pain, and functional outcomes were also matched between AKP patient groups (4.1/10 cm in visual analogue scale; 41 months; 54/80 score in Lower Extremity Functional Scale). For quadriceps strength, maximal voluntary isometric contraction (MVIC) was obtained. For quadriceps activation and power, central activation ratio (CAR) and rate of torque development during MVIC assessments were calculated. Parametric or non-parametric tests (depends on normal distribution) with calculations of effect sizes [ES] determined the group differences ($p < 0.05$). **RESULTS:** As compared with the matched healthy controls, AKP patients with and without a history knee surgery showed a less quadriceps strength (3.1 vs. 2.2 [1.2] and 1.8 [2.3] N·m/kg, $p < 0.001$) and power (10.1 vs. 7.8 [1.0] and 7.2 [1.1] N·m/kg/s, $p < 0.03$). There were no differences between AKP patient groups in quadriceps strength ($p = 0.15$) and power ($p = 0.79$). A less quadriceps activation was observed in AKP patients without a surgery (0.75 in CAR), as compared with the knee surgery group (0.90 [1.7], $p = 0.002$) and healthy controls (0.96 [3.0], $p < 0.0001$). **CONCLUSION:** Both chronic AKP patient groups showed a similar amount of strength deficit that an experience of knee surgery does not appear to result in a summative effect. Central activation closed to normal (0.90 in CAR) in chronic AKP patients with a past surgical history may suggest that peripherally mediated inhibition plays a bigger role in their quadriceps weakness. Supported by the National Research Foundation of Korea (NRF-2017S1A8022854).

3424 Board #245 May 29 2:30 PM - 4:00 PM
Abstract Withdrawn

3425 Board #246 May 29 2:30 PM - 4:00 PM
Muscle Activation Signal Decay
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Muscle activation can be measured through a technique called muscle functional magnetic resonance imaging (mfMRI), which uses T2 signal decay in muscle tissue to

measure activation. This method allows for activation of deep muscles to be measured in a noninvasive way. However, this method requires users to account for the intensity of subjects' previous activity and allow for sufficient rest time to assure the accuracy of measurements.

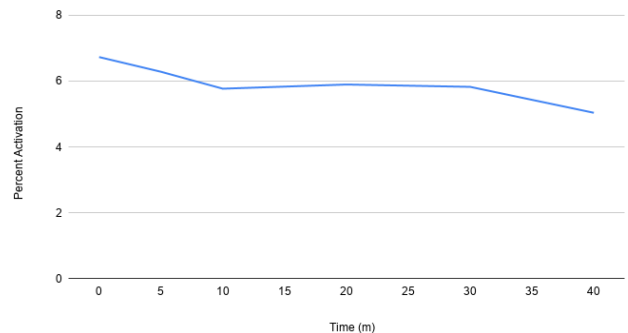
Purpose: To determine a method to assess calf muscle activation from a single bout of walking.

Methods: Four participants (female=2; 20-25 y) having had minimal activity prior in the day rested their legs for over an hour to assure the calf muscle activation had completely returned to baseline prior to scanning. A pre-exercise scan of the participants right calf muscle was performed to measure baseline activation. Participants then walked barefoot on a treadmill at a brisk pace (~3.5mph) for 15 mins. Immediately after, they were scanned in the same location of the calf every 2 mins for the next 45 mins.

Results: There was an average 6.7% increase in activation ($p = 0.02$), of the four calf muscle groups being tracked, after 15 min of barefoot walking. Muscle activation signal slowly decreased for 10 mins before plateauing at around 5.7% activation above the pre-exercise levels ($p < 0.07$). This post exercise activation level remained relatively constant for over 30 mins.

Conclusion: Muscle activation from walking can be accurately measured immediately after exercise but continued measurements taken after 10 mins of scanning, post-low intensity exercise, may be affected by factors related to the MRI scanning procedure and not changes in actual muscle activation. This post exercise activation level plateau may be due to tissue heating or other factors related to prolonged scanning.

Signal Decay of Muscle Activation



3426 Board #247 May 29 2:30 PM - 4:00 PM
Corticomotor Network Activity Does Not Contribute To The Bilateral Deficit Phenomenon
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 (No relevant relationships reported)

The bilateral deficit (BLD) phenomenon is an inability to maximally contract bilaterally as compared to the sum of the corresponding unilateral contractions, and is expressed as an index (BI). The underlying mechanism is unknown, but altered transcallosal inhibition (TCI) and diminished voluntary activation (VA) during bilateral homologous (BH), as compared to bilateral non-homologous (BNH) and unilateral tasks, is considered the most likely mechanism. **PURPOSE:** To examine corticospinal activity during BH, BNH, and unilateral maximal contractions, and resultant changes from task practice. **METHODS:** Eleven healthy adults (6 women/5 men, 25.6±3.7years; 171.81±11.44cm; 74.4±21.2kg) participated in the counterbalanced repeated measures study. TCI and VA were assessed with transcranial magnetic stimulation for BH, BNH, and unilateral dominant flexion (DF) sessions 1 and 7. For sessions 2-6, five of each BH elbow flexion, BNH flexion/extension, and DF maximal voluntary isometric contraction (MVIC) tasks were practiced. Paired t-tests or Wilcoxon signed-rank tests, as appropriate, were used to test TCI and VA between sessions 1 and 7. Pearson or Spearman correlation coefficients, as appropriate, between VA and TCI measures and BLD and peak force measures were used to assess any association between neurological and performance variables on test days 1 and 7. **RESULTS:** There were no differences in VA or TCI between BH, BNH, and DF. BH VA decreased from day 1 (95.14±4.3%) to day 7 (92.2±4.4%, $p = 0.014$), but did not exceed the minimal detectable change (6.47). VA for BH ($r = -0.655$; $p = 0.039$) and DF ($r = -0.636$; $p = 0.035$) was associated with BH BI on day 1. When associated with peak force, day 7 BH ($r = -0.627$, $p = 0.039$) and BNH ($r = -0.682$, $p = 0.021$) TCI was correlated. **CONCLUSION:** BI was similar to prior research, but neurophysiological measures did not explain these differences. This is similar to previous equivocal research between BH and unilateral maximal force and TCI and/or VA, suggesting differences in BH and BNH BI are not solely influenced by neural drive modifications.

Of interest, TCI was highly correlated with force, revealing neurophysiological influence between tasks, but differences in bilateral and unilateral force may be influenced by outside mechanisms.

3427 Board #248 May 29 2:30 PM - 4:00 PM

Electromyographic Activity Of Rolling Mat Pilates Exercises For Intensity Analysis

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There are a discrepancy in relation to the pre-classification intensity of Pilates exercises (PE) and their real impact on muscular activation compromising training prescription. **PURPOSE:** To compare five muscles EMG activation during seven PE. **METHODS:** Surface EMG were recorded for lower (LRA) and upper rectus abdominis (URA), internal (IO) and external obliques (EO) and multifidus (MS) muscles, while seventeen women performed the Rolling Like a Ball basic (RLBbas), Rolling Like a Ball intermediate (RLBint), Rolling Like a Ball advanced (RLBadv), The Seal, Open Leg Rocker (OLR), The Hundred basic, and The Hundred advanced (HDadv) exercises. **RESULTS:** For the URA, LRA, IO and EO muscles, the exercises RLBbas (21.94% ± 7.3; 26.31% ± 9.79; 31.59% ± 11.65; 39.50% ± 13.5, respectively), RLBint (20.72% ± 11.52; 29.27% ± 9.8; 36.76% ± 16.44; 44.91% ± 15.95, respectively), RLBadv (25.20% ± 7.33; 30.89% ± 9.66; 35.35% ± 8.87; 43.88% ± 13.09), SL (24.11% ± 13.53; 33.28% ± 13.87; 35.15% ± 16.37; 37.6% ± 17.24, respectively), OLR (21.91% ± 10.78; 30.94% ± 11.39; 33.65% ± 13.87; 34.26% ± 10.26, respectively) and HDbas (53.92% ± 16.3; 47.92% ± 20.59; 36.54% ± 16.83; 46.64% ± 26.05, respectively) exercises presented significant less EMG percentage when compared to HDadv (71.69% ± 18.03; 75.69% ± 17.44; 57.86% ± 16.49; 88.71% ± 30.40, respectively). Besides, for the URA muscle significant ($p < 0.001$) more EMG percentage was found comparing the HDbas to the RLBbas, RLBint, RLBadv, SL and OLR exercises. Furthermore, for the MS muscle, significant greater EMG was found when compared the RLBbas (27.59% ± 10.95), RLBint (27.68% ± 12.9), RLBadv (32.26% ± 13.29) and SL (32.1% ± 13.81) exercises to the HDbas (7.89% ± 3.20; $p < 0.001$) and HDadv (9.89 ± 3.08; $p = 0.001$; $p < 0.001$; $p = 0.002$, respectively) exercises. **CONCLUSIONS:** The HDadv was the most effective exercise in producing muscle activity of the spinal flexors, while the other exercises could be grouped at the same moderate level of intensity for the LRA, URA, IO and EO muscles. Contrary to the current PE prescription, the RLBbas, RLBint, RLBadv and SL exercises, although indicated as spinal flexors exercises (less than 30% of maximum for spinal flexor muscles), seem to play a more significant role in the activation of MS, resulting in a moderate EMG activation. Supported by Capes and CNPq.

3428 Board #249 May 29 2:30 PM - 4:00 PM

Comparison Of Fascicle Behaviors Between Superficial And Deeper Muscles Of Triceps Brachii During Isometric Contractions

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(No relevant relationships reported)

Fascicle length and pennation angles during muscle contraction are often used in biomechanical models of the muscle-tendon complex to understand the functional roles of muscles and tendinous tissues. However, previous studies have focused on the lower limb muscles, information on fascicle behavior of the upper limb muscles is missing. **PURPOSE:** Ando et al. (2016) showed different between superficial and deeper muscles of the lower extremities in humans; however, the muscles of the upper limbs have not been examined in previous studies. The purpose of this study was to assess whether the fascicle behaviors of the upper extremities are similar to those of the lower extremities during isometric contractions. **METHODS:** Thirteen healthy men and women performed isometric elbow extension tasks at 50% and 75% of maximal voluntary contraction (MVC) at 60°, 90°, and 120° of elbow extension (full extension = 180°). Extended field-of-view (EFOV) B-mode ultrasonography was used to obtain sagittal plane panoramic images of the long head (TB-Long) and medial head (TB-Med) of the triceps brachii at rest and during contraction; fascicle length and pennation angle were measured. **RESULTS:** In the TB-Long, significant fascicle shortening from rest was found during 50% (8.7 ± 0.3 to 7.6 ± 0.3 cm, $P < 0.05$) and 75%MVC (8.7 ± 0.3 to 7.5 ± 0.3 cm, $P < 0.05$) at 60° and during 75%MVC (8.2 ± 0.3 to 7.2 ± 0.2 cm, $P < 0.05$) at 90° of extension. There was no significant fascicle shortening in the TB-Med muscle under any conditions. There was no significant pennation angle change from rest in either muscle. The pennation angle of the TB-Long (e.g. rest, $12.9 \pm 0.8^\circ$ at 90°) was significantly greater than that of the TB-Med (e.g. rest, $9.3 \pm 0.5^\circ$ at 90°) under all conditions. **CONCLUSION:** These results suggest that fascicle shortening

in the TB-Long muscle occurs in flexion; however, no change was found in the TB-Med. Different MTC features between superficial and deep muscles will be developed in the upper limbs, as shown in lower limb muscles. Supported by a Grant-in-Aid for Scientific Research (B) from the Ministry of Education, Culture, Sports, Science and Technology Grants (17H02142)

3429 Board #250 May 29 2:30 PM - 4:00 PM

Kinetics And Kinematics Of Isoinertial Ballistic Contractions In Older Adults

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Regular resistance training (RT) is recommended for older adults to help offset age-induced declines in neuromuscular performance (e.g. power, force and velocity). However, there is limited research comparing the kinetics (force) and kinematics (velocity and power) of different types of RT contractions, and specifically concentric only (CON-ONLY) and eccentric-concentric (ECC-CON) contractions aiming to throw the load as far as possible. **PURPOSE:** To compare the kinetics and kinematics of ballistic contractions performed as CON-ONLY (explosive concentric contraction performed from rest) vs ECC-CON (a prior controlled eccentric lowering of the load followed by an explosive concentric contraction) in an older adult population. **METHODS:** Twelve healthy active older adult males (age: 66 ± 5 yrs; height: 1.81 ± 0.1 m; body mass: 78.5 ± 11.0 kg; activity: 2175 ± 1450 MET-min-week) completed 3 sessions (1 familiarisation and 2 measurement) using an instrumented isoinertial (30°) leg press dynamometer that facilitated recording of force and displacement that were used to derive velocity and power. Participants performed a series of attempts using both types of contraction (CON-ONLY and ECC-CON: counterbalanced) with a range of loads in ascending order during each measurement session (day 1: 20, 35 and 50; day 2: 50, 65 and 80%1RM). **RESULTS:** No main effect for contraction ($p > 0.05$) was found for peak power or peak velocity across loads. A main contraction effect was found for peak force ($p = 0.012$), with post hoc analysis revealing no difference ($p > 0.05$) between contractions at any load. A main effect for contraction type was found for mean power ($p = 0.016$) and mean velocity ($p < 0.01$), with post hoc analysis revealing that mean power was higher for ECC-CON at 65% (310 vs. 430 W, $+23.0\%$, $p < 0.01$) and 80%1RM (229 vs. 337 W, 47.3% , $p < 0.01$). Mean velocity was higher in ECC-CON across all loads ($+13.7$ - 49.5% ; all $p < 0.01$). **CONCLUSIONS:** CON-ONLY and ECC-CON ballistic contractions produced similar peak neuromuscular performance in an older adult population. However, ECC-CON contractions involved greater mean power and mean velocity. In conclusion, it may be beneficial for older adults to perform ECC-CON contractions as they provide equivocal peak neuromuscular performance as CON-ONLY, but superior mean neuromuscular performance.

F-64 Free Communication/Poster - Posture and Balance

Friday, May 29, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

3430 Board #251 May 29 2:30 PM - 4:00 PM

Reliability Of The Repeated Unilateral Partial Squat As A Neuromuscular Control Screening Activity

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PURPOSE: A single leg squat task is often used to assess dynamic strength, flexibility, coordination and balance of an athlete. The composite of these physical components provides insight to the clinician about an athlete's overall neuromuscular control. However, the variation in the non-weight bearing limb's position influences body alignment causing variability in movement patterns. The repeated unilateral partial squat (RUPS) activity is designed in hopes to limit this variability. The purpose of this study is to assess the within-subject kinematic repeatability of the RUPS activity. **METHODS:** A 20 Vicon MX™ T-series motion capture system (240 Hz) was used to construct a 15-segment model of 33 study consenting female adolescent athletes (mean age = 17.4 ± 3.1 y). Each stood on one leg at the edge of a 20-cm box, with opposite

limb dangling straight. The subject lowered the contralateral limb without ground contact for 5 repetitions in a row. Peak pelvis drop and lower limb joint angles at the time of peak knee flexion were calculated using Visual 3D™ biomechanics software. After a practice trial, 1 trial was performed on each limb with 3 of the 5 repetitions included in an ICC two-way mixed effects evaluation of kinematics repeatability reliability. **RESULTS:** Joint kinematics across the ankle, knee, hip, trunk and pelvis demonstrated good to excellent repeatability reliability with consistent levels of within item variability (Table 1). Peak knee, hip and trunk flexion and the position of the non-weight bearing limb demonstrated good to excellent consistency. The frontal plane measures, such as pelvis and trunk lateral flexion and hip adduction demonstrated good consistency (Table 1). **CONCLUSIONS:** Results demonstrate good to excellent repeatable kinematics during the RUPS activity especially in the sagittal plane. Findings of this repeatability study suggest that the RUPS may be a possible neuromuscular control screening tool for similar healthy athletes.

Table 1. Joint angle calculations at time of peak knee flexion across 3 repetitions of the repeated unilateral partial squat task

Measure	Mean (variance)	Cronbach's a	ICC
Ankle dorsiflexion(+)plantar (-)	35.339 (0.002)	0.959	ICC3,1=0.889 (0.837-0.928), p<0.0001
Ankle eversion (+)inversion (-)	3.032 (0.009)	0.983	ICC3,1=0.951 (0.927-0.969), p<0.0001
Ankle pronation (+)supination(-)	8.107 (0.005)	0.954	ICC3,1=0.874 (0.816-0.918), p<0.0001
Knee flexion (+)extension (-)	57.876 (0.004)	0.972	ICC3,1=0.921 (0.883-0.949), p<0.0001
Knee valgus (+)varus(-)	3.159 (0.001)	0.995	ICC3,1=0.986 (0.978-0.991), p<0.0001
Knee internal (+)external rotation (-)	2.715 (0.031)	0.967	ICC3,1=0.909 (0.865-0.941), p<0.0001
Hip flexion (+)extension (-)	36.519 (0.154)	0.987	ICC3,1=0.962 (0.943-0.976), p<0.0001
Hip abduction (+)adduction (-)	-15.36 (0.026)	0.958	ICC3,1=0.885 (0.831-0.925), p<0.0001
Hip external (+)internal rotation (-)	1.477 (0.002)	0.972	ICC3,1=0.921 (0.882-0.949), p<0.0001
Pelvis flexion (+)extension (-)	-7.686 (0.101)	0.987	ICC3,1=0.959 (0.938-0.974), p<0.0001
Pelvis lateral flexion	0.422 (0.018)	0.951	ICC3,1=0.867 (0.806-0.913), p<0.0001
Trunk flexion (+)extension (-)	-0.122 (0.037)	0.990	ICC3,1=0.989 (0.954-0.981), p<0.0001
Trunk lateral flexion	0.12 (0.003)	0.951	ICC3,1=0.868 (0.808-0.914), p<0.0001
Contralateral hip flexion (+)extension (-)	17.906 (0.120)	0.985	ICC3,1=0.954 (0.931-0.971), p<0.0001
Contralateral hip abduction (+)adduction (-)	1.93 (0.045)	0.959	ICC3,1=0.885 (0.832-0.925), p<0.0001

3431 Board #252 May 29 2:30 PM - 4:00 PM
Relationship Of Mets And Muscle Engagement To Learning Of Yoga Postures

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PURPOSE: We are developing an exergame that provides real-time assessment of performance for yoga postures by measuring basic physiologic parameters analyzed to assess yoga skill acquisition as a means to promote healthy physical activity and wellness.
METHODS: A convenience sample of 20 adult students in a college yoga course were recorded by a Microsoft Kinect 3D digital camera attached to a PC while following instructions from a yoga instructor. Three yoga sessions scheduled as pre-test, mid-way and a post-test were captured during the regularly scheduled yoga class which met twice weekly for 75 minutes, over a 10-week period. In addition for a positive control, we recorded six yoga instructors performing the same series of five yoga postures as the “gold standard” for training using a machine learning classifier. Scoring of frames were performed by at least two yoga instructors. We examined various statistical functions derived from raw frame scores of false and true positives and negatives. The statistical measure of sensitivity showed consistent increasing trends for *Mountain*, *Forward Bend*, and *Upward Salute* postures. For *Mountain*, sensitivity went from 0.78 to 0.87, while the expert’s test clips scored 0.94. Which suggests greater training has occurred as the student postures were closer to the yoga instructor’s poses as the “gold standard”. VO₂ was measured as METS.
RESULTS: We found more difficult or strenuous yoga postures measured higher METS. Repeated Measures analysis of posture learning found significance for majority of yoga postures. We sought to determine if different yoga poses that scored easier to learn based on the linear fit slope of sensitivity correlate with muscle-skeleton complexity of that pose as estimated with total engaged muscle mass. Using literature values of estimated standard muscle masses and identity of muscle engagements in a yoga pose, we ranked yoga poses by total muscle mass engaged. From linear fit slopes, the hardest to learn are *Upward Salute* and *Side Bend* poses, while *Forward Bend* was easiest with greatest slope of learning.
CONCLUSIONS: We developed a score based on the muscle-skeleton complexity of that pose from engaged muscle masses. We find that engaged muscle mass relates to the magnitude of VO₂ and that the greater the engaged muscle mass the easier the posture is to learn.

3432 Board #253 May 29 2:30 PM - 4:00 PM
Visual Biofeedback Improves Balance Control... Until It Doesn'T

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PURPOSE: Visual feedback of one’s balance has potential to augment balance training. However, natural visual cues of the environment already provide robust stabilization, and therefore additional visual biofeedback may have little effect on body sway. We quantified the extent to which different types of visual feedback influence sway in a novel trunk balancing task. **METHODS:** Twelve healthy young adults sat on a motorized bench that tilted up and down in direct proportion to trunk sway. This paradigm greatly increases the difficulty of the balance task and requires subjects to rely on visual and vestibular systems. In each trial, participants were provided different types visual feedback through a rotating needle-gage display on a 15 by 20 cm computer monitor located 0.85 m in front of the participant. Trials lasted 100 s, were randomly ordered, and included direct feedback (needle rotated in proportion to body sway), inverted feedback (needle rotated in the opposite direction of sway), time delayed feedback (0.5 s), random feedback RF, eyes closed, and control (eyes open with screen off). Participants were informed “visual feedback might be helpful”. **RESULTS:** Direct feedback trials had a large and significant (p<.05) impact on sway resulting in lower positional variability (root-mean-square, RMS): 62% of control trials. Despite moving in the opposite direction, inverted feedback also reduced sway to appreciable amounts of 80% RMS compared to control, but was not statistically significant. Time delayed feedback only reduced sway to 90% of control RMS. In contrast, random feedback actually significantly (p<.05) increased participants’ sway by 44%, similar to the anticipated significant (p<.05) increases in sway in the eyes closed trial (90% increase). RMS velocity was less impacted by visual feedback with only eyes closed trials associated with significant changes. **CONCLUSION:** Real-time position-based visual feedback had a powerful effect on balance, reducing body sway, while random feedback increased sway. Interestingly, even when participants were trying to ignore the random feedback, it still increased body sway. Results suggest that carefully selected real-time visual feedback could be useful in augmenting balance training during challenging balance tasks. Funding: NSF DARE 1803714

3433 Board #254 May 29 2:30 PM - 4:00 PM
NOT JUST A FOOTWEDGE - GOLF SPECIFIC FOOTWEAR AND ITS EFFECTS ON HUMAN BALANCE

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Golfers represent a unique situation in terms of postural control, in that during a normal round of golf, players are on their feet for close to four hours. Several golf specific footwear are available. However, little is known about how these types of golf footwear affect neuromuscular control of the lower extremities over prolonged periods of standing and walking. **PURPOSE:** To examine the effects of duration of walking/standing while barefoot (BF) and wearing a dress shoe (DS), tennis shoe (TS), and minimalist (MIN) style golf shoe, on muscle activity of the lower extremity during standing postural control. **METHODS:** Six male adults completed this study. Standing balance was recorded under six different conditions: eyes open (EO), eyes closed (EC), eyes open sway referenced vision (EOSRV), eyes open sway referenced platform (EOSRP), eyes closed sway referenced platform (ECSR), and eyes open sway referenced vision and platform (EOSRVP). Surface electromyography (EMG) was recorded during balance testing from the left leg vastus medialis (Q), and semitendinosus (H). Raw EMG data were collected at 1,500 Hz, Band-pass filtered (20-250Hz) and rectified prior to analysis. Variables of interest were the mean muscle activity (mV) of each muscle. The testing sessions consisted of a counterbalanced allocation of footwear over 4 separate testing days, separated by at least 48 hours. Each session included muscle activity measures during standing balance every 60 minutes, for 4 hours (pre, 60, 120, 180, 240 minutes). A 4x5 repeated measures ANOVA was used, with an alpha level of 0.05. **RESULTS:** A significant interaction was observed in the EOSRV condition for Q (F(12,60) = 1.945, p = 0.05), suggesting that at 60 minutes, the MIN condition was significantly higher than BF and TS (5.60 > 2.45 & 3.515). Further, a significant interaction was observed in the EOSRP condition for

H ($F(12,60) = 2.057, p = 0.03$). This interaction suggests that at 180 minutes, the DS was significantly higher than the MIN ($3.980 > 1.812$). **CONCLUSION:** The current results suggest that standing postural control measures are altered by footwear differences. Over time it appears that some footwear may cause balance strategy changes possibly due to increased workload on the lower extremity.

3434 Board #255 May 29 2:30 PM - 4:00 PM
Correlation Between Pelvic Tilt Angle, Hip Range Of Motion And Hip Muscles Torque Ratios
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Anterior pelvic tilt is associated with excessive foot pronation, excessive hip internal rotation (HIR), and knee valgus, which may lead to hip muscles strains, sciatic nerve compressions, and sacroiliac and lumbosacral joint instability. Posterior pelvic tilt is associated with feet supination and increased hip external rotation (HER), which may lead to tibial stress fractures, medial tibial stress syndrome, knee pain, anterior cruciate ligament injury, and low back pain. Hip adductors/abductors (add/abd) torque ratio (TR) below 80%, was associated with adductor strains. The average hip flexors/extensors (flex/ext) TR in sport performance was found to be 70%. There is a lack of evidence that correlates pelvic tilt angle with limited HIR, HER, add/abd TR, and flex/ext TR. **PURPOSE:** to examine the correlation between natural pelvic tilt angle and HIR, HER, add/abd TR, and flex/ext TR. **METHODS:** Twenty-six subjects participated in this study, fifteen females (22.0 ± 2.8 years old, 163.5 ± 7.5 cm, 65.9 ± 10.4 kg) and eleven males (22.0 ± 2.2 years old, 178.5 ± 4.5 cm, 78.4 ± 8.7 kg). Using a 3D motion analysis system, the measurement of both natural pelvic tilt (NPT) in standing natural position and HIR and HER in lunge position, for the right and left limbs, were recorded. Hip torques were collected with an isokinetic dynamometer, five trials at 30 deg/s and at 60 deg/s. **RESULTS:** The mean value for NPT was 5.7 ± 5.4 deg. There were no significant correlations between NPT and the dependent variables for the right limb: HIR ($r = -0.16, p = 0.43$), HER ($r = -0.11, p = 0.58$), add/abd TR at 30 deg/s ($r = -0.19, p = 0.34$), add/abd TR at 60 deg/s ($r = -0.13, p = 0.51$), flex/ext TR at 30 deg/s ($r = 0.32, p = 0.10$) and flex/ext TR at 60 deg/s ($r = -0.70, p = 0.70$). Similar results were observed for the left limb: HIR ($r = -0.20, p = 0.89$), HER ($r = -0.25, p = 0.21$), add/abd TR at 30 deg/s ($r = -0.17, p = 0.38$), add/abd TR at 60 deg/s ($r = -0.12, p = 0.55$), flex/ext TR at 30 deg/s ($r = 0.60, p = 0.75$) and flex/ext TR at 60 deg/s ($r = -0.19, p = 0.33$). **CONCLUSION:** the measurement of NPT angle in standing natural position is not a good predictor of HIR, HER, add/abd TR, and flex/ext TR. Future research should look at these relations during functional dynamic movements and during pelvic tilt end range of motion.

3435 Board #256 May 29 2:30 PM - 4:00 PM
Effects Of Hip Range Of Motion On Balance With Presence Or Absence Of A Warm-up
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 (No relevant relationships reported)

Baseline balance assessments are commonplace in the athletic training field. They are used in comparison with re-evaluations to determine if an injury has occurred. **PURPOSE:** The specific aim of this study was to evaluate in what manner a warm-up effected hip range of motion (ROM) and balance testing in a collegiate population. The significance of this study is to reduce the inconsistencies surrounding baseline balance assessments. Currently there is limited research looking into how hip ROM directly impacts balance. **METHODS:** Data was collected from a total of 16 participants. Participants completed two testing periods under the condition of a biking protocol or a waiting protocol. The biking protocol required participants to cycle on an ergometric bike for 20 minutes at 3-5 METs, while the waiting protocol required no movement for 20 minutes. Immediately following each protocol, a manual goniometer was used to collect ROM values for hip flexion, extension, abduction, and internal and external rotation. The two balance assessments were then completed. Test one consisted of the Balance Error Scoring System (BESS) with the second test utilizing a baseline balance test with the use of force plate technology. Hip ROM values and balance scores were compared between the two conditions. **RESULTS:** A Shapiro test was used to ensure the sample points were approximately normally distributed for the differences between the matched pairs. The flexion values for the left (p -value $< .008$) and right (p -value $< .01$) hip joints were found to be significant. All other hip ROM values demonstrated no significance. Significance was found for total errors of the BESS (p -value $< .01$). No significance was recorded for the force plate balance test. **CONCLUSION:** These results demonstrate the presence of a warm-up increased hip flexion range of motion in both hip joints and also impacted BESS balance scores. In conclusion, this suggests the addition of a warm-up to baseline balance assessment. A larger sample size is needed to further validate these findings.

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3436 Board #257 May 29 2:30 PM - 4:00 PM
Stroboscopic Vision-induced Sensory Re-weighting During Dynamic Postural Control
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Three main sensory systems (somatosensory, visual, and vestibular) contribute to human postural control. These three sensory systems can compensate for each other if one of them lose their orientation information. Adjusting sensory input is referred to as sensory re-weighting. However, due to experimental limits, little is known how disrupted vision affects sensory re-weighting during dynamic postural control. **PURPOSE:** Therefore, this study examined the effect of impaired visual sensory input on dynamic postural control through the use of stroboscopic glasses. **METHODS:** Subjects were 24 physically active adults (male: 12, female: 12, height: 172.1 ± 7.8 cm, weight: 67.5 ± 10.4 kg) recruited from a university population, aged 18-35 years. Each subject performed the star excursion balance test (SEBT), which includes 3 trials comprised of 3 directions (anterior, posteromedial: PM, and posterolateral: PL) on each visual condition (eyes open: EO, Low Strobe frequency Vision: LSV, High Strobe frequency Vision: HSV) Each trial and visual condition was run on both firm and foam surface. Reach distance was analyzed by 2 (surface conditions) \times 3 (vision conditions) ANOVAs. **RESULTS:** In surface condition main effects, subjects performed significantly ($p < .05$) shorter reach distances (anterior, PM, and PL). In vision condition main effects, subjects with EO performed significantly lower reach distances in the PM direction than HSV and LSV ($p < .05$, both), and subjects demonstrated shorter reach distance with EO than with LSV in PL direction ($p < .05$). Only with HSV, subjects performed shorter reach distance on the foam surface than the firm surface ($p < .05$). **CONCLUSIONS:** People with impaired visual sensory (strobe vision) input and/or unstable surface tend to have decreased dynamic postural control when tasked to move in a medial and lateral direction. People also demonstrated higher reliance on visual information when the somatosensory function is disturbed. The stroboscopic glasses may be used to identify the reliance of visual information in people who have an altered or reduced somatosensory system.

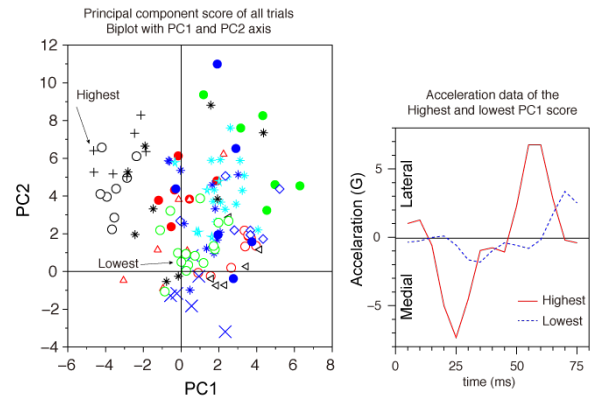
3437 Board #258 May 29 2:30 PM - 4:00 PM
Effect Of Postural Control And Exertion On Dynamic Visual Acuity In Collegiate Athletes.
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Dynamic visual acuity (DVA) requires visuo-perceptual processing to resolve the critical details of a target in motion. Athletes demonstrate superior DVA performance compared to non-athletes in a seated position. **PURPOSE:** To investigate the effects of different postures and exertion levels on DVA in athletes. **METHODS:** Varsity rugby players ($n = 10$; female = 6; age = 20.4 yrs ± 1.4) without recent concussion (> 2 years) and/or vestibular-ocular abnormalities were included. DVA was assessed using a custom program (moV&V&MP, University of Waterloo, Ontario) displayed on a 55" LCD monitor at a viewing distance of 4m. The program presented a randomly (RW) or horizontally (H) moving letter 'E' target facing left/right/up/down. Participants had to correctly identify the orientation of the target with a keypad as it progressively reduced in size. DVA was scored as the log of the minimum angle of resolution (LogMAR), of the smallest target correctly identified (i.e., low score = better DVA). Participants completed one RW and H trial at a speed of 2.31m/s (30° /s) during four conditions: seated; standing; and treadmill walking at low (85-100 beats per minute [bpm]) and moderate (115-130bpm) intensities. **RESULTS:** The difference in LogMAR scores from the seated condition were calculated for each of the other conditions. There were no interaction effects of target motion and posture ($F = 1.02, p = .382$), and no main effect of target motion ($F = 0.30, p = .598$). However, there was a trending main effect of posture (Stand: 0.00 vs. Walk Low: -0.14 vs. Walk Mod: 0.04 $p = .056, f = 0.25$). These findings indicate that athletes' DVA improved from seated during moderate intensity treadmill walking more so than both standing and low-intensity treadmill walking. **CONCLUSION:** Athletes appear to have improved DVA in sport-specific conditions of greater postural and exertional demands. Therefore, sport training experience may enhance visuo-perceptual skills. These findings may inform clinicians to consider the assessment of DVA with progressive, dynamic contexts for rehabilitation, such as for return to sport from concussion.

3438 Board #259 May 29 2:30 PM - 4:00 PM
Comparison Of Balance Between Middle-aged Adult Olympic Weightlifters And Runners

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Beginning at about middle-age (e.g., 40 to 50yrs), notable declines in strength, balance and functional performance begin to occur; however, participation in physical activity has been demonstrated to slow down the progression of these age-related declines. Middle-age runners (RUN) are demonstrated to exhibit superior balance compared to healthy age-matched counterparts. Whether similar balance benefits occur in middle-age Olympic weightlifters (OWL) has not been studied. **PURPOSE:** To compare balance performance between middle-age adults regularly participating in either OWL or RUN. **METHODS:** A total of 48 National Masters Olympic Weightlifting competitors (22 females, 47.3±8.5yrs) and 42 (17 females, 47.7±8.5yrs) distance RUN who were training at least 30km/week participated in two 30s balance testing trials on firm (FI) and foam (FO) surfaces with eyes open (EO) and eyes closed (EC). Medial-lateral center of pressure velocities (MLCPV) were averaged across trials for each condition and natural logarithm transformed to reduce positive skewness. Bivariate coefficients (separate by group) between age, height, mass, years of experience, and body mass index (BMI) with MLCPV were performed followed by a three factor (exercise group x gender x condition) repeated measures analysis of variance. **RESULTS:** No significant ($P>0.08$) relationships for the OWL between MLCPV and age, height, mass, BMI and experience ($r = -.230$ to $.211$) were revealed. For the RUN, age was significantly related ($P=0.043$) to MLCPV across all four conditions ($r = .313$ to $.360$). While there were no significant differences between the groups for either EO-FI ($P=0.143$, $d = .34$) or EO-FO ($P=0.209$, $d = .26$), the OWL demonstrated significantly better balance (lower MLCPV) than the RUN for both EC-FI ($P=0.009$, $d = .59$) and EC-FO ($P=0.001$, $d = .70$). There were no significant differences related to gender ($P>0.05$). **CONCLUSIONS:** The most salient result was the identification of better balance performance by the OWL, particularly when visual inputs were unavailable, compared to the RUN. As Olympic weightlifting involves high-velocity whole-body movements, the OWL may develop an enhanced ability to utilize vestibular and somatosensory inputs to compensate for the absence of visual information.



3439 Board #260 May 29 2:30 PM - 4:00 PM
Classification Of Lower Limb Frontal Plane Excursion During Single-legged Landing Using Principal Component Analysis Of Inertia Sensor Data

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 (No relevant relationships reported)

PURPOSE: This study aimed to evaluate the temporal pattern of the frontal-plane lower limb translation during single-legged landing using the principal component analysis (PCA) of the inertial sensor data. **METHODS:** Eighteen legs from nine healthy women were tested. Participants performed a total of six single-legged landings for each leg. The wearable inertial sensor was fixed at the participant's tibial tuberosity. The x-axis of the inertia sensor was aligned to the transverse axis of the shank segment, and the mediolateral acceleration of the proximal end of the shank segment was measured at 200Hz. The time window of interest was 0 to 75 ms after foot contact (15 data points). The acceleration data matrix (108 trials * 15 data point) from all trials of all participants was constructed for PCA. Eigenvalues and eigenvectors of the covariance matrix of the acceleration data matrix were calculated to identify the principal components (PC). **RESULTS:** The first two PCs explained more than 90% of total data variation (1st PC 69.7%, and 2nd PC 21.7%). The 1st PC represented the medially directed abrupt acceleration of the proximal shank, and the 2nd PC showed the slow but oscillated knee motion. The athlete of the highest PC score of the 1st PC showed a rapid medial knee motion just after foot impact, whereas the lowest one showed a stable knee motion after landing. **CONCLUSIONS:** PCA using acceleration signals successfully classified the degree of the medial knee translation after single-legged landing and screened the athletes who had a rapid medial knee translation. The abrupt increase of the medial knee translation has reported being a risk of non-contact anterior cruciate ligament (ACL) injury; therefore, the PCA based evaluation would be a useful technology for risk prediction of the non-contact ACL injury.

3440 Board #261 May 29 2:30 PM - 4:00 PM
Gathering Your 'Sea Legs': Changes In Postural Control Following Extended Duration In An Offshore Environment

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 (No relevant relationships reported)

Mal de débarquement (MdD) is the subjective perception of self-motion experienced after prolonged episodes of passive motion (PM) such as a boat ride (e.g. sea legs). Transient MdD (< 48 hours) occurs frequently and is described as a rocking, bobbing, or swaying sensation accompanied by unsteadiness and disequilibrium after cessation of the PM stimulus, and is suggested to impact postural control. **PURPOSE:** To examine changes in postural control after prolonged exposure to boat movement at sea. **METHODS:** Postural control of 24 adults (13 M, 11 F; age = 35 ± 12 y; height = 170.3 ± 8.8 cm; mass = 84.2 ± 17.0 kg) was assessed in bilateral stance on a force platform with eyes open (EO), eyes closed (EC), foam surface eyes open (FEO), and foam surface eyes closed (FEC) before (PRE) and after (POST) a 7-hour deep sea fishing excursion. Postural control measurements including average sway (cm), sway range (cm), sway velocity (cm/s), and maximum sway velocity (cm/s) were analyzed in the medial/lateral (ML) and anterior/posterior (AP) directions. Time-to-boundary (TTB) measures of postural control (minimum, average, SD of minima) were computed. All variables were compared PRE/POST using a paired *t*-test and Cohen's *d* effect sizes were calculated. **RESULTS:** Greater ML sway excursion was observed POST in EC ($t = 2.37$, $p = .013$, $d = 0.66$, PRE = 0.13 ± 0.04, POST = 0.18 ± 0.10), FEO ($t = 2.95$, $p = .004$, $d = 0.46$, PRE = 0.40 ± 0.14, POST = 0.47 ± 0.17), and FEC ($t = 2.03$, $p = .027$, $d = 0.42$, PRE = 0.50 ± 0.12, POST = 0.55 ± 0.15). Greater AP sway excursion was observed POST in FEO ($t = 1.77$, $p = 0.045$, $d = 0.38$, PRE = 0.63 ± 0.17, POST = 0.72 ± 0.30) and FEC ($t = 2.18$, $p = 0.02$, $d = 0.48$, PRE = 0.87 ± 0.21, POST = 0.98 ± 0.24). ML sway range ($t = 3.34$, $p = .001$, $d = 0.54$, PRE = 2.42 ± 0.66, POST = 2.87 ± 0.99) and AP sway range ($t = 2.18$, $p = 0.020$, $d = 0.53$, PRE = 4.01 ± 0.80, POST = 4.64 ± 1.56) increased POST in FEO. Maximum AP sway velocity increased POST in EO ($t = 1.73$, $p = 0.049$, $d = 0.45$, PRE = 4.20 ± 1.26 cm/s, POST = 5.14 ± 2.93 cm/s). Analysis of TTB measures did not reveal PRE/POST differences among any condition. **CONCLUSION:** Extended durations on a boat at sea increase postural sway upon returning to land. These findings suggest that 'sea legs' impairs the ability to re-weight appropriate sensory information in conditions dependent on somatosensory and vestibular feedback.

3441 Board #262 May 29 2:30 PM - 4:00 PM
Reactive Balance Differences Between Collegiate Sports

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Static and dynamic postural stability have been characterized in athletes and shown to differ across sports. However, these tests of stability may not specifically capture the

balance required for reactive athletic movements. The Push-and-Release (P&R) test is a standardized clinical tool used to assess reactive postural control in balance-impaired populations.

PURPOSE: To examine differences between sport team and task (single [ST] and dual task [DT]) in reactive postural response measures.

METHODS: 40 healthy, male athletes (age 18.50 ± 0.75 ; body mass index [BMI] 24.11 ± 2.38) were recruited from 3 collegiate teams: baseball ($n=12$), lacrosse ($n=17$), and swimming ($n=11$). Reactive postural responses were assessed using the P&R in backward and forward directions under ST and DT (concurrent verbal cognitive task) conditions. All conditions were performed with eyes closed. Inertial sensors on the sternum, lumbar, feet, and right tibia were used to assess step latency (L), time of first heel contact (HC), and time to stabilization (TTS). A sensor on the tester's hand was used to determine release time. To assess if postural response measures differ by sport and task, linear mixed effects models with random intercepts and stratified by direction (forward or backward), were used and adjusted for age and BMI.

RESULTS: Lacrosse players had faster L compared to baseball players in the forward direction ($p=0.018$). No other differences by sport were observed. In the forward direction, DT outcomes were slower than ST outcomes (L: $p<0.0001$; HC: $p=0.0004$; TTS: $p=0.0064$). In the backward direction, L was slower in the DT condition ($p=0.0034$), but no task differences were found for HC or TTS ($p=0.0628$ and $p=0.8733$, respectively).

CONCLUSION: In the forward direction only, DT slowed all postural responses. While L differed between lacrosse and baseball in the forward direction, no other differences were found across sports. As most outcomes were unaffected by sport, the P&R may be a clinically relevant assessment in athletics. However, due to the limited sample size, caution should be applied when interpreting these findings and future studies are needed.

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3442 Board #263 May 29 2:30 PM - 4:00 PM
Reactive Postural Responses In Collegiate Athletes

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 (No relevant relationships reported)

Athletes frequently need to recover balance after an external disturbance during tasks with high cognitive demand. Mobility impaired populations demonstrate deficits in reactive postural responses to backward and lateral perturbations but, little is known about postural responses in college athletes.

PURPOSE: To examine differences in direction and task (single [ST] and dual task [DT]) in reactive postural response measures during the push-and-release (P&R) test.

METHODS: Reactive postural responses in 98 healthy ($F=42$, age 19.3 ± 1.60 years, BMI 23.56 ± 3.29 kg/m²) college athletes were assessed using the P&R in four directions (forward, backward, right, left), with eyes closed, under ST and DT (concurrent verbal cognitive task) conditions. Inertial sensors on the sternum, lumbar, right tibia, and feet were used to assess step initiation latency, time of first heel contact (HC), and time to stabilization (TTS). A sensor on the tester's hand determined release time. Linear mixed models with random intercepts were used to determine if postural response measures differed by direction and task.

RESULTS: There was a significant interaction between direction and task for HC ($p=0.04$), with the largest difference in DT and ST in the forward direction ($95\%CI = [0.05, 0.08]$), and the smallest difference in the backward direction ($95\%CI = [0.02, 0.05]$). There were also significant main effects for direction ($p<0.0001$) and task ($p<0.0001$) for each postural response (latency, HC, TTS). Means adjusted for age, sex, and BMI are presented below.

	Latency (s)	Time to Stabilization (s)	Heel Contact (s)
Direction			
Backward	0.13 (0.12 - 0.14)	1.19 (1.14 - 1.24)	-
Left	0.18 (0.17 - 0.19)	1.02 (0.97 - 1.08)	-
Right	0.17 (0.17 - 0.18)	1.03 (0.98 - 1.09)	-
Forward	0.20 (0.19 - 0.21)	1.06 (1.01 - 1.11)	-
Task			
Dual	0.20 (0.19 - 0.20)	1.15 (1.11 - 1.20)	-
Single	0.15 (0.14 - 0.15)	1.00 (0.96 - 1.04)	-
Direction x Task			
Backward, Dual	-	-	0.47 (0.45 - 0.48)
Backward, Single	-	-	0.43 (0.42 - 0.45)
Left, Dual	-	-	0.52 (0.51 - 0.53)
Left, Single	-	-	0.47 (0.45 - 0.48)
Right, Dual	-	-	0.53 (0.51 - 0.54)
Right, Single	-	-	0.46 (0.45 - 0.48)
Forward, Dual	-	-	0.57 (0.55 - 0.58)
Forward, Single	-	-	0.50 (0.49 - 0.51)

CONCLUSION: Postural responses differ by direction during the P&R in college athletes. The largest differences were between the forward and backward directions. These directions may be most sensitive to detecting changes in reactive postural control; future work will examine the utility of the P&R for return-to-play decisions. Supported by PAC 12 (PI: Fino, Dibble); University of Utah Study Design and Biostatistics Center (UL1TR002538)

3443 Board #264 May 29 2:30 PM - 4:00 PM
THE EFFECTS OF GOLF SPECIFIC FOOTWEAR ON MUSCLE ACTIVATION DURING STANDING POSTURAL CONTROL

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Postural control in golf represents an unusual challenge as players are on their feet four hours or more. Several golf specific footwear are available, though, little is known about how these footwear affect human balance. **PURPOSE:** To examine the effects of durations of walking/standing while barefoot (BF) and wearing a dress shoe (DS), tennis shoe (TS), and minimalist (MIN) style golf shoe, on muscle activity of the lower extremity during balance. **METHODS:** Six male adults completed this study. Balance was recorded under six conditions: eyes open (EO), eyes closed (EC), eyes open sway referenced vision (EOSRV), eyes open sway referenced platform (EOSRP), eyes closed sway referenced platform (ECSR), and eyes open sway referenced vision and platform (EOSRVP). Surface electromyography (EMG) was recorded during balance testing from the left leg tibialis anterior (DF), and medial gastrocnemius (PF). Raw EMG data were collected at 1,500 Hz, Band-pass filtered (20-250Hz) and rectified. Variables of interest were the mean muscle activity (mV) of each muscle. Testing sessions consisted of a counterbalanced allocation of footwear over 4 separate days, separated by at least 48 hours. Each session included muscle activity measures during balance every 60 minutes, for 4 hours (pre, 60, 120, 180, 240 minutes). A 4x5 repeated measures ANOVA was used, with an alpha level of 0.05. **RESULTS:** A significant interaction was observed in the EO condition for PF muscle activity ($F(12,60) = 1.94$, $p = 0.04$). With the MIN muscle activity significantly lower than TS, and DS at 2 hours ($4.16 < 6.86 & 6.58$). An interaction was also observed in the EOSRV condition for the PF ($F(12,60) = 1.97$, $p = 0.048$), suggesting that at 4 hours, the DS was significantly higher than the MIN ($9.96 > 5.83$). A footwear effect was observed for the EC condition

(F(3,12) = 3.96, $p = 0.035$). With the MIN condition significantly higher than the DS (3.06 > 1.77). A time effect was observed in the EOSRV condition for the DF (F(4,16) = 3.86, $p = 0.022$), with muscle activity at 60 minutes, significantly lower than 120 and 180 (1.86 < 2.56 & 2.30) **CONCLUSION:** These results indicate a possible shift in balance strategy, particularly when visual information is removed. Certain golf specific footwear may increase the workload on the ankle musculature and cause a shift to a more hip/knee balance strategy.

3444 Board #265 May 29 2:30 PM - 4:00 PM
The Relationship Between Functional Movement And Balance
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 Functional movement assessments are used to predict injury in multiple populations, but the components that most contribute to functional movement are unknown. Identifying the influence of static balance via the Balance Error Scoring System (BESS) and dynamic balance via the Y-Balance Test (YBT), can provide valuable information to clinicians. This knowledge can be used to help individuals improve functional movement screening (FMS) scores which, in turn, can reduce injury risk. **PURPOSE:** To examine the contributions of static and dynamic balance on functional movement. **METHODS:** Participants from the general population ($N = 77$; men = 31; women = 46; average age = 42 ± 16 years) completed the FMS, YBT, and BESS during one laboratory visit. **RESULTS:** Together, YBT and BESS were significant predictors of FMS scores ($p < .001$, $R^2 = .54$). Individually, both YBT ($p < .001$, $R^2 = .498$) and BESS ($p < .001$, $R^2 = .321$) were significant predictors of FMS scores. When controlling for age ($p < .001$, R^2 Change = .364) and history of lower body surgery ($p < .001$, R^2 Change = .532), the YBT and BESS were still significant predictors of the FMS. Risk of injury according to YBT risk and FMS risk were not associated, $\chi^2(1, N = 77) = 1.20, p = .273$, $Cramer's V = .125$. There was a significant association between BESS risk and FMS risk, $\chi^2(1, N = 77) = 9.29, p = .01$, $Cramer's V = .347$. **CONCLUSION:** Static and dynamic balance both contribute to functional movement. This information can be used when developing training and rehabilitation protocols to reduce injury risk as measured by FMS.

3445 Board #266 May 29 2:30 PM - 4:00 PM
The Impact Of Balance With Visual Feedback On Tibialis Anterior/gastrocnemius Neuromuscular Activity In Healthy Young Adults.
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Balance is a functional activity that must be worked on in rehabilitation of every type of back and lower extremity pathology or trauma. With these types of issues, balance generally will become impaired, requiring activities to increase the patient's stability. **PURPOSE:** To identify the impact of balance activities with visual cues on lower extremity muscle activation timing. **METHODS:** This study assessed muscle activation and postural strategies during different visual feedback activities on a balance board with a fix middle fulcrum. Fifteen young, healthy adults were recruited and performed seven tasks on two different levels of difficulty. The various visual activities were projected to a wall, 10 feet away from the balance board. Participants had to follow a target by moving the balance board in 7 pre-set different tasks. Participants had surface electromyography on tibialis and gastrocnemius muscles. Gastrocnemius and tibialis anterior muscle activation were recorded with EMGworks software for each trial. In the analysis of the electromyography data, the following variables were measured: time to peak muscle activation, time to decay of muscle contraction, and time of muscle contraction duration. A repeated measure ANOVA was used for all the variables of interest. **RESULTS:** High and lower fulcrum balance boards appear to provoke similar muscle activation among all variables ($P > 0.05$). TA muscle compensates differently on the rear twist (RT), front twist (FT), and counter clock (CC) balance maneuvers compared to the other four tasks. TA showed a faster Timed to peak [seconds] (RT 0.007+/-0.001, FT 0.007+/-, CC 0.009.005 +/- .004; $P < 0.001$), rapid decay [seconds] (TT .008+/-0.005, FT 0.10+/-0.1, CC 0.009+/-0.005; $P < 0.001$), and shorter time of duration [seconds] (RT 0.2+/-0.001, FT 0.2+/-0.1, CC 0.02+/- 0.005; $P < 0.001$) of muscle activation.

CONCLUSIONS: Balance with visual feedback can provoke a different muscle activation pattern in lower extremities muscles, such as tibialis anterior. For patients with balance alteration related to nerve conduction or muscle weakness on the lower extremity, we recommend activities were muscle activation is a challenge due to the surface but also due to visual feedback/cortex interplay.

3446 Board #267 May 29 2:30 PM - 4:00 PM
The Effect Of Renewal Massage And Modified Squat Exercise On Body Alignment In Genu Varum Patients
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PURPOSE: This study evaluates the effect on body alignment three weeks after massage and squat exercise in patients with genu varum. **METHODS:** Twenty-one participants with genu varum have participated in the study and randomly assigned into 3 groups: renewal massage group ($n=7$), modified squat exercising group ($n=8$), and controlled group ($n=6$). A renewal massage is a full body massage that begins with the central part of the body and proceeds with the whole body. Renewal massage and modified squats exercising were carried out for three weeks, five times a week, and 40 minutes per week. Dependent variables were C-spine angle, T-spine angle, L-spine angle, sacral inclination angle, femoral-tibial angle of both right and left. Descriptive analyses including mean and standard deviation were computed for all variables using SPSS/PC ver 18.0, and the group mean difference was analyzed as ANCOVA with the pre-test values as covariates. The post-hoc test was performed with the least significant difference (LSD). The significance level set at .05. **RESULTS:** The ANCOVA result indicated that after controlling for differences in pre-test values, there was a significant difference in the sacral inclination angle (F[2,17] = 3.590, $p < .05$). The post-hoc test result showed that the renewal massage group (19.86 ± 3.18) has lower mean than control group (34.63 ± 4.07). No statistical significance difference was found on C-spine angle, T-spine angle, L-spine angle, femoral-tibial angle of both right and left. **CONCLUSIONS:** The three-weeks renewal massage seems to have differed only in the sacral inclination angle. Further studies are warranted to examine the effect of dose-response relationship (i.e., changing the duration and frequency) for the renewal massage.

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 Friday, May 29, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

3447 Board #268 May 29 1:30 PM - 3:00 PM
Fronto-parietal Network Hyperconnectivity As A Result Of Head Impacts In College Ice Hockey
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Impairment in executive functioning has been reported as a result of sustaining repetitive, sports-related head impacts (RHI) after just one season of play. Brain networks associated with executive functioning may be damaged by RHI, which can be assessed through resting-state functional connectivity (rs-FC) with fMRI, which has previously shown connectivity to be affected by RHI. **PURPOSE:** To examine rs-FC related to the fronto-parietal network (FPN) over the course of an ice hockey season. **METHODS:** Twenty-three collegiate club ice hockey players (19M/4F) were divided into two groups: Impact (men's forwards/defensemen, $n=17$) and No Impact (goalenders and women, $n=6$). Players were scanned on a Siemens Prisma 3T scanner prior to the first game of their season (PRE) and within two weeks of their final game (POST). Six seed regions-of-interest (ROIs) within the FPN were selected for rs-FC analysis: R/L middle frontal gyrus, R/L posterior parietal cortex, and R/L lateral prefrontal cortex; all data analysis was completed using SPM12/Conn Toolbox. A 2x2 repeated measures ANOVA was performed to test for significant ($p < 0.01$) group-by-time interactions. A secondary regression analysis was performed in a subset of Impact players ($n=13$) to identify if accelerometer (Triax, Norwalk, CT) and video confirmed total number of head impacts sustained over a season were predictive of PRE/POST changes in rs-FC. **RESULTS:** A significant group-by-time interaction was found in connectivity between the R middle frontal gyrus and R posterior parietal cortex ($T = 3.49, p < .01$); post-hoc analysis revealed significant POST hyperconnectivity in the Impact group only ($T = 2.96, p < .01$) and no PRE/POST changes were noted in the No

Impact group. Total number of impacts (54.8±33.5) significantly predicted POST hyperconnectivity between the L lateral prefrontal cortex and L pallidum ($r^2=0.79$, $p=0.001$).

CONCLUSIONS: Post-season hyperconnectivity between ROIs involved in executive functioning was found in athletes who regularly sustain impacts compared to those who do not, which is consistent with previous rs-FC RHI findings in different networks. Hyperconnectivity has been suggested to represent brain injury and players who sustain more impacts may be more likely to have neurological damage that results in deficits in executive function.

3448 Board #269 May 29 1:30 PM - 3:00 PM

Identifying The Educational Needs Of 9th And 10th Grade High School Students Regarding Concussion

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PURPOSE: To evaluate adolescent concussion knowledge and behaviors regarding concussion using a modified Rosenbaum Concussion Knowledge and Attitudes Survey (RoCKAS) questionnaire.

METHODS: RoCKAS questionnaire was taken by female and male 9th and 10th-grade high school students ($n=190$) with a mean age of 15.1 ± 0.8 years (64.7% female; 35.3% male). 59.4% reported belonging to a competitive sports team. A sampling of questions from the RoCKAS questionnaire was used to assess groups for (1) general concussion knowledge and (2) the demonstration of safe attitudes and behaviors in situational decision making ("safe" or "unsafe").

RESULTS: Validity scale scores were appropriate, meaning participants were actually reading and answering the questions thoughtfully. General concussion knowledge was correctly answered by 83.8% ($p=0.007$). Those not participating in athletics were less knowledgeable than those participating in sports (20.1%). Males not participating in sports answered incorrectly 23.4% of the time. There was no statistical significance comparing females in relation to sports participation. Responses to the four situational questions analyzed identified answers to be unsafe on the behavior questions 87.1 % of the time ($p=0.0001$). In fact, the actual age of the participants negatively correlated with the behavior answers ($r=-0.4$, $p=0.0001$).

CONCLUSIONS: High school 9th and 10th-graders are knowledgeable about concussion. Those participating in sporting teams are more knowledgeable, especially males. There is no knowledge differences between females who participate or do not participate in sports. Situation based questions indicate an unacceptable level of safety, suggesting poor behaviors in return-to-play (RTP) and concussion reporting decisions, which was worse in older individuals. The RoCKAS information may be helpful to identify behavior deficits that can inform cohort-specific concussion educational programs designed to enhance the safety of youth athletics.

3449 Board #270 May 29 1:30 PM - 3:00 PM

Fear Of Re-injury Correlates With Concussion Symptoms And Reaction Time Among Adolescents With Concussion

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Background: Athletes appear to be at an increased risk of musculoskeletal injury following return to play after concussion. Underlying causes are likely multi-factorial but not well established. Fear of re-injury has been widely studied in musculoskeletal injuries, but its effect on concussion recovery is unknown.

Purpose: To examine the association of fear of re-injury with physical and self-reported measures after concussion. We hypothesized that greater fear of re-injury would be correlated with a higher symptom severity, worse sleep quality, and worse physical test performance.

Methods: Athletes ($n=19$; 15.0 ± 1.8 years of age; 42% female; 7.4 ± 3.3 days post-injury) were tested within 14 days of concussion, and underwent assessments of self-reported and physical examination measures. Self-reported measures included the Tampa Scale of Kinesiophobia (TSK)- assessing fear of re-injury, Post-Concussion Symptom Inventory (PCSI), and Pittsburgh Sleep Quality Index (PSQI). Physical examination measures included clinical reaction time, near point of convergence, single and dual-task tandem gait, and Balance Error Scoring System (BESS). We examined correlations between TSK scores and each outcome measure using Pearson correlation coefficients, adjusting for age, sex, and time from injury using linear regression models.

Results: Higher TSK scores were significantly correlated with higher symptom severity (PSCI) scores ($r=0.69$; $p=0.001$) and slower reaction times ($r=0.53$; $p=0.02$). TSK scores were not significantly correlated with single-task tandem gait ($r=0.23$;

$p=0.34$), dual-task tandem gait ($r=0.29$; $p=0.23$), PSQI ($r=0.43$; $p=0.08$), NPC ($r=0.03$; $p=0.91$), or BESS ($r=0.23$; $p=0.35$) scores. After adjusting for the effect of age, sex, and time from injury to examination, higher TSK scores were significantly associated with slower clinical reaction time performance ($\beta=2.8$; 95% CI= 0.94, 4.62; $p=0.006$), greater symptom severity ($\beta=3.64$; 95% CI=2.07, 5.21; $p<0.001$), and worse sleep quality ($\beta=0.37$; 95% CI= 0.05, 0.68; $p=0.03$).

Conclusions: In accordance with our hypothesis, higher TSK scores were correlated with higher symptom severity and slower reaction times. This suggests that assessing an athlete's fear of re-injury may be useful following concussion and throughout recovery.

3450 Board #271 May 29 1:30 PM - 3:00 PM

Neurofilament Light Not Associated With Concussion History Or Recency In Special Operations Forces Combat Soldiers

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Special Operations Forces (SOF) combat soldiers sustain high rates of blast and blunt neurotrauma. Most are mild traumatic brain injuries (i.e., concussion). Repetitive concussions may develop long-term neurological sequelae. Detecting the effects of cumulative exposure to concussion may be helpful to recognize and intervene therapeutically before chronic symptoms begin emerging. Neurofilament light chain (NfL) is an abundantly expressed cytoskeletal component of large caliber myelinated subcortical axons. Peripheral increases may indicate ongoing axonal disruption or chronic repetitive white matter injury within the brain.

PURPOSE: To determine the effects of concussion history, lifetime incidence, and recency on NfL concentrations in SOF combat soldiers. **METHODS:** 185 SOF combat soldiers (age=33.0±3.5 yrs) participated in our cross-sectional study and self-reported concussion history (90 no, 95 yes), lifetime incidence (0, 1, 2, 3+) and recency (<1 month, <1 year, >1 year). Fasted blood samples were obtained from an antecubital vein at a standardized time for all subjects. Serum was separated and stored until analysis. Serum NfL levels were quantified using sandwich enzyme immunoassay kits according to manufacturer instruction. Medians and interquartile ranges (IQRs) were reported because NfL concentrations were not normally distributed. A Wilcoxon rank-sum analysis compared NfL concentrations between those with and without concussion history. Kruskal-Wallis tests compared NfL concentrations across lifetime incidence and recency. **RESULTS:** We did not observe differences in NfL concentrations ($z=1.80$, $p=0.07$) between those with (median=449.7 pg/mL, IQR=192.1) and without (median=484.4 pg/mL, IQR=221.2) concussion history. There was no effect of concussion lifetime incidence ($X^2(3)=3.87$, $p=0.28$) or recency ($X^2(2)=0.86$, $p=0.65$) on serum NfL concentrations. **CONCLUSION:** We did not observe differences in serum NfL concentration in SOF combat soldiers based on concussion history, lifetime incidence, and recency. Our SOF combat soldiers were otherwise healthy and asymptomatic. Despite this, our findings suggest SOF combat soldiers demonstrated higher NfL concentrations than those reported for civilian severe brain injury and neurodegenerative disease patients.
Funded by USASOC

3451 Board #272 May 29 1:30 PM - 3:00 PM

Parent Beliefs Regarding Chronic Traumatic Encephalopathy Associated With Sport-related Concussion

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(No relevant relationships reported)

PURPOSE: To determine CTE beliefs of youth athletes' parents, and examine the association of sex and prior concussion history with those views.

METHODS: This was a cross-sectional survey study of parents ($n=467$; males = 185, females = 282; history of concussion = 52) of youth contact sport athletes (i.e., football, soccer, ice hockey, lacrosse). The survey included items on demographics, diagnosed concussion history, and a standardized concussion knowledge assessment with two exploratory items about CTE beliefs. Parents were asked if CTE was a complication of multiple concussions and premature return-to-play. The 15-minute

survey was administered on-site after practices/events. The association between CTE beliefs, sex (male/female), and concussion history (yes/no) were assessed using chi-square analyses with significance set at $p \leq .05$.

RESULTS: A majority 70.7% (n=319/451) of parents indicated CTE was a complication of multiple concussions; 67.1% (n=294/438) identified CTE was a complication of returning to play prematurely. A greater proportion of male parents (77.4%, n=137/177) indicated CTE was a complication of multiple concussions compared to female parents (66.3%, n=181/273; $\chi = 6.38, p = .01, V = .12$). A greater proportion of male parents (74.6%, n=129/173) identified CTE was a complication of premature return to play compared to female parents (62.1%, n=164/264; $\chi = 7.32, p = .007, V = .13$). There were no significant associations between diagnosed concussion history and CTE beliefs (χ^2 's = .51-1.52, p 's = .22-.47, V 's = .03-.06).

CONCLUSIONS: Parents commonly recognized CTE as a complication of multiple concussions and premature return to play, which shows they are aware of this neurodegenerative condition. Additionally, a greater proportion of male parents endorsed CTE beliefs compared to females. This finding could be a byproduct of the media's attention towards CTE cases in male athletes specifically. Future research should consider how beliefs about CTE may influence sport participation within a family unit.

3452 Board #273 May 29 1:30 PM - 3:00 PM
Associations Of Concussion And Playing History With Clinical Outcomes In Young College Football Alumni
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The effects of concussion history (CH) and years of playing football on cognitive function and mood-related symptoms in former football players is unclear. Most former player studies include mid-to-late life individuals, and little is known about younger cohorts.
PURPOSE: Assess the influence of CH and years played on cognitive function, mood-related symptoms, and life satisfaction in former football players.
METHODS: Former collegiate football players (n = 58; age 37.9 ± 1.5 years; BMI 31.3 ± 5.0 kg/m²) from 16 schools completed a health survey and subsequent in-person evaluation 15 yrs post-college football. Outcomes included cognitive tests: Symbol Digit Modalities Test (SDMT), Controlled Oral Word Association Test (COWAT), revised Hopkins Verbal Learning Test (HVLTr), and Trails A (TMTA) and B (TMTB); and self-reported outcomes: NeuroQOL Cognition Short Form (NQC), Beck Depression Inventory (BDI-II) and Anxiety (BAI-II) inventories, and Satisfaction with Life Scale (SWLS). Current symptom severity (SS) was reported on the Graded Symptom Checklist alongside typical hours slept per night. CH was split into tertiles: 0-1, 3-6, or 7+ prior concussions. Multivariable linear regression models were used to assess the influence of CH and years played on each outcome with BMI, sleep, and SS as covariates.
RESULTS: Model predictors and adjusted R² values are in Table 1. Higher SS was associated with worse outcomes on most measures. Worse SDMT scores were partially explained by greater CH and years played. In addition to SS, greater CH related to better COWAT performance; those with more sleep had longer TMTA times; and those with lower BMI and more sleep had higher SWLS.
CONCLUSIONS: Our data show no clear influence of CH or years played on cognitive function, mood-related symptoms, or life satisfaction. In our relatively young sample, SS at the time of testing was associated with worse outcomes. Continued longitudinal analyses may explain age related changes on these outcomes.

Table 1. Backwards Removal Regression Coefficients.

Outcomes	Adj. R ²	Predictors										
		Concussion History		Years of Football Played		Body Mass Index		Average Sleep Duration		Total Symptom Severity		
		Beta	p	Beta	p	Beta	p	Beta	p	Beta	p	
SDMT	.159	-.22	.08	-.43	<.01	...	...	...	...	...	...
COWAT	.068	.23	.09	...	...	...	...	...	...	-.30	.03	
HVLTr Total Score	.057	...	...	...	...	...	...	...	...	...	-.27	.04
HVLTr Percent Retention	N/A	...	...	...	...	...	...	...	...	...	...	...
HVLTr Recognition	N/A	...	...	...	...	...	...	...	...	...	...	...
TMTA	.155	...	...	...	...	...	...	.45	.001	...	.27	.05
TMTB	.115	...	...	...	...	...	...	...	...	...	.36	<.01
NQC	.440	...	...	...	...	...	...	...	...	...	-.67	<.01
BDI-II	.522	...	...	...	...	...	...	...	...	...	.73	<.01
BAI-II	.591	...	...	...	...	...	...	...	...	...	.77	<.01
SWLS	.176	...	...	...	...	-.23	.06	.26	.05	...	-.22	.09

Standardized Betas and p-values are presented only for the final model of predictors remaining after the backwards elimination process for each outcome. Removal criterion p-value was $\geq .1$. SDMT = Symbol Digit Modalities Test, COWAT = Controlled Oral Word Association Test, HVLTr = Hopkins Verbal Learning Test - Revised, TMTA = Trail Making Test A, TMT B = Trail Making Test B, NQC = NeuroQOL Cognitive Function Short Form, BDI = Beck Depression Inventory, BAI = Beck Anxiety Inventory, SWLS = Satisfaction With Life Scale, Adj. R² = Adjusted R² value for the regression model of each outcome.

3453 Board #274 May 29 1:30 PM - 3:00 PM
Sport-related Concussion Reporting Behaviors And Non-disclosure Patterns Of Youth Contact Sport Athletes
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Current literature on sport-related concussion (SRC) reporting behaviors and reasons for non-disclosure is dominated by older athletic populations. Youth athletes participating in contact sports are at risk for SRC; however, little is known about SRC disclosure patterns and reasons for non-disclosure in this group. **PURPOSE:** To examine SRC reporting behaviors and reasons for non-disclosure in youth contact sport athletes.
METHODS: Youth athletes (n = 442; 66.5% male, 33.5% female) aged 8-14 years participating in football (22.4%), ice hockey (26.5%), lacrosse (24.9%), and soccer (26.2%) completed a 15-minute survey composed of demographics, diagnosed and non-disclosed SRC history, and reasons why they did not report a suspected SRC. The survey was adapted for elementary school readability and researchers were present to clarify any athlete questions. Descriptive statistics expressed frequencies of self-reported diagnosed SRC, suspected SRC non-disclosure, and reasons for non-disclosure.
RESULTS: A total of 44 (10%) youth contact sport athletes recalled a diagnosed SRC; 68.1% (n = 30) of those recalled 1, 20.5% (n = 9) recalled 2, and 13.6% (n = 6) recalled ≥ 3 diagnosed SRC. Youth athletes also indicated they thought they had a SRC but still played in a practice (n = 55, 13.0%) or game (n = 51, 12.0%), respectively. While, 50 (11.8%) athletes reported they thought they sustained a SRC and did not report it to anyone. The most common reasons for non-disclosure selected by youth athletes included: I did not want to lose playing time (n = 33, 66.0%), I did not want to miss a game (n = 10, 56.0%), at the time I did not think it was a concussion (n = 26, 52%), I did not want to let my team down (n = 23, 46%).
CONCLUSIONS: Epidemiological evidence of SRC in this setting is lacking; however, these novel results identified 10% of youth athletes self-reported a previous SRC. Significantly, 13% of athletes indicated they remained in play with a suspected SRC and 12% of athletes did not report their suspected SRC to anyone. Youth athletes' reasons for non-disclosure were similar to those reported in high school and college athletes. Recent research suggests negative consequences of continued play with SRC, especially in acute stages. Future educational initiatives should emphasize these risks, and focus on reasons why athletes withhold reporting.

3454 Board #275 May 29 1:30 PM - 3:00 PM

Assessing The Relationship Between Depression-related Symptoms And Post-concussion Clinical OutcomesChristine E. Callahan¹, Robert D. Moore², Alison A. Crew³, Michael Vesia⁴, Johna K. Register-Mihalik¹, Steven P. Broglio⁴.
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Concussive injury and depression affect millions of individuals each year and are connected through common overlapping symptoms. **PURPOSE:** Aim 1 was to establish an association between post-concussion depression-related symptoms and post-concussion symptoms, balance performance, vestibular function, and executive function. Aim 2 was to further establish the relationship between concussion history and post-concussion depression-related symptoms, concussion symptoms, and mood disturbance. **METHODS:** 164 concussed individuals (mean age=14.52±3.51 years, 50.61% male, mean time from injury=18.24±13.60) were included in this analysis. Depression-related symptoms were quantified using the Beck Depression Inventory (BDI-II) and post-concussion symptoms using the Rivermead Post-Concussion Symptoms Questionnaire (RPQ). Clinical post-concussion assessments utilized were the modified Balance Error Scoring System (mBESS), Vestibular/Ocular-Motor Screening (VOMS), and, for adolescent patients, the Behavior Rating Inventory of Executive Function (BRIEF). Mood disturbance was quantified using the Profile of Mood States (POMS). mBESS, VOMS, RPQ, and BRIEF were measured against BDI-II scores using Pearson Correlation and Linear Regression analyses. BDI-II, POMS, and RPQ scores were analyzed based on concussion history using Wilcoxon Rank-Sum Tests. **RESULTS:** As depression-related symptoms increased, post-concussion symptoms ($p<0.001$, $r=0.68$) and VOMS scores measuring changes in headache and dizziness ($p<0.001$, $r=0.34$; $p=0.01$, $r=0.20$ respectively) significantly increased. There was no significant correlation between depression-related symptoms and balance performance ($p=0.093$, $r=0.13$). In adolescents, as depression-related symptoms increased parent reported executive function decreased ($p<0.001$, $r=0.46$). Those who reported a concussion history reported significantly more depressive-related symptoms ($p=0.004$), concussion symptoms ($p=0.004$), and mood disturbance ($p=0.002$). **CONCLUSION:** This study adds to the current literature surrounding the relationship between concussion and depression by identifying a relationship between depression related symptoms, post-concussion symptoms, and post-concussion clinical assessments.

3455 Board #276 May 29 1:30 PM - 3:00 PM

Nonverbal Hand Movements Indicate Symptoms After Sport Related ConcussionsIngo Helmich. *Department of Neurology, Psychosomatic Medicine, and Psychiatry, Cologne, Germany.*

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Because post-concussion symptoms are often not clearly visible, speech-accompanying gestures may help clinicians to gain additional information about the patient's history and symptoms during medical consultation. **PURPOSE:** We hypothesized that athletes with SRC and who suffered from persisting symptoms would display more gestures during concussion assessment protocols when compared to non-concussed athletes because of the athletes' previous motor-sensory experiences made during the concussive event. **METHODS:** Three matched groups of 40 (active) athletes were investigated in the context of concussion assessment (and baseline) protocols: 14 symptomatic and 14 asymptomatic athletes with a SRC, and 12 non-concussed athletes. Certified raters using a standard analysis system for nonverbal behavior analyzed videotaped hand movements and gestures during a standardized concussion assessment protocol. **RESULTS:** Symptomatic athletes spent significantly more time with *in space* hand movements, i.e., movements that act in the body-external free space without touching anything and specifically, *motion quality presentation* gestures than non-concussed athletes. **CONCLUSIONS:** Increased *in space* movements, which are functionally gestures, and specifically, *motion quality presentation* gestures in symptomatic athletes indicate that the more vivid sensory motor experience of the head trauma is reflected in more gestural expressions. Thus, hand movements and gestures differentiate athletes who suffer from post-concussion symptoms from non-concussed athletes indicating the athletes' motor-sensory experiences of the event and its aftereffects. The present study highlights the fact that gestures can be employed as behavioral markers of symptoms after sport-related concussions.

3456 Board #277 May 29 1:30 PM - 3:00 PM

Baseline Concussion Symptom Reporting As A Possible Screening Method For Generalized Anxiety DisorderEric E. Hall, FACSM, Anna Keane, Emma McCabe, Emily Klevan, Ethan Williams, Caroline J. Ketcham. *Elon University, Elon, NC.*

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(No relevant relationships reported)

Athletes with previous diagnosis of a psychiatric condition, such as depression or anxiety, have been shown to experience a larger overall concussion symptom score compared to those without a previous psychiatric treatment. Anxiety rates in college students is high (42%) with student-athletes only slightly lower (37%) compared to the general population (18%). **PURPOSE:** The purpose of this study was to compare concussion-related anxiety symptoms and validated anxiety disorder screeners to see if baseline concussion symptoms could be used as a screening tool for follow-up mental health assessments. **METHODS:** 254 club level collegiate student-athletes (18.2±1.4yrs, 150 female, 104 male) completed the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) including the 22-item Post-Concussion Symptom Scale (PCSS), the Patient Reported Outcome Measurement Information System (PROMIS-29), and the Depression Anxiety Stress Scales (DASS-21). DSM-5 Anxiety symptoms were compared to the PCSS symptoms and an anxiety-related concussion symptom score was calculated. These along with the anxiety sub-scores for both the DASS-21 and PROMIS-29 were used for analysis. **RESULTS:** Participants were divided into 4 anxiety level groups based on norms from the DASS-21 (normal=36; mild=76; moderate=87; severe=28). There was a significant correlation ($p<0.001$) between Anxiety Cluster PCSS symptom score and DASS-21 anxiety subscale ($r=.41$) and PROMIS-29 Anxiety Sub-score ($r=.44$). The DASS-21 and PROMIS-29 were also significantly correlated ($r=.64$, $p<0.001$). There were significant group differences across the 4 DASS-21 anxiety levels for Anxiety Symptom Cluster ($F(4, 226)=9.27$, $p<0.001$) and the PROMIS-29 Anxiety subscale ($F(4,223)=31.01$, $p<0.001$). **CONCLUSIONS:** The significance from this data shows that the proposed symptom clusters that potentially pertain to anxiety symptoms are meaningfully related to higher scores on the DASS-21 and the PROMIS-29 anxiety related questions. Participants that demonstrated a higher overall concussion-related anxiety symptom score were more likely to exhibit more severe levels of anxiety suggesting that this cluster score could potentially screen individuals at risk for anxiety disorders thus providing a pathway to refer and provide resources and support.

F-66 Free Communication/Poster - Metabolism and Behavior

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

3457 Board #278 May 29 1:30 PM - 3:00 PM

SELF-PERCEIVED HEALTH AND PHYSICAL FUNCTION ARE ASSOCIATED WITH BODY COMPOSITION AND BLOOD LIPIDSMadison Filippini, Emilija Peleckas, Alexandra I. Hopun, Gabrielle A. Volk, Melanie Ziazaris, Kyle L. Timmerman, FACSM. *Miami University, Oxford, OH.* (Sponsor: Kyle Timmerman, FACSM)

(No relevant relationships reported)

Clinical indicators of health status such as body composition, blood lipids, and cardiorespiratory fitness are objective; however, self-perceived health may be influenced by multiple factors. Thus, the **PURPOSE** of the present study was to explore associations among objective measures of health, self-perceived health, and habitual physical activity in overweight, older adults. **METHODS:** In 35 (27 F/8 M) overweight (body mass index, BMI ≥ 27 kg/m²), older adults (>58 years) we assessed blood lipids (point-of-care analyzer); body composition (bioelectrical impedance); habitual physical activity (7-day accelerometry); cardiorespiratory fitness (VO₂max); and self-perceived health (36-item short form survey, SF-36). The SF-36 includes questions that assess eight health concepts including perceptions of physical function and general health. Scores for each concept can range from 0% (poor) to 100% (excellent). Associations were assessed utilizing partial correlations (controlling for age and sex). Significance was set to $p<0.05$. **RESULTS:** Average values for these subjects included: age: 64±5y; SF-36 (general health): 63±14%; SF-36 (physical function): 77±16%; BMI: 35±5 kg/m²; body fat percentage: 44.7±0.1%; VO₂max: 16±3 ml/kg/min; moderate-to-vigorous physical activity (MVPA): 47±23 min/day; LDL cholesterol: 105±27 mg/dL, HDL cholesterol: 49±11 mg/dL, triglycerides: 113±40 mg/dL, and glucose: 100±15 mg/dL. Self-perceived physical function was

significantly ($p < 0.05$) correlated with indices of body composition and blood lipids [body fat percentage ($r = -0.39$), visceral fat area ($r = -0.42$), and LDL cholesterol ($r = -0.51$)], but not habitual MVPA. Self-perceived general health was significantly correlated with LDL/HDL ($r = -0.60$), but not indices of body composition or physical activity level. **CONCLUSIONS:** These preliminary data suggest that perception of general health and physical function are more closely related to indices of body composition and blood lipids than habitual physical activity level.

3458 Board #279 May 29 1:30 PM - 3:00 PM
Contributors To Percent Body Fat In Career Firefighters

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(No relevant relationships reported)

Firefighters have substandard levels of fitness and a high prevalence of overweight and obesity. Understanding exercise status and barriers to exercise may be important factors regarding body composition. **PURPOSE:** The purpose of this study was to examine the influence of exercise status and barriers to exercise on percent body fat (%BF) in career firefighters. **METHODS:** Fifty-eight male career firefighters [age: 31.3±7.0 yrs; stature: 178.9±7.6 cm; body mass: 90.0±17.6 kg; %BF: 23.5±7.5%] volunteered for this investigation. Participants self-reported exercise status and rated sixteen barriers to exercise (e.g., too busy) on a Likert-type scale (1-7). Dual-energy X-ray absorptiometry was used to assess %BF. Aerobic exercise time [AER = moderate intensity minutes + (vigorous intensity minutes × 2)] and resistance training workload [RT = days × minutes × intensity] were calculated. Pearson's correlation coefficients were used to determine the relationships between %BF and potential predictor variables including AER, RT, and the sixteen barriers. The significant exercise barriers were averaged into one construct (BAR). The internal consistency of BAR was measured using Cronbach's alpha. Multicollinearity was monitored using the variance inflation factor (VIF). Stepwise regression analysis was conducted. An alpha level was set *a priori* at 0.05 for all analyses. **RESULTS:** %BF was related to AER ($r = -0.364; P = 0.005$) and RT ($r = -0.400; P = 0.002$). Seven of the sixteen barriers (i.e., too busy, not enough time, irregular work hours, family obligations, interferes with work, too tired, lack of support from officers) were significantly related with greater %BF ($r = 0.270-0.354; P = 0.006-0.042$) and were included in the final construct BAR. The Cronbach's alpha for BAR was 0.80. The stepwise analysis suggests that AER and BAR were significant predictors of %BF ($R^2 = 0.306, P < 0.001$; maximum VIF = 1.98). **CONCLUSIONS:** These findings suggest that firefighters with poorer body composition likely partake in less aerobic exercise and experience greater perceived barriers to exercise. Interventions aiming to mitigate barriers to exercise, specifically aerobic exercise, may be helpful in improving body composition.

3459 Board #280 May 29 1:30 PM - 3:00 PM
Examining The Perceived Barriers To Physical Activity Among Older Adults: Moderating Effects Of Body Mass Index

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Lack of physical activity (PA) is a major public health concern, especially for older people. However, data on possible factors limiting older adults' engagement in PA are still under-investigated. **PURPOSE:** The purpose of this study is twofold: 1) to examine the association of perceived PA barriers with leisure-time PA (LTPA) in a sample of older adults; and 2) to explore the possible moderating effect of body mass index (BMI). **METHODS:** 296 older adults aged ≥60 years old took part in a cross-sectional survey. LTPA was measured by the International Physical Activity Questionnaire and participants were categorized into the three groups, no-LTPA group for individual who did not report LTPA; and below/upper 50th percentile of total LTPA MET values for low- and high-LTPA groups, respectively. Barriers to being active questionnaire (BBAQ) was used to assess perceived PA barriers in a binary manner (i.e., no barrier/at least 1 barrier) for each of the seven domains (i.e., time, social, energy, will, injury, skill, and resources). BMI (kg/m²) was calculated by self-reported height and weight and used to create the three BMI groups (BMI <25, 25-29.99, and ≥30). Using a no-LTPA group as a referent, a multinomial logistic regression model predicting the likelihoods of being low- and high LTPA groups was established after adjusting for study covariates, followed by stratified analyses by BMI groups. **RESULTS:** In general, "lack of will" (49.66%) was the most frequently cited PA barrier followed by "social influence" (38.51%) and "fear of

injury" (36.49%). In the fully adjusted multinomial logistic regression model, greater perceived barrier in "social influence" was associated with lower odds of reporting high-LTPA (odds ratio (OR) = 0.41). In the follow-up stratified analyses demonstrated that PA barriers differently affect LTPA levels by BMI groups. Among individuals with BMI between 25 and 29.99, "lack of time" (OR = 0.11) was the significant predictor of LTPA level. Whereas, "fear of injury" (OR = 0.11) and "lack of energy" (OR = 0.18) were the significant factors associated with LTPA among those with BMI ≥30. **CONCLUSIONS:** The present study provides relevant data on barriers to LTPA for older adults. Promotion and intervention strategies should consider the exposed barriers of older adults in order to reduce their obstacles to PA.

3460 Board #281 May 29 1:30 PM - 3:00 PM
Sex-specific Correlates Of Metabolic Syndrome Risk In College Students

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Over half of college students possess ≥1 metabolic syndrome (MetS) risk factors, with each subsequent risk factor increasing lifetime cardiovascular disease risk. As opposed to taking a reactionary response to established disease, early behavioral intervention may be effective in preventing MetS risk advancement. While correlates of MetS in the general adult population have been described, ideal targets for sex-specific primary prevention strategies in college students are unknown. **PURPOSE:** To identify the sex-specific prevalence of MetS risk factors and their correlates in a college-aged population. **METHODS:** First-year students aged 18-20 y/o ($n=390$; 67.4% female; 70% white) were screened for traditional MetS risk factors using IDF/AHA/NHLBI harmonized criteria. Potential correlates of MetS risk included inflammatory markers, relative adiposity, anxiety, depression, stress, diet, physical activity, alcohol consumption, smoking, and sleep. Principal component analysis was used to construct sex-specific continuous MetS risk scores, with waist circumference, systolic blood pressure, HDL-C, and fasting glucose, insulin, and triglycerides as factors in the final model. Two principal components with an eigenvalue ≥1 created the continuous MetS risk score, explaining 51.2% and 54.2% of the variance in risk in females and males, respectively. Multivariate linear regression assessed the relationships between potential correlates and MetS risk score. **RESULTS:** One or more MetS risk factors were present in 66.9% of males and 59.3% of females, with 3.1% and 2.3% having defined MetS, respectively. In females, % kcal from sugar ($\beta = .25, p = .001$), stress ($\beta = .19, p = .003$), and relative adiposity ($\beta = .45, p < .001$) were positively associated with MetS risk, whereas moderate to vigorous physical activity ($\beta = -.12, p = .028$) and anxiety ($\beta = -.15, p = .017$) were negatively associated with MetS risk. In contrast, correlates in males included race ($\beta = .24, p = .002$; coded as non-white=0, white=1), C-reactive protein ($\beta = .20, p = .006$), and relative adiposity ($\beta = .53, p < .001$), with % kcal from saturated fat approaching significance ($\beta = .23, p = .064$). **CONCLUSION:** The sex-specific prevalence of MetS risk factors and correlates suggest that a one-size-fits-all approach to prevention may not be effective in this population.

3461 Board #282 May 29 1:30 PM - 3:00 PM
How Motivation Affects Our Training And Nutrition Goals: A Comparison Between Bodybuilders And Overweight Women

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Bodybuilders are well known by their addiction to the perfect physique, requiring not only a strong body, but also a strong mind. This potential psychological, motivational, emotional and dedication in bodybuilding has significant impact in athletes' lives, supporting self-control, confidence, individual's social realization and mood. Moreover, their motivation and self-control are important skills for a competition. On the other hand, most part of the population doesn't have this strong motivation, struggling a bit more with nutrition and training programs. In nutritional studies, the "triangle" defined by trigger, behavior and reward really influence how people stick to a diet plan and their actions facing a goal related to losing or gaining weight. **PURPOSE:** The aim of this research is to study how the strong mind, dedication of bodybuilders, associated with intrinsic and extrinsic motivation, affect their success through a nutritional program, in comparison to non-athletes. Furthermore, we also want to understand the relevance of behavior and locus of control differences between these two groups.

METHODS: The current study was designed to compare two groups ($n=18$): bodybuilders women ($n=10$) and overweight women ($n=8$). The data were collected by

survey monkey link, composed by 12 sentences about nutrition and training lifestyle with 3 column each: depend on myself, depend on a reward and depend on others. Participants were requested to answer by classifying how the sources of control affect each item with scales from 1 to 5 (1- very low influence, 5- very high influence). The average of each question and column were calculated for comparison. **RESULTS:** According to the protocol, the column "depend on myself" had the same average 4.9/5 for bodybuilders and overweight women. For "depend on others" the athletes average was 1.2/5 and for non-athletes 1.4/5. The major difference was regarding "depend on a reward" with an average of 2.7/5 for the bodybuilders group and 1.9/5 for non-athletes. **CONCLUSIONS:** When discussing about motivation in fitness and nutrition goals, we concluded that a source of reward is much more significant to athletes.

3462 Board #283 May 29 1:30 PM - 3:00 PM
Diabetes Prevention Program: An Investigation Of Lifestyle Coaches' Habits And Motivations

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The Diabetes Prevention Program (DPP) was created after a 27-center randomized clinical trial was conducted to determine if lifestyle intervention alone, or combined with pharmacological therapy could prevent or delay the onset of Type 2 Diabetes (T2DM). Lifestyle intervention decreased the incidence of T2DM by 58% compared with a 31% reduced incidence in the pharmacological group. A key component of the DPP are lifestyle coaches (LC). LC deliver curriculum intended to initiate and promote lifestyle change to individuals at risk for T2DM. Little is known about the behaviors of the LC. **PURPOSE:** The purpose of this study was to investigate the habits and motivations of LC to elucidate their motivations for coaching. **METHODS:** A sixteen item electronic survey was emailed to LC. Data was analyzed using descriptive and qualitative analyses, as well as chi-square tests. **RESULTS:** Sixty-three participants (60 female, 3 male) (Age range = 18-75+) responded to the survey. Descriptive analyses indicated that the majority of responding coaches worked in healthcare fields (59.65%) and achieved ≥ 150 minutes of physical activity (PA) per week (68.42%). Qualitative analyses indicated two types of motivation for coaching: internal (N=19) and external motivation (N=36). External motivation further included two sub-themes external-others (N=11) and external-self (N=25). Additional chi-square analyses revealed that those with bachelor and master's degrees, and working full time in healthcare occupations reported significantly less incidence of diabetes ($p < .05$) and higher instances of achieving 150 minutes or more PA per week ($p < .05$). **CONCLUSION:** These results suggest that lifestyle coaches are employed mainly in healthcare fields and are motivated to coach by external factors. The results indicate coaches may serve as appropriate role models in the adoption of PA behaviors and could help with training, delivery, and recruitment efforts for future coaches. Supported by Health Promotion Council (HPC) Grant.

3463 Board #284 May 29 1:30 PM - 3:00 PM
Obesity In Adolescence: Does Motor Competence Or Physical Activity Matter?

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Physical activity (PA) and motor competence are closely related to each other since motor competence is mainly, although not entirely, determined by PA patterns (i.e., Light PA [LPA], Moderate PA [MPA], and Vigorous PA [VPA]) in adolescence (Stodden et al, 2009). How the development of the motor competence may be influenced by PA patterns and how the interaction of these two variables may be correlated with obesity in adolescent years are understudied. **PURPOSE:** The main purpose of this study was to investigate the relation among PA patterns including LPA, MPA, and VPA, motor competence, and obesity (body composition, waist circumference) in adolescents. The second purpose was to test the gender differences among the study variables. **METHODS:** Participants were 307 students ($M_{age} = 12.5 \pm 0.9$; boys=142, girls = 165) randomly recruited from four middle schools in the U.S. Students' PA patterns were assessed using Actical monitors for 5 consecutive school days. Students' ball skill competence including volleyball, soccer, and ultimate Frisbee (PE Metrics™; NASPE, 2010) were assessed in PE classes. Body mass index (BMI) and waist circumference were used to represent indices of obesity in this study. **RESULTS:** Both LPA and VPA were significantly correlated with BMI and waist circumference ($p < .05$). All three ball skills were significantly associated with both MPA and VPA (r ranges from .21 to .33). Regression analyses indicated that only VPA and soccer skill merged as significant predictors of BMI ($\beta = -.16$; $\beta = -.24$, $p < .05$) and waist circumference ($\beta = -.15$; $\beta = -.15$, $p < .05$), respectively. Structural equation modeling suggested a mediating role of motor competence in the relationship between

PA patterns and obesity. After controlling for all the covariates, MANCOVA indicated boys had higher levels of VPA than girls ($p < .001$), but no significant differences were found for overall motor competence and MPA. Girls had higher waist circumference and LPA than boys. **CONCLUSION:** The findings indicate that engaging in at least vigorous PA may lead to higher and more accurate ball skill competence among adolescents. The potential "physical activity divide" may occur especially among girls between low-skilled adolescents and their skilled counterparts, which suggests a potential trajectory of obesity in adolescent years.

3464 Board #285 May 29 1:30 PM - 3:00 PM
Accelerometer-measured Sedentary Patterns Are Related To Poorer Inhibitory Control In Obese-middle-aged Adults

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Self-reported sedentary behaviors have been negatively related to executive functions (EFs) in older adults. However, the relationship of objectively measured sedentary time (ST) to EFs in adults with overweight and obesity is poorly understood. **PURPOSE:** To assess the relationship between accelerometer-measured ST and inhibitory control in middle-aged adults with overweight and obesity. **METHODS:** Pre-intervention data from 87 subjects (60 (67%) females, $M_{age} = 35.0 \pm 5.9$ yrs, BMI= 32.2 ± 5.4 kg/m²) participating in the *Persea Americana* for Total Health randomized controlled trial were analyzed. ST and physical activity were measured over 7 days with a hip-worn wGT3X-BT accelerometer. Valid wear time was defined as ≥ 4 days, ≥ 10 hrs/d. Daily ST (min/d), frequency, and time spent in sedentary bouts lasting ≥ 5 , 10, 20 and 30 consecutive min were estimated using a < 100 counts per minute (CPM) cut point. Moderate-to-vigorous physical activity (MVPA) was defined using an NHANES cut point. Inhibitory control was expressed as accuracy (AC), reaction time (RT), and inverse efficiency (IE = AC/RT) on incongruent trials of a modified Eriksen flanker task; performance on congruent trials indexed controlled processes. Multiple hierarchical regression models controlling for age, sex, intelligence, % fat mass, MVPA and ST (for sedentary bouts) were used to assess relationships between ST, sedentary bouts, inhibitory control, and controlled processes. **RESULTS:** Frequency ($bs \leq -0.22$, $ts \geq 2.11$, $Ps \leq 0.04$, $Fs(6,86) \geq 3.25$, $Ps \leq 0.007$) and time ($bs \leq -0.22$, $ts \geq 2.01$, $Ps \leq 0.047$, $Fs(6,86) \geq 3.17$, $Ps \leq 0.008$) spent in sedentary bouts lasting ≥ 20 and 30 min were associated with lower AC during incongruent trials. While ST and time spent in sedentary bouts ≥ 20 min were related to faster RTs during congruent trials ($bs \leq -0.23$, $ts \geq 2.08$, $Ps \leq 0.04$, $Fs(6,86) \geq 3.04$, $Ps \leq 0.01$), greater ST was related to lower IE on congruent and incongruent trials ($bs \leq -0.43$, $ts \geq 2.33$, $Ps \leq 0.023$, $Fs(7,86) \geq 2.76$, $Ps \leq 0.01$). **CONCLUSION:** In adults with overweight and obesity, more prolonged ST was related to poorer inhibitory control and less efficient controlled processes as indicated by more impulsive responding. Our results reveal a novel relationship between sedentary patterns and an aspect of EFs that has been implicated in the maintenance of obesogenic behaviors.

3465 Board #286 May 29 1:30 PM - 3:00 PM
The Role Of BMI On Cognition Following Acute Physical Activity In Preadolescent Children

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PURPOSE: There is an increasing prevalence of physical inactivity during childhood, concurrent with a rise in obesity rates (as measured by Body Mass Index, BMI), which is associated with a variety of health problems. However, the extent to which increased BMI influences acute physical activity (PA) benefits on cognition in childhood remains unknown. The aim of this study was to examine the relationship of BMI and acute PA on performance of a modified flanker task, which modulates inhibitory control. **METHODS:** In a sample of 116 children pooled from four prior studies (ages 8-11; 51 females), demographic measures of age, sex, IQ, socioeconomic status, and aerobic fitness were considered along with BMI. Children participated in a counterbalanced, randomized crossover study, whereby they completed two different interventions; 20 minutes of restful reading or treadmill walking (60-70% heart rate max). Following each intervention, children performed a modified flanker task to assess inhibitory control. Correlations were conducted to determine the influence of demographic variables, fitness, and BMI on inhibitory control following each intervention. Subsequent hierarchical regression analyses were performed with

significant demographic factors in the first step, aerobic fitness in the second step when significant, and BMI in the final step. **RESULTS:** Analyses indicated that children exhibited improved task performance ($p \leq 0.001$) following the walking intervention, as well as decreased interference ($p = 0.04$), indicating greater benefits following acute PA for the task condition requiring greater inhibitory control. Regression analyses were conducted to examine the influence of BMI on task performance following each intervention. Results revealed that increased BMI was related to decreased performance following acute PA ($p = 0.001$), an effect not seen following restful reading ($p \geq 0.11$). **CONCLUSIONS:** These findings indicate that the beneficial effects following an acute bout of PA on cognition are generalized across conditions of a flanker task, but are selectively greater for the task conditions requiring greater inhibitory control. However, the effects may be blunted in children with higher BMI. These results suggest that indices of inhibition are influenced by PA and adiposity in children.

3466 Board #287 May 29 1:30 PM - 3:00 PM

An Investigation Of Exercise Motivation In Normal Weight And Obese Humans And Rodents

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PURPOSE: The leading causes of morbidity and mortality stem from predetermined factors, but from maladaptive health behaviors that people have the ability to change. One primary example is physical inactivity, which is the fourth leading risk factor for global mortality and is a direct contributor to the global epidemic of obesity. Both the behavioral and neural mechanisms underlying sedentary behavior in healthy and obese populations are unknown, and constitute a major gap in our understanding of health behaviors. Understanding the mechanisms that regulate the motivation for exercise would allow us to devise treatments to target sedentary behaviors in both healthy and obese populations. As a precursor for these studies, the purpose here was to delineate levels of exercise motivation in both humans and a preclinical mouse model of obesity.

METHODS: Self-reported measurements of exercise motivation in humans ($n=727$) was collected via Amazon Mechanical Turk. Voluntary wheel running data was collected in both wild type mice and mice with a targeted deletion of the basic helix-loop-helix (bHLH) gene *Nhlh2* (N2KO), which serve as a preclinical model of obesity. Wheel running data was collected continuously for a period of 21 days as well as after a 72-hour period of wheel deprivation (rebound running response, Basso & Morrell, 2015).

RESULTS: Here, we demonstrate that compared to normal weight controls, exercise motivation is significantly impaired in obese individuals, with normal weight controls reporting higher intrinsically regulated motivations to exercise, and obese individuals reporting higher externally regulated motivations to exercise. Further, we demonstrate that wheel running in rodents is highly motivating and that running motivation is significantly impaired in the N2KO mice.

CONCLUSIONS: Impairments in exercise motivation may be a driver of obese outcomes, which are demonstrated here in both human and preclinical models of obesity. Previous work from our lab has demonstrated that regions of the motivational circuitry including the medial prefrontal cortex regulate the motivation for voluntary wheel running in rodents. We are currently investigating in both wild type and N2KO mice the hypothesis that neural activity in the PFC, modulated by dopamine, regulates the motivation for exercise.

3467 Board #288 May 29 1:30 PM - 3:00 PM

Sleep Parameters During A 12-month Behavioral Weight Loss Intervention With Varying Doses Of Physical Activity: The Heart Health Study

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(No relevant relationships reported)

Obesity is associated with poor sleep. Weight loss following caloric restriction has been shown to improve sleep, but whether physical activity (PA) alongside caloric restriction can augment these improvements is unclear. **Purpose:** To examine whether self-reported sleep parameters improve as a result of a behavioral weight loss intervention that included varying doses of moderate-vigorous PA compared to a diet-only condition. **Methods:** 383 adults with overweight or obesity ($\text{age}=46.2 \pm 7.7$ years; $\text{BMI}=32.1 \pm 3.8$ kg/m²) participated in a 12-month behavioral weight loss intervention and were randomized to one of three conditions: diet alone (DIET; $n=127$); diet plus a moderate dose of MVPA (DIET+MODPA; $n=129$); diet plus a high dose of PA (DIET+HIGHPA; $n=127$). All intervention conditions were prescribed a diet that reduced caloric intake to 1200-1800 kcal/day and received behavioral counseling

targeting weight loss. DIET+MODPA and DIET+HIGHPA conditions were prescribed home-based MVPA that progressed to 150 and 250 min/wk, respectively. Weight and sleep measures were collected at 0, 6, and 12 months. Sleep measures included the Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS). **Results:** Weight (LS mean [95% CI]) significantly decreased over time (0 months: 90.3 [89.0, 91.7] kg; 6 months: 81.7 [80.4, 83.0] kg; 12 months: 81.2 [79.8, 82.6] kg) ($p < 0.001$), with no difference between groups (Group: $p=0.29$; Group X Time: $p=0.50$). PSQI scores (LS mean [95% CI]) were reduced (i.e., improved) (0 months: 3.0 [2.8, 3.2]; 6 months: 2.8 [2.5, 3.0]; 12 months: 2.8 [2.5, 3.0]) ($p=0.08$), with no difference in the pattern of change by group (Group X Time: $p=0.59$). ESS scores did not change over time ($p=0.98$) in any group. Weight change (adjusting for intervention group) was associated with PSQI change at 6 months ($P < .01$) and 12 months ($P = .001$), but not ESS change at either time point ($P \geq .41$). **Conclusion:** Improvements in sleep quality were primarily associated with weight change in this behavioral weight loss intervention. Physical activity did not result in any additive improvements in sleep quality. In adults with overweight or obesity, enhancing long-term weight loss may be an important target for improving sleep quality. **Support:** National Institutes of Health (R01HL103646)

F-67 Free Communication/Poster - Smartphone and Behavior

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

3468 Board #289 May 29 1:30 PM - 3:00 PM

Analysis Of Physical Activity-Related Smartphone Apps For Behavior Change Potential

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(No relevant relationships reported)

The majority of Americans do not meet physical activity (PA) guidelines. Adoption and adherence may be improved with personalized intervention. Smartphone app use has increased exponentially in the past decade, extending to many areas of life and crossing socioeconomic status, ethnicity, and gender. Free smartphone apps that address habitual PA may be a useful tool, but their potential to support PA behavior change is not well understood. **PURPOSE:** To evaluate top-ranked free health and fitness apps for PA behavior change potential and to determine the relationship between this evaluation and consumer perceptions of quality, such as app store ranking and consumer ratings. **METHODS:** The top 100 "free" health and fitness apps in the US iOS app store were screened for inclusion. Apps were excluded if the descriptions did not address any aspects of PA or fitness; required an external device, purchase/subscription after a trial period, or a health club membership or specific health insurance. Apps were also excluded if their descriptions was not written in English. Two investigators downloaded and evaluated the remaining apps that met the inclusion criteria using the App Behavior Change Scale (ABACUS). Apps were scored on 21 strategies within 4 categories (knowledge/information, goals/planning, feedback/monitoring, and actions), and prevalence in the sample was calculated. Pearson correlations were estimated for the relationship between ABACUS total scores and relative app ranking, as well as consumer rating. Significance was set at $p < 0.05$. **RESULTS:** 23 apps met the inclusion criteria. 100% offered some form of personalization; 96% incorporated self-monitoring and/or rehearsal; and 70% included options for goal-setting. Only 13% recommended restructuring of the environment, and 4% provided advice on distraction or avoidance. There were no significant correlations between ABACUS score and store ranking ($r^2 = -0.15$, $p = 0.49$) or consumer rating ($r^2 = -0.26$, $p = 0.91$). **CONCLUSIONS:** Free apps may have the potential to support PA behavior change, especially in the areas of planning and self-monitoring. There is no correlation between the total number of evidence-based behavior change strategies and app popularity, however, so it may be beneficial for wellness professionals to counsel patients and clients on app choice.

3469 Board #290 May 29 1:30 PM - 3:00 PM

Determining Participant Compliance In Completing Pre- And Post-exercise Surveys In Real Time Using Smartphones

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(No relevant relationships reported)

Ecological momentary assessment of physical activity and its correlates is often implemented using mobile surveys distributed in a full coverage, semi-randomized

schedule. However, to gather accurate data of temporal dynamics of exercise, proximal pre/post-bout assessments are necessary. Active, smartphone-based self-monitoring is one option, but the feasibility of this approach is unknown. **PURPOSE:** Determine respondent reporting compliance with a one-time request to complete mobile surveys immediately before and after a single bout of exercise. **METHODS:** Enrolled individuals were at least 18 years old, owned a smartphone, and intended to exercise "in the near future." Participants received one email containing web links to a pre-exercise survey (PreS) and a post-exercise survey (PostS), with a request to complete them immediately before/after a bout using their smartphone Internet browser. The PostS contained items to self-report bout duration (SRBD) and lag time between bout completion and opening the PostS (SRLag). Variance in SRLag was assessed using descriptive and frequency analyses. Reporting accuracy was determined by comparing participant-estimated time intervals (PreS time+SRBD+SRLag) and actual time-stamped intervals (PostS time-PreS time) using a Wilcoxon signed-rank test. **RESULTS:** Participants (N=42, 36±13y, 68% women, 80% Caucasian) completed the PreS and PostS within a median of 3 days (interquartile range, IQR:1-6). The SRLag was ≤5-min for 26% of participants, and ≥30-min for 45%. Actual PreS-to-PostS time intervals appeared to be greater than those reported by participants (average rank of 17.48 vs. 13.32; Z=-.1990, p=.047). While the median absolute difference between reported and actual time intervals was 22-min (IQR:3-58), respondents were classified as having differences of <10-min (38%), 11-30-min (26%), and > 30-min (36%). **CONCLUSIONS:** Longer lag times between behavior and self-monitoring may introduce various biases (recall, mood-congruent memory), so it may be sensible to incorporate reminders for reporting goals. Additional research is necessary to explore sources of error regarding discrepancies between expected vs. actual PreS-to-PostS time intervals, as intentional deceit or unintentional misreporting may negatively impact subsequent data analysis.

3470 Board #291 May 29 1:30 PM - 3:00 PM
Exploring Correlates Of Forecasted And Recalled Affective Responses To Acute Aerobic Exercise Using Mobile Surveys
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 (No relevant relationships reported)

BACKGROUND: Exercise-related affective valuations (feelings of pleasure/displeasure) purportedly impact exercise-related cognitions and future behavioral decisions. The majority of prior research is laboratory-based, and supports an inverse relationship between affect during exercise (i.e. in-task affect) and ratings of perceived exertion (RPE), both of which may be impacted by an individual's pre-exercise mental states. **PURPOSE:** To explore correlates of forecasted and recalled in-task affect to an acute bout of exercise in free-living conditions. **METHODS:** Participants (N=42, 71% female, 36±12y, body mass index=25±4 kg/m²) were asked to complete an electronic survey via their smartphone immediately before and after a single bout of ambulatory exercise. RPE was measured via Category-Ratio 10 scale, forecasted and recalled in-task affect was measured via 100mm Visual Analog Scale, and the Multidimensional Mood Questionnaire captured the affect circumplex (degrees of valence and arousal). Data for psycho-perceptual variables were non-normally distributed and analyzed with Spearman's rank correlations. **RESULTS:** Forecasted affect was moderately related to recalled in-task affect (p=.57, p<.001). Forecasted and recalled RPE had no significant correlations with forecasted or recalled in-task affect (p's ranged -.05 to -.01, all p's>.73). Forecasted affect was moderately related to pre-exercise ratings of Valence (p=.39, p=.01), Calmness (p=.36, p=.02), and Energetic Arousal (p=.39, p=.01). Low correlation was observed between recalled in-task affect and pre-exercise ratings of Valence (p=.16, p=.29), Calmness (p=.05, p=.76) or Energetic Arousal (p=.15, p=.53). **CONCLUSIONS:** The current data stands contrary to existing literature in that RPE was not significantly related to forecasted or recalled in-task affect. The voluntary, dynamic nature of exercise components in free-living conditions compared to the often-prescribed exercise components in laboratory settings may contribute to this discrepancy. Because individuals can opt to deviate from their initial exercise intentions by making alterations to the mode, duration, or intensity of exercise after beginning a bout, it may be important to create survey items capable of capturing and explaining such incongruencies.

3471 Board #292 May 29 1:30 PM - 3:00 PM
Problematic Smartphone Use Is Negatively Related To Physical Activity In American College Students
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Multiple studies from our research group examining American adults have conclusively identified smartphone use as a sedentary behavior (SB). However, the same work has repeatedly found no relationship between smartphone use and physical activity (PA). Typically, SB is negatively related to PA. This may not be true of smartphones as the device can displace PA (e.g., watching videos, social media) and also promote PA (e.g., fitness apps, mHealth). Thus, different smartphone behavioral patterns should be considered in relationship to PA. Researchers have recently identified problematic smartphone use as a behavioral pattern motivated by the recurrent craving to use a smartphone. It is an addiction-like behavior leading individuals to use their smartphone compulsively in inappropriate situations such as during classroom lectures, while driving a car, or perhaps in environments intended for PA or planned exercise. Therefore, while total use is not associated with PA, problematic smartphone use may interfere with PA. **PURPOSE:** To assess the relationship between total and problematic smartphone use to PA in a sample of American college students. **METHODS:** A sample of American college students (N = 471, 21.1 ± 2.8 years old) completed validated surveys assessing total daily smartphone use, PA, SB (both assessed via the International Physical Activity Questionnaire) and problematic smartphone use (assessed via the Mobile Phone Problem Use 10-item scale). Pearson's correlations were then performed. **RESULTS:** As in previous studies, there was a significant, positive relationship between total daily smartphone use and SB (r = 0.31, p < 0.001) and no relationship with PA (r = 0.05, p = 0.32). However, while problematic smartphone use was similarly significantly and positively related to SB (r = .26, p < .001) it was also significantly and negatively related to PA (r = -0.18, p < .001). **CONCLUSION:** While prior research and the current study has found no relationship between total smartphone use and PA, this is the first study to assess the relationship between problematic smartphone use and PA. Results suggest that, unlike total daily smartphone use, problematic smartphone use may occur at the expense of PA behavior.

3472 Board #293 May 29 1:30 PM - 3:00 PM
The Relationship Between Cell Phone Use And Motivation To Exercise In College Students
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Previous research has shown that high cell phone usage is associated with sedentary behavior, poor physical fitness, and poor mental health. In today's era of technological advances, most individuals own a smartphone, but those who are college-aged have the highest rate of ownership (94%). Limited research exists on the relationship of smartphone usage on physical activity and mental health. **PURPOSE:** The purpose of this study was to examine the relationship between college students' smartphone usage, exercise motivation, mental health, and physical activity. **METHODS:** College students completed an electronic survey (n=157; female = 135; age = 20.01±1.49; BMI = 24.39 kg/m², SD = 5.7; smartphone use=218.1 min/day, SD = 122.9) that assessed exercise motivation (BREQ-3), physical activity (IPAQ-short), smartphone addiction (SAS-SV), daily smartphone use, height and weight, depression, anxiety, stress (DASS) and fear of missing out (FoMO). Data were analyzed with Pearson correlation and independent t-tests using SPSS. **RESULTS:** Low and high cell phone usage levels were established by splitting participants into two groups based on median usage (180 min/day). Overall, high cell phone users had greater BMI (23.2 vs. 25.5) and depression scores (10.2 vs. 7.1), and lower physical activity (2597.5 vs. 3616.6 min/wk) compared to low cell phone users (p<0.01). Sedentary minutes per week (r=0.24, p<0.01), amotivation (r=0.19, p<0.01), and smartphone addiction risk (r = 0.24, p<0.01) were positively associated to smartphone usage. Introjected (r = -.24, p<0.01), identified (r = -0.28, p<0.001), integrated (r = -0.31, p<0.001), and intrinsic motivation (r = -0.24, p < 0.01) was negatively associated with smartphone usage. High cell phone users had greater amotivation to exercise (t=-3.9, p<0.001), whereas low cell phone users had higher integrated regulation (t=5.3, p<0.001). **CONCLUSIONS:** This study has shown that smartphone usage is related to exercise motivation. Integrated regulation has been shown to be one of the strongest predictors

of exercise duration, which may help to explain why low cell phone users engaged in more weekly physical activity. Future research should examine whether limiting cell phone use will increase motivation to exercise to improve overall quality of life.

3473 Board #294 May 29 1:30 PM - 3:00 PM
Sedentary Behavior And Associations To Portable Screen-Based Device Use And Parental Influence In Rural Children

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Previous studies from our research group have examined the potential link between portable screen-based devices (i.e., smartphones and tablet computers) and sedentary behavior/physical activity in a primarily suburban population of young children and their parents. It was determined child sedentary behavior was related to portable screen-based device use while physical activity was not. While such relationships were found in a suburban population, rural demographic groups have been shown to differ in both their screen-based device use and physical activity variables suggesting the corresponding associations may also differ.

PURPOSE: To examine screen-based media device (smartphone, tablet, television, video games, computer) use in children and parents from a rural population in relation to sedentary behavior and physical activity.

METHODS: Parents ($N = 7$, 33.57 ± 3.95 years old) completed validated questionnaires assessing average daily total screen use (smartphone, tablet, television, video games, computer), portable screen-based device use (smartphone, tablet), sedentary behavior, and physical activity for both themselves and their children ($N = 7$, 7.00 ± 1.15 years old). Four standard regression models were used to assess the relationship between criterion variables and the following predictor variables: child age, child sex, child average daily sedentary time, and child physical activity. Criterion variables included (a) child portable screen-based device use (Model 1), (b) child total screen use (Model 2), (c) parent portable screen-based device use (Model 3), and (d) parent total screen use (Model 4).

RESULTS: Child sedentary time was significantly ($\beta = 0.92$, $t = 4.65$, $p = 0.04$) and positively associated with parent screen-based device use. Child age, sex, and physical activity were not significantly ($p > 0.05$) related to either parent or child portable or total device use.

CONCLUSION: Contrary to findings in young children from suburban populations, the current results from this limited sample suggest child sedentary behavior was not found to be related to portable screen-based device use in rural children. Furthermore, the data confirms previous findings that parental screen-based device use was predictive of sitting in their children.

3474 Board #295 May 29 1:30 PM - 3:00 PM
Associations Between Screen-time And Depressive Symptoms: Results From CSPPA-2

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 (No relevant relationships reported)

Screen-time (e.g., television, phone, tablet use) has been linked to increased depression and sedentary behaviour. A better understanding of associations between screen-time and depression is critical due to increased levels of screen-time and sedentary behaviour. **Purpose:** As part of a large nationally-representative observational study, the cross-sectional study reported here examined associations between self-reported screen-time and depressive symptoms among 396 adolescents (13.43 ± 0.87 y; 115 female) in primary and second level schools in the Republic of Ireland. **Methods:** Participants completed the Quick Inventory of Depressive Symptomatology and reported the number of days during the prior seven days that spent watching television, on a computer, and on a tablet or smartphone, and, on average, the number of hours spent on these devices on each reported day. One-way ANOVA examined potential sex-related differences in screen-time and depressive symptoms. Linear regression quantified crude and adjusted associations between total weekly hours of screen-time and depressive symptoms. Age, sex, waist circumference, functional disabilities, moderate-to-vigorous physical activity (MVPA), and school status (i.e., whether the school is in a government identified economically disadvantaged location) were included covariates. **Results:** Mean \pm SD hours of screen-time per week and depressive symptoms were 17.33 ± 18.53 and 5.47 ± 4.27 , respectively. Males (18.10 ± 18.73) reported more screen-time than females (15.19 ± 17.77 ; $p = 0.084$). Depressive symptoms did not differ by sex ($p = 0.99$). Total weekly hours of screen-time was significantly, positively associated with depressive symptoms ($\beta = 0.10$, $p \leq 0.05$). After adjustment

for age, sex, waist circumference, functional disabilities, MVPA, and school status, screen-time was significantly, positively associated with depressive symptoms ($\beta = 0.14$, $p \leq 0.006$). MVPA was the only statistically significant covariate in the model ($\beta = 0.11$, $p < 0.04$). **Conclusions:** Screen-time was significantly associated with greater depressive symptoms in Irish adolescents. Lower levels of screen-time and sedentary behaviour should be encouraged to reduce depressive symptoms among adolescents.

F-68 Free Communication/Poster - Hydration/Fluid Balance

Friday, May 29, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

3475 Board #296 May 29 2:30 PM - 4:00 PM
Hypohydration And Endurance Performance: A Meta-analysis

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 (No relevant relationships reported)

PURPOSE: The primary purpose of this meta-analysis was to systematically evaluate the differences in endurance performance while in a hypohydrated state achieved through varying dehydration methods. A secondary purpose was to evaluate the moderation between types of hypohydration (fluid restricted vs. exercise-induced) and changes in heart rate and core temperature.

METHODS: A systematic literature search of databases and specific journals relating to the subject, as well as a forward search with relevant researchers was performed to identify research papers meeting the inclusion criteria.

RESULTS: Eleven total studies met the inclusion criteria including a minimum of 2% hypohydration. All 11 included articles measured heart rate and 6 included articles measured core temperature. The meta-analysis using a random effects model indicated a hypohydration had a significant impact of hydration on heart rate ($ES = -0.42$, $p < .00$) and core temperature ($ES = -0.6$, $p = .017$). Method of dehydration did not significantly moderate the change in heart rate ($p = .59$) or core temperature ($p = .37$).

CONCLUSIONS: Heart rate and core temperature are elevated in a hypohydrated state. Current literature does not suggest that the method of dehydration impacts the elevation of heart rate and core temperature.

3476 Board #297 May 29 2:30 PM - 4:00 PM
Mild Hypohydration Following 24-hour Water Intake Reduction Does Not Affect Anaerobic Power Performance

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Hypohydration is common among athletes and can be the result of a failure to maintain hydration between exercise bouts. The negative impact of hypohydration on aerobic performance is well characterized. However, little is known about the effect of hypohydration on anaerobic performance particularly when the hypohydration is the result of insufficient water intake prior to the onset of exercise, not water loss due to body temperature regulation. **PURPOSE:** The purpose of this study was to examine the effect of hypohydration on anaerobic performance following voluntary water intake reduction. **METHODS:** Fifteen healthy adults (8 women, 7 men) completed two exercise sessions, euhydrated (EUD) and hypohydrated (HYP). Subjects were asked to voluntarily limit water intake during the 24-hours prior to the hypohydrated trial. Sessions consisted of baseline anthropometric and blood lactate measurement followed by a 30-second Wingate test and 3 maximum vertical jump trials. The vertical jump trials were completed approximately 1 minute after finishing the 30-second Wingate test and used to measure anaerobic performance in an anaerobically challenged state. Additional blood lactate measurements were taken immediately and at 5, 10, and 15-min post Wingate test. **RESULTS:** The hypohydration protocol resulted in a significant 1.5% reduction in body mass (EUD 69.1 ± 17.2 kg, HYP 68.1 ± 16.6 kg, $p = 0.039$). The 30-sec Wingate peak power (EUD 971 ± 302 W, HYP 960 ± 316 W, $p = 0.578$) was not different between conditions, nor was maximum vertical jump height (EUH 26.4 ± 4.5 cm, HYP 26.6 ± 3.6 cm, $p = 0.778$). Blood lactate ($p \leq 0.001$) was elevated immediately following the 30-sec Wingate test and remained elevated throughout the remainder of the trial. There were no differences in blood lactate between conditions. **CONCLUSIONS:** Acute anaerobic power and exercise performance are not negatively affected by mild voluntary hypohydration during and following a single 30-second Wingate test.

3477 Board #298 May 29 2:30 PM - 4:00 PM
Effects Of Cold Water Intake During A Short Exercise In Heat On Cognitive Function

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PURPOSE: This study evaluated the effect of cold water intakes before and during exercise in the heat on the cognitive function in healthy young man. **METHODS:** Ten men (26.3±4.4 yrs, 176.2±5.8 cm, 77.2±14.6 kg) who participated in vigorous exercises at least twice in a week and maximal oxygen capacity estimated by Rockport's 1-mile test was over 32.7 ml/kg/min were recruited. They underwent three testing sessions with different conditions in separate days; cold water (CW, 4 °C), neutral temperature water (AW, 36 °C), and no water conditions (NW). Testing order was randomly assigned and balanced. In each session, they were asked to ingest a prescribed amount of tap water (10 ml/body weight) at rest (1/3 of the total amount) and during exercise (2/3 of the total amount). After resting, they ran on a treadmill for 20 min in a hot environment (39.2±2.1 °C, 41.7±9.4 % relative humidity) at their predicted 75% of maximal heart rate. At 6, 12, and 18 min of exercise of CW and AW, they drank water. Cognitive test was performed 3 times; at rest, immediately after exercise, and after 20 min of recovery, by using Stroop color-word test (SCWT). During resting and exercise, their temperature, heart rate (HR), ratings of perceived exertion (RPE), naked body weight changes, and water intakes were measured. **RESULTS:** The average ear temperature during exercise was 37.2±0.6, 37.5±0.6, and 37.2±0.5 °C, and mean skin temperature was 34.8±2.3, 35.3±1.6, and 34.9±1.2 °C at CW, AW, and NW, respectively (p>0.05). Average HR and RPE was 148.3±14.1, 150.8±15.6, and 149.9±12.7 bpm and 13.3±0.7, 13.0±0.9, and 12.7±1.4 at CW, AW, and NW, respectively (p>0.05). They drank a total of 813±133 ml at CW and 812±130 ml at AW. They lost weight by sweating 493±145, 507±257, and 390±139 ml at CW, AW, and NW, respectively. The reliability of cognitive test was 0.909. The cognition score was 23.5±16.2, 24.3±15.5, and 22.0±11.8 in CW, 24.2±13.5, 28.1±10.4, and 25.1±9.7 in AW, and 17.5±8.3, 22.3±10.6, and 21.1±7.9 in NW, at resting, immediately after exercise, and after recovery, respectively (p>0.05). **CONCLUSIONS:** No advantage of cold water drinking before and during a short bout of exercise in the heat was evident for the cognitive function. The mode, intensity, and duration of exercise may be responsible for the outcomes.

3478 Board #299 May 29 2:30 PM - 4:00 PM
Body Mass And Urinary Hydration Measures During Preseason High School Football Practices In The Heat

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 (Sponsor: Douglas J. Casa, FACSM)

(No relevant relationships reported)

Hydration assessment is an important measure to help reduce the risk of exertional heat illness. Maintaining adequate hydration can be problematic for football players practicing in the heat on consecutive days. **PURPOSE:** To examine day to day differences and the relationships between urinary markers of urine color (U_{col}) and urine specific gravity (U_{SG}), and percent body mass loss (%BML) during football practices in the heat. **METHODS:** Thirty-one male high school football players (16 ± 1 years; 181.2 ± 12.0 cm; 68.1 ± 5.4 kg; BMI: 20.8 ± 1.8 km/m²) volunteered to participate in this study. Before and after each practice, players were weighed (in shorts) and provided a urine sample. Urine was assessed for U_{col} and U_{SG} and was assessed by the same person. Correlations assessed relationships, while t-tests assessed differences between both pre-post differences and subsequent days. P value was significant at P<.05. **RESULTS:** Mean wet-bulb globe temperature across 8 practices was 30.6 ± 2.5°C. There were significant correlations between pre- U_{col} and pre- U_{SG} ($r = 0.73$, $p = 0.00$, $n = 209$) and post- U_{col} and post- U_{SG} ($r = 0.66$, $p = 0.00$, $n = 209$). Post- U_{col} (5 ± 1) was significantly greater than pre- U_{col} (4 ± 2; $p = 0.00$). Post- U_{SG} (1.022 ± 0.008) was significantly greater than pre- U_{SG} (1.020 ± 0.008; $p = 0.00$). Post body mass measures were significantly lower than pre-body mass resulting in 0.9 ± 1.1%BML. Post-practice body mass and U_{SG} were not significantly different from the next day's pre-practice measures ($p > 0.05$); however, post- U_{col} was significantly higher (5 ± 2) compared to the next day's pre-practice U_{col} (4 ± 1; $p = 0.000$). **CONCLUSION:** Although the football players' body mass measures were similar on subsequent days, their U_{col} was lighter before the next day's practice. We also found a strong relationship between U_{col} and U_{SG} , suggesting U_{col} is an acceptable hydration measure where U_{SG} is not feasible in field settings. Due to individual variability in these hydration measures, clinicians should provide individualized recommendations to ensure adequate hydration during practices in the heat as well as from one day to the next. *This study was fully funded by the National Athletic Trainers' Association Research & Education Foundation.*

3479 Board #300 May 29 2:30 PM - 4:00 PM
Association Between Free-living Weekday 24-hour Urinary Hydration Markers And Weekend Sleep Measures

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(No relevant relationships reported)

PURPOSE: Inadequate sleep and underhydration have been independently associated with adverse health outcomes. However, the relation between hydration status and sleep has yet to be investigated over the course of several days in young adults. Thus, the purpose of this study was to assess the association between 24h urinary hydration markers and both perceived and objective sleep quality. **METHODS:** Eighteen participants (female, $n = 7$; age, 23±3; height, 174.6±15.3cm; body mass, 73.5±15.9kg; body fat, 19.4± 9.4%) provided a 24h urine sample on seven consecutive days for measures of urine volume (U_{VOL}), urine osmolality (U_{OSMO}), urine specific gravity (U_{SG}) and urine color (U_{COL}). Objective sleep metrics (wrist-worn actigraphy) and subjective sleep assessments (Karolinska Sleep Diary) were recorded each day. Actigraph measures included periods of wakefulness after defined sleep onset (WASO), sleep time, wake time, and sleep efficiency. The Karolinska Sleep Diary included nine questions used to assess perceived sleep quality from the previous night. Mean values were calculated for each participant for all variables on weekdays (Monday-Friday) and weekend days (Saturday/Sunday). **RESULTS:** Higher weekday U_{SG} and darker U_{COL} were both associated with greater weekend time spent sleeping (U_{SG} , adj $R^2 = 0.203$, $p = 0.024$; U_{COL} , adj $R^2 = 0.274$, $p = 0.015$). Decreased weekday U_{VOL} was associated with increased weekend time spent sleeping (adj $R^2 = 0.220$, $p = 0.028$). Higher weekday U_{OSMO} was associated with greater weekend WASO actigraph measures (adj $R^2 = 0.205$, $p = 0.045$). **CONCLUSIONS:** Mean 24-hour urinary hydration markers depicting a state of underhydration (elevated U_{SG} and reduced U_{VOL}) across weekdays were associated with an increased number of awakenings during the weekend nights, albeit, having a longer sleep time. Determining how day-to-day variations in hydration status and other general health behaviors influence sleep has yet to be explained.

3480 Board #301 May 29 2:30 PM - 4:00 PM
Change In Physiological Strain And Cognitive Processing Following Electrolyte And Carbohydrate Supplementation

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PURPOSE: The purpose of this study was to examine the effects of 3 different fluid conditions on hydration, physiological strain index (PSI), and cognitive processing speed during and following a simulated wildland firefighter (WLFF) ingress hike. **METHODS:** 7 subjects (27.4±4yrs, 5M/2F) performed 3 visits of 2hrs of treadmill walking at 3mph/7% grade in an environmental chamber set to 33°C/10% relative humidity. In random order, subjects consumed either water (W), water+electrolyte (GZ), or water+electrolyte+sugar (G) at each visit. Throughout exercise (EX), subjects wore fire-retardant attire, carried a 50lb pack, and drank *ad libitum* to mimic WLFF conditions. Pre and post EX, body mass (BM), fluid consumption, and plasma osmolality (pOsm) were measured. PSI, an calculated index of cardiovascular (CV) and thermal strain, and core temperature (T_C) were recorded every 15mins during EX. Plasma glucose (GLU) was measured every 30mins. Cognitive processing speed, measured via the Stroop Color and Word Test (SCWT), was measured post EX and compared to baseline (BL) values. **RESULTS:** There were no significant differences between fluid conditions (W, GZ, and G) for BM ($\Delta 0.6 \pm 0.2$, 0.9 ± 0.3 , and 0.8 ± 0.2 Kg), fluid consumption (1.9 ± 0.3 , 2.2 ± 0.2 , and 1.9 ± 0.3 L), pOsm ($\Delta 1.2 \pm 5.1$, 9.5 ± 5.4 , and 8.1 ± 2.1 mmol/L), peak PSI (7.6 ± 0.6 , 7.8 ± 0.5 , and 8.6 ± 0.7) and peak T_C (38.8 ± 0.2 , 38.9 ± 0.2 , and 39.1 ± 0.2 °C). Compared to W and GZ, GLU significantly increased in the G condition (107 ± 14 , 107 ± 13 , and 113 ± 11 mg/dL at 60, 90, and 120mins, $P < 0.05$). Compared to BL, SCWT performance significantly decreased in all conditions (204.2 ± 21 , 213 ± 24 , and 222 ± 21 ms, $P < 0.05$). **CONCLUSION:** Fluid condition had no effect on hydration status or physiological strain. Following EX, there was a similar decrease in SCWT in all fluid conditions, indicating a decreased ability to inhibit cognitive interference. Additionally, PSI was higher than previously reported, suggesting that the ingress hike may lead to dangerously high CV and thermal strain in WLFFs. PSI should be monitored (HR and T_C) during ingress hikes by medical staff or supervisors, especially when conditions yield high ambient temperatures. This could aid in reducing the amount of WLFFs that succumb to heat related illness each year. **Grant Funding:** The project was funded by the US Forest Service.

3481 Board #302 May 29 2:30 PM - 4:00 PM

Exploration Of Hydration Practices And Prolonged Endurance Exercise Effects On Plasma Apelin Concentration

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(No relevant relationships reported)

Reduced circulating concentrations of the endogenous peptide apelin is implicated in many negative health conditions, and apelin administration can reverse sarcopenia processes. While acute and chronic exercise elicits greater circulating apelin concentrations, little attention has been given to apelin's water regulatory roles (i.e., AVP opposition) and manipulation by water intake to enhance human health. **PURPOSE:** We investigated the impact of hydration status and process on plasma apelin following prolonged endurance exercise and after a subsequent water challenge. **METHODS:** Twenty-two male cyclists (age median=54y and range=29-72y) completed a 161km event (mean=26°C, 76%RH; maximum=30°C, 93%RH; mean finish time = 372 ± 93min). Participants were interviewed for dietary intake in the morning and during the ride. Hydration biomarkers included body mass change (BMA), urine specific gravity (U_{sg}) and color (U_{col}), plasma osmolality (P_{osm}) and copeptin (P_{cop}), and apelin (P_{ap}), which were collected before (PRE), immediately after the ride (POST), and 1h following a 650mL water bolus (POST1h). **RESULTS:** P_{ap} paradoxically decreased after exercise (PRE = 1.19 ± 0.29 , POST = 1.02 ± 0.27 ng/mL; $p = 0.04$). It is plausible that hypohydration at POST (according to -1.96% BMA and P_{cop} , U_{sg} , U_{col} ($p < 0.05$), but not P_{osm} ($p = 0.31$)) masked any drive of acute exercise to increase P_{ap} , or that prolonged endurance exercise differentially affects P_{ap} , although POST and POST1h P_{ap} did not correlate with finish time ($p = 0.76$ and 0.31 , respectively). Interestingly, the water bolus did not alter P_{ap} concentrations versus POST (POST1h = 1.0 ± 0.29 ng/mL; $p = 0.66$). POST P_{ap} correlated with PRE P_{osm} ($r = -0.47$), and POST1h P_{ap} with PRE U_{col} ($r = -0.46$; both $p < 0.05$), suggesting baseline hydration might alter P_{ap} responses. Despite previous reports, P_{ap} was not significantly correlated with age at any time point ($p = 0.36$ to 0.73) perhaps due to chronic exercise practices of these cyclists. **CONCLUSIONS:** This real-world scenario demonstrated complex relationships among plasma apelin, exercise, and hydration. Our data suggests insufficient baseline hydration might mitigate the acute exercise-induced P_{ap} elevation. As an increasingly valuable modulator of chronic health, further research should address complexities of P_{ap} responses.

3482 Board #303 May 29 2:30 PM - 4:00 PM

Effects Of Fluid Restriction On Muscular Strength And Fatigue

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(No relevant relationships reported)

Fluid restriction (FR) is commonly performed by athletes competing in weight-class sports, but the effects of fluid restriction on strength performance remain controversial. **PURPOSE:** To assess the effects of fluid restriction on muscular strength performance and fatigue. **METHODS:** Six participants (age 24 ± 2 y, body mass 87 ± 16 kg, ht 1.7 ± 0.1 m, body fat $18 \pm 8\%$) randomly completed two experimental trials (euhydrated, EU, or FR). FR consisted of three days of graded decreases in fluid intake (1.5 L three days prior, 0.5 L two days prior, and 0.5 L the day prior to the trial). For each trial, participants cycled at 50 W for 10 minutes on cycle ergometer and completed a standardized dynamic warm-up. Participants then performed strength testing on an isokinetic dynamometer involving three repetitions of isometric knee flexion and extension at 70° and 90° and isokinetic contractions at 50 and $150^\circ/\text{sec}$. Next, a fatigue protocol of 30 maximal effort repetitions of isokinetic contractions at $180^\circ/\text{sec}$ was performed, followed by the initial strength testing protocol. **RESULTS:** Body mass was reduced $1.9 \pm 1.3\%$ with FR compared to EU (mean difference: 1.8 ± 1.5 kg, $P = 0.02$). Urine specific gravity was increased following FR (1.025 ± 0.005) compared to EU (1.015 ± 0.008 , $P = 0.02$). Perceived thirst was greater in the FR trial (grand mean, 3.4 ± 1.4) compared to the EU (grand mean, 7.2 ± 0.9 , $P < 0.001$) and rating of perceived exertion tended to be increased in the FR trial (16.1 ± 1.8) compared to the EU (15.1 ± 1.9 , $P = 0.06$, $d = 0.87$). Isometric strength was not different between conditions for extension at 70° ($P = 0.44$, $\eta_p = 0.12$) and 90° ($P = 0.75$, $\eta_p = 0.02$). Isokinetic strength was also not different between conditions at $50^\circ/\text{sec}$ (EU 198.4 ± 50.7 , FR 184.8 ± 38.7 Nm, $P = 0.26$, $\eta_p = 0.24$) and $150^\circ/\text{sec}$ (EU 136.2 ± 35.8 , FR 129.0 ± 41.9 Nm, $P = 0.20$, $\eta_p = 0.31$). During the fatigue protocol, total work completed was not different between conditions (EU 2656 ± 794 , FR 2689 ± 902 Nm,

$P = 0.63$), but, average power demonstrated a moderate-large effect ($d = 0.71$) for reduction in the FR condition (182.6 ± 65.0 W) compared to EU (206.5 ± 58.8 W, $P = 0.14$). **CONCLUSIONS:** These preliminary results suggest FR does not alter muscular strength or fatigue. However, perceptual strain (thirst, exertion) may be increased, requiring a greater effort to produce similar performance.

3483 Board #304 May 29 2:30 PM - 4:00 PM

The Relationship Between Whole-body Heat Exchange And Thermoregulatory Responses During Exercise In The Heat In A Dehydrated State

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Whole-body heat loss has been extensively examined during exercise in hot environments. Interestingly, the relationship between predicted heat balance parameters and thermoregulatory strain have been limited to individuals in a euhydrated state. As dehydration has been shown to exacerbate thermal and cardiovascular strain, it is imperative to examine whether dehydration modulates heat exchange during exercise in the heat and its relationship to physiological responses to exercise in the heat. **PURPOSE:** to examine whether predicted heat balance parameters explain variance in core temperature (T_{core}) and heart rate (HR) responses to exercise in the heat following 24 h of fluid restriction. **METHODS:** 8 participants (4 males and 4 females; age: 19 ± 2 yrs; VO_{2max} : 47.4 ± 6.5 ml/kg/min; body mass: 61.5 ± 9.4 kg; height: 166.7 ± 7.5 cm) performed a 30-min bout of treadmill running and walking in the heat (32°C , 55% relative humidity) under two conditions: 1) 24 h of fluid restriction (DEH) and 2) euhydration (EUH). Participants exercised at 11W/kg for 15 min followed by 7W/kg for 15 min, which were derived via indirect calorimetry. T_{core} was continuously assessed through rectal thermometry and HR was measured at the end of each intensity. Metabolic heat production (M-W), dry heat loss (DHL), and evaporative requirement (E_{req}) were calculated for both exercise intensities. Pearson correlation coefficients were utilized to examine the relationship between M-W, DHL, E_{req} and T_{core} , change in T_{core} (ΔT_{core}), HR, and change in HR (HR) under DEH and EUH. Linear regressions were performed for all significant correlations. Statistical significance was set at $p \leq 0.05$. **RESULTS:** M-W and DHL were not correlated with T_{core} , ΔT_{core} , HR, or HR in DEH or EUH at 11W/kg . At 7W/kg under DEH, DHL was negatively correlated with T_{core} ($R^2=0.54$, $p=0.05$) and HR ($R^2=0.67$, $p=0.024$). All other heat balance parameters were not correlated with physiological responses at 7W/kg in DEH or EUH. **CONCLUSION:** In this preliminary dataset, E_{req} and M-W did not explain variance in physiological responses during DEH. DHL under DEH explained 67% of the variance in post HR and 54% of the variance in T_{core} at 7W/kg . Therefore, DHL may contribute to the variation in physiological strain during low intensity exercise in the heat under DEH.

3484 Board #305 May 29 2:30 PM - 4:00 PM

Sex Differences In Response To Passive Dehydration Via 24-h Fluid Restriction

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(No relevant relationships reported)

Dehydration is a known stressor on the human body. It has been previously observed that a proportion of individuals may live in a chronic state of mild dehydration, either due to physical activity and lack of proper rehydration, or due to low habitual fluid consumption. This state of chronic dehydration propagated by low fluid consumption can be simulated via passive dehydration and fluid restriction. Physiological responses to fluid restriction have previously been investigated in men, leaving sex differences or unique responses in women uninvestigated. **Purpose:** The purpose of this investigation was to assess differences in response to 24-h fluid restriction (FR) between men and women. **Methods:** Eleven participants ($n=5$ male: 21 ± 3 y, 69.97 ± 8.4 kg, 172.4 ± 3.8 m; $n=6$ female: 20 ± 2 y, 57.04 ± 3.62 kg, 163 ± 4.9 m) underwent passive dehydration via 24-h FR one time for men, and twice for women. Females were tested in the late follicular and mid-luteal phases of the menstrual cycle (days 12-14 and 19-21, respectively). Body mass loss assessed via nude body mass, plasma osmolality (P_{osm}), and blood pressure were assessed pre- and post-FR. During FR participants also collected their urine which was assessed for urine color (U_{col}), urine specific gravity (USG), osmolality (U_{osm}), and volume (L). **Results:** No differences were found in this preliminary data set between men and women for body mass loss (%BML; male: 1.28 ± 1.14 , female: $.68 \pm 1.2$, $p=.407$), plasma osmolality post-FR (male: 291 ± 4 mOsmo $\cdot\text{kg}^{-1}$, female: 294 ± 3 mOsmo $\cdot\text{kg}^{-1}$, $p=.319$), U_{col} (male: 5 ± 2 , female: 6 ± 1 , $p=.594$), USG (male: 1.026 ± 0 , female: 1.027 ± 0 , $p=.862$), urine volume (male: $0.30 \pm .47$ L, female: 0.16 ± 0.20 L, $p=.501$), or U_{osm} (male: 805 ± 313 mOsmo $\cdot\text{kg}^{-1}$, female: 740 ± 115 mOsmo $\cdot\text{kg}^{-1}$, $p=.621$). The only differences present between male

and female participants were in pre-FR P_{osm} (male: 293 ± 4 mOsmo·kg⁻¹, female: 286 ± 3 mOsmo·kg⁻¹, p=0.05). **Conclusion:** These preliminary data show no sex differences in response to 24-h FR, but this ongoing investigation and full dataset seeks to fully elucidate possible differences in response to FR simulating chronic mild dehydration that can affect young physically active, as well as elderly populations. Character Count: 1885/2000

3485 Board #306 May 29 2:30 PM - 4:00 PM
**Renal Stress Responses To Work In The Heat
 Comparing Different Hydration Regimens**

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Workplace safety organizations recommend that workers predicted to incur heavy sweat loss should consume a 'sport drink' during work. These sugar-sweetened beverages (SSB) often include fructose, which can lead to acute kidney injury (AKI), especially when combined with hypohydration. **PURPOSE:** Investigate the effect of SSB on renal stress in response to simulated industrial work in the heat, while maintaining euhydration. **METHODS:** Twenty male participants (24 ± 2y, 179 ± 6cm, 24.7 ± 9.0% body fat) completed two randomized, matched trials of simulated industrial work (2-hr total; two 45-min work and two 15-min rest bouts) in the heat (30°C, 55% RH). Equal amounts of SSB or placebo were provided during rest and within 2-hr of completing work. Urine specific gravity (USG), heart rate (HR), and rectal temperature (T_{rec}) were monitored throughout trials. Serum [Na⁺], hemoglobin, and hematocrit levels were measured at baseline, pre- and post-work, and 16-hr post-work. Urinary kidney injury molecule-1 (uKIM-1) and urinary neutrophil gelatinase-associated lipocalin (uNGAL) were measured pre- and post-work, 3-hr and 16-hr post-work. Total urine volume was measured for 16-hrs following work. Change in plasma volume (ΔPV) was calculated using the Dill & Costill equation. **RESULTS:** There was no significant trial difference in USG (p=.277) or HR (p=.209), but post-work (p≤.011) and 16-hr post-work USG were elevated compared to baseline (p=.043) and 3-hr post-work (p=.001). There was no difference in maximum T_{rec} achieved between trials (SSB 38.84 ± 0.52°C; placebo 38.68 ± 0.40°C; p=.330). Serum [Na⁺] was elevated post-work compared to baseline and 16-hr post-work (p=.006), but there was no trial difference (p=.612). There was no trial difference in hemoglobin (p=.650) or hematocrit (p=.637). uKIM-1 was elevated post-work and 16-hr post-work compared to baseline (p≤.028) and 3-hr post-work (p≤.009), but showed no trial difference (p=.126). uNGAL 3-hr post-work was significantly lower than baseline (p=.011), but showed no trial difference (p=.992). There was no significant trial difference in total urine volume (p=.277) or ΔPV (p=.098). **CONCLUSION:** These findings indicate that beverage type did not affect renal stress biomarkers following simulated industrial work in the heat when euhydration was maintained.

3486 Board #307 May 29 2:30 PM - 4:00 PM
**No Relation Between Short-term Sodium Intake And
 Whole Body Sweat Sodium Concentration During
 Exercise-heat Stress**

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Reported Relationships: R.P. Nuccio: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc.. Ownership/interest/stock; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..

Research has been limited and mixed with regards to the effect of normal, short-term dietary sodium (Na) intake on sweat Na concentration ([Na]) and total sweat Na losses during exercise.

Purpose:

To determine the relation between dietary Na intake during exercise and up to 48-h before exercise on whole-body (WB) sweat [Na] and total sweat Na loss during 90 min of moderate-intensity cycling in the heat.

Methods:

Forty-nine recreational athletes (34 men, 15 women; 34 ± 4 years; 75 ± 12 kg) cycled for 90 min at 78 ± 5% HR_{max} in the heat (32°C, 25-50% RH). The WB washdown technique was used to collect sweat electrolytes during exercise and ion chromatography analysis was used to determine sweat [Na]. Total sweat Na loss was the product of WB sweat [Na] and WB sweat loss. Subjects were instructed to consume their normal diet before their trials. Upon arriving to the lab, each subject turned in a diet log, which included specific portion sizes and brand/type for all foods,

fluids, and dietary supplements consumed in the previous 48 h. The investigators reviewed the diet logs for completeness with the subjects. Na intake was determined by Registered Dietitians using a computer based dietary analysis tool. Na intake during the trial was determined from the volume of 6% carbohydrate electrolyte (38 mmol/L Na) solution consumed *ad libitum*. Pearson correlation analysis was used to determine the relation between Na intake versus WB sweat [Na] and total sweat Na loss. Data are shown as mean ± SD.

Results:

WB sweat [Na] was 41.1 ± 15.6 mmol/L and total sweat Na losses were 60.9 ± 35.3 mmol. Na intake during exercise, 24-h and 48-h before exercise were 32.4 ± 18.0 mmol, 188 ± 102 mmol, and 350 ± 159 mmol. There were no significant correlations between dietary Na intake and WB sweat [Na] (r = -0.002 to 0.02, p=0.90-0.99) or total sweat Na losses (r = 0.07 to 0.19, p=0.20-0.61) for any of the comparisons.

Conclusion:

There were no correlations between normal dietary Na intake during and up to 48 h before exercise versus WB sweat [Na] or total sweat Na losses. These results suggest that short-term Na intake does not play a significant role in explaining the inter-individual differences in WB sweat Na during exercise.

3487 Board #308 May 29 2:30 PM - 4:00 PM
**Exogenous Fluid Delivery Schedule And Composition
 On Fluid Balance And Substrate Use In The Heat**

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(No relevant relationships reported)

Hydration position stands outline suggested volume considerations but remain somewhat ambiguous regarding frequency parameters. **PURPOSE:** To determine the effects of micro-dosing or bolus-dosing plain water (MW, BW, respectively) or a carbohydrate-electrolyte solution (MCE, BCE, respectively) on fluid retention and carbohydrate oxidation during exercise in the heat. **METHODS:** In a repeated measures cross-over design, males (n=8, 80.3 ± 11.8 kg, VO₂ peak 53 ± 5.0 ml·kg⁻¹·min⁻¹) completed four 2-hour trials (treadmill, 1.3 m·s⁻¹ at a 5% grade) in a heat chamber (33°C and 30% RH) with a 15 kg pack. Fluids were delivered to equal 100% of a pre-determined hourly fluid loss familiarization trial. Micro-dosed fluids were provided at 22 doses·h⁻¹ (49 ± 13 ml·dose⁻¹), while bolus-dosed fluids were provided at 1 dose·h⁻¹ (1075 ± 274 ml·dose⁻¹). CE trials delivered 67 ± 17 g CHO·hr⁻¹ and 939 ± 239 mg Na⁺·hr⁻¹. Nude body weight, urine volume, and urine specific gravity (USG) were recorded during and 1-hour post exercise. Steady state expired air samples were collected to evaluate rates of carbohydrate oxidation. A two-way ANOVA with repeated measures was used to determine differences. Statistical significance was established at p < 0.05. **RESULTS:** Total body weight loss was similar across all four trials (-0.60 ± 0.25, -0.53 ± 0.17, -0.67 ± 0.34, and -0.50 ± 0.27 kg, for the BCE, MCE, BW, and MW trials, respectively, p > 0.05). Cumulative urine output was similar across all four trials (725 ± 478, 779 ± 494, 818 ± 507, 718 ± 446 ml, for the BCE, MCE, BW, and MW trials, respectively, p > 0.05). USG was additionally similar across all trials at 0, 60, 120, and 180 minutes (n=7, 1.008 ± 0.006, 1.008 ± 0.007, 1.007 ± 0.007, 1.008 ± 0.006, p > 0.05). Carbohydrate oxidation was significantly higher in the CE trials when compared to the W trials (1.5 ± 0.3 and 0.8 ± 0.2, g·min⁻¹, p < 0.05) but was not different between dosing styles of the same composition (1.6 ± 0.3 and 1.5 ± 0.3 g·min⁻¹ for BCE and MCE; 0.8 ± 0.2 and 0.8 ± 0.3 g·min⁻¹ for BW and MW, p > 0.05). **CONCLUSION:** These data demonstrate minimal differences in overall fluid retention and substrate oxidation during exercise in the heat across varied fluid composition and delivery intervals. Supported by the United States Forest Service (USFS), National Technology and Development Program

F-69 Free Communication/Poster -
Thermoregulation/Hyperthermia

Friday, May 29, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

3488 Board #309 May 29 2:30 PM - 4:00 PM
**Heat Load, Cooling Methods And Hydration Of Sailors
 During Summer Training Camp In Japan**

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Purpose: Weather forecasts for the upcoming Olympic Games in Tokyo predict hot and humid conditions, which have a negative effect on performance. Our aim was to

estimate the heat load sensation and efficacy of cooling methods using self-reports, and by measuring parameters of hydration status of Olympic-level 470 sailors and windsurfers, during a training camp in the summer of 2019 in Japan.

Methods: Seven females (4 windsurfers, 3 sailors 470) and 4 males (470 sailors), age 21.17y ± 1.4, used cooling vests, plates, and collars before and in-between training races. Weather conditions were measured using Kastrel 5500. Athletes scored their heat load sensation on a scale of 1 – “comfortable” to 5 – “unbearably hot” after each practice. Following the use of different cooling accessories, the athletes were asked to rate cooling method efficiency between 1 – “not efficient” to 5 – “very efficient”. Hydration status, was assessed by urine specific gravity (USG) prior to each training, body weight change and fluid intake measure during training sessions.

Results: During the 8 training days the average weather conditions were: heat index 26.3°C ± 3.7; humidity 84% ± 7%; and temperature 27.7°C ± 1.5°C. Average sea training duration was 221min ± 66 for sailing and 177min ± 34 for windsurfing. Although the heat index did not change, the heat load sensation rating was affected by wind speed – rated as 2.5 when the wind speed was above 8 knots and 4 with lower wind speed (P < 0.002). Using cooling vests before and between races was rated as efficient (4). Cooling plates (inserted under the life vests) and a cooling collar were somewhat less efficient (3.5 and 3.1 respectively). Athletes were well hydrated before training (average USG 1.009 ± 0.007), and maintained good hydration during training (average fluid consumption of 2Lit ± 0.9 and average weight loss of 0.05Kg ± 0.55).

Conclusions: High humidity with a moderate heat index was measured at the area of the Tokyo Olympic Sailing Arena during July 2019. The athletes reported high heat load sensation during training and found different cooling methods efficient. Higher wind speed decreased the heat load sensation, probably due to the acceleration of sweat evaporation. High awareness and prior training in a hot environment like Israel may contribute to improved drinking behavior and hydration status.

3489 Board #310 May 29 2:30 PM - 4:00 PM

Sweat Rate Variability Between Training Sessions

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Practitioners regularly develop hydration plans for athletes based on measured sweat rate. Often times, this is a single measure utilized over various training sessions without consideration for sweat rate variability.

PURPOSE: The purpose of this study was to investigate sweat rate variation in self-selected training sessions to assess the potential error that might be seen when determining sweat rate.

METHODS: Eleven endurance trained runners (7 competitive and 4 recreational) arrived at the research facility once a week over four weeks. Upon arrival, researchers recorded athlete's body mass. Athletes then completed a running workout lasting a minimum of 30 minutes exercise time. Pace and distance were left to the individual runner's preference for the training session. Immediately upon run completion, researchers reassessed the runners' body mass. Difference in body mass pre- to post-run was reported as sweat rate as no fluid or beverage were ingested during the run. The highest and lowest sweat rate recorded for each individual during the four-week period were used for comparison. Paired sample t-tests were used to compare run duration, run distance, running pace, WBGT, and sweat rate with significance set a priori at P < 0.05.

RESULTS: There were no differences in run duration (41.3 ± 11.0 min; p = 0.68), run distance (8.13 ± 2.85 km; p = 0.94), run pace (5.11 ± 0.78 min/km; p = 0.07), or WBGT (21.9 ± 1.4°C; p = 0.41) between trials. Participants highest sweat rate recorded during the four-week period was significantly higher 1.08 ± 0.39 l/h compared to the lowest of 0.89 ± 0.32 l/h, (p = 0.003).

CONCLUSIONS: Assessing sweat rate is a useful tool for aiding in the determination of fluid intake during exercise however, a single point assessment may not accurately capture an individual's typical rate. Caution needs to be taken when relying on a single assessment or extrapolating to longer training sessions even in similar conditions.

3490 Board #311 May 29 2:30 PM - 4:00 PM

Elite Female Rugby Sevens Tournament Match-Play - Core Temperature Changes

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PURPOSE: Characterise player core temperature (Tc) across a World Rugby Women's Sevens Series (WRWSS) tournament day and determine the efficacy of commonly

employed cold water immersion (CWI) protocols. **METHODS:** Tc was measured in twelve elite female rugby sevens athletes across 3 games (G1-3) from day 1 of the Sydney WRWSS tournament. Exertional heat illness symptoms, perceptual scales, CWI details, playing minutes, external load data (measured by Global Positioning Systems) and wet globe temperature (range: 18.5–20.1°C) were also collected. Linear mixed models and magnitude-based inferences were used to assess differences in Tc between periods [G1-3 and warm-ups (WU)]. **RESULTS:** Average Tc was very likely lower (ES; ±90% CL, -0.33; ±0.18) in G1 compared to G2. Peak Tc was very likely (0.71; ±0.28) associated with increased playing time. CWI did not remove the accumulated Tc due to WU and match-play activity (~1–2°C rise in Tc still present compared to Tc at WU onset for players ≥ 6 min match-play). **CONCLUSIONS:** Elite female WRWSS athletes experienced high Tc during WU (Tc peak 37.9–39.0°C) and matches (Tc peak 37.9–39.8°C), a magnitude known to reduce intermittent high-intensity physical performance (≥39°C). The CWI protocol resulted in players (≥ 6 min match-play) with a ~1–2°C raised Tc compared to Tc at WU onset.

3491 Board #312 May 29 2:30 PM - 4:00 PM

Patch Application Timing And Adherence Duration Effects On Local Sweating Rate And Sweat Electrolyte Concentrations

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Sweat testing is often conducted to assist with electrolyte replacement plans for athletes. However, the effect of patch application timing and on-skin duration on local sweating rate (LSR) and sweat electrolyte concentrations is unclear. **Purpose:** To determine the effect of patch application timing and on-skin duration on LSR and local sweat [Na⁺], [K⁺], and [Cl⁻]. **Methods:** Thirty-nine recreationally trained (VO₂ max: 47.1 ± 7.8 ml/kg/min) athletes (27 M, 12 F; 75.4 ± 12.4 kg) cycled at ~80% HR_{max} in the heat (32°C, 39% rh). Prior to (PRE) and 15 min into exercise (EX), two sweat patches were applied to the left and right mid-back, respectively. The patches were removed after a skin adherence duration of 30 (SHORT) or 70 (LONG) min. LSR was equated from sweat mass over patch surface area (11.9 cm²) and duration. Sweat was centrifuged and analyzed for [Na⁺], [K⁺], and [Cl⁻] by ion chromatography. A two-way repeated measures ANOVA was used to determine the effect of patch application timing (PRE vs. EX), duration (SHORT vs. LONG), and interaction effects on each variable, followed by Tukey post-hoc where main effects were found. Significance was set at p < 0.05. **Results:** There was an interaction effect with EX LONG and EX SHORT > PRE LONG > PRE SHORT for [Na⁺] (56.8 ± 21.6, 58.5 ± 22.3 > 50.7 ± 20.1 > 46.8 ± 19.6 mmol/L, p < 0.0001), [Cl⁻] (55.2 ± 23.5, 53.5 ± 25.1 > 38.2 ± 21.7 mmol/L, p < 0.0001), and LSR (1.4 ± 0.3, 1.6 ± 0.6 > 1.1 ± 0.3 > 0.8 ± 0.4 mg/cm²/min, p < 0.0001). There were no significant differences for [K⁺] between EX LONG, EX SHORT, PRE LONG, AND PRE SHORT (3.8 ± 0.6, 4.0 ± 0.9, 3.6 ± 0.6, 3.3 ± 0.6 mmol/L, p = 0.79). **Conclusion:** The on-skin duration did not affect sweat [Na⁺] and [Cl⁻] when patches were applied during exercise. However, applying patches prior to exercise resulted in lower sweat [Na⁺] and [Cl⁻], especially when removed after a short duration. This was likely due to lower LSR during the ramp up to steady state sweating. Therefore, practitioners should take patch application timing into account when interpreting sweat electrolyte results. Local sweat [Na⁺] and [Cl⁻] measured from patches applied prior to exercise may not be representative of concentrations during the full bout of exercise. However, more research is needed to determine the impact of patch timing in the context of whole body sweat [Na⁺] and [Cl⁻] estimations.

3492 Board #313 May 29 2:30 PM - 4:00 PM

Cross-validation Of Whole Body Sweat Sodium Prediction Equations

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Reported Relationships: **L.B. Baker:** Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..

We have previously published regression equations to estimate whole body (WB) sweat sodium concentration ([Na]) from regional (REG) measures; however, a cross-validation is needed to corroborate the applicability of these prediction equations

between studies. **PURPOSE:** To determine the validity of published regression equations (Baker et al. 2018) in predicting WB sweat [Na] from REG measures when applied to a new data set. **METHODS:** Forty-nine recreational athletes (34 men, 15 women; 75±12 kg) cycled for 90 min while WB sweat [Na] was measured using the washdown technique. Exercise intensity (82% HR_{max}) and environmental conditions (32°C, 39% rh, 2.4 m/s air flow) were similar to the 2018 study in which the prediction equations were developed. REG sweat [Na] was measured from seven regions using absorbent patches (3M Tegaderm+Pad, 10 cm²). Regression equations from Baker et al. 2018 were applied to REG sweat [Na] to determine predicted WB sweat [Na]. Bland-Altman analysis of mean bias (raw and predicted minus measured) and 95% limits of agreement (LOA) were used to compare raw (uncorrected) REG sweat [Na] and predicted WB sweat [Na] to measured WB sweat [Na]. **RESULTS:** Mean±SD WB sweating rate was 0.94±0.32 L/h and measured WB sweat [Na] was 41±16 mmol/L. Mean bias (±95% LOA) between raw REG sweat [Na] and measured WB sweat [Na] was 10(±20), 0(±19), 9(±20), 22(±25), 23(±24), 0(±15), -4(±18) mmol/L for the dorsal forearm, ventral forearm, upper arm, chest, upper back, thigh, and calf, respectively. The mean bias (±95% LOA) between predicted WB sweat [Na] and measured WB sweat [Na] was 3(±14), 4(±12), 0(±14), 2(±17), -2(±16), 5(±13), 4(±15) mmol/L for the dorsal forearm, ventral forearm, upper arm, chest, upper back, thigh, and calf, respectively. **CONCLUSIONS:** The use of regression equations enables prediction of WB sweat [Na] within a mean bias of 0-5 mmol/L and within a 95% LOA of ±12-17 mmol/L across all sites. By contrast, the use of raw REG [Na] increases the mean bias to 9-23 mmol/L for the dorsal forearm, upper arm, chest, and upper back, and increases the 95% LOA to ±15-25 mmol/L across all sites. Regression equations improve the accuracy of estimating WB sweat [Na] from REG measures and are therefore recommended for use in Na balance studies and field tests to determine individualized sweat electrolyte losses.

3493 Board #314 May 29 2:30 PM - 4:00 PM
Gender Differences Of Sweat Rates In Endurance Trained Athletes

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(No relevant relationships reported)

Adequate fluid replacement around exercise is an important consideration for endurance athletes. While sex-based differences in maximal sweat rate have been identified, sex-based differences in sweat rate variability between training sessions is less understood. **PURPOSE:** The purpose of this study was to observe differences in sweat rate in endurance-trained males and females. **METHODS:** Endurance-trained males (n=4) and females (n=14) completed training sessions lasting a minimum of 30 minutes once per week. Body mass was collected before and immediately after exercise. Total sweat loss (TSL) was calculated from changes in body mass. TSL and duration of exercise were used to calculate absolute sweat rate (ASR), and subsequently relative sweat rate (RSR). Heat stress was recorded using a WBGT, with temperatures ranging from 9.21-23.65°C. Data were analyzed using two-sample T-tests to evaluate differences between the maximum ASR and RSR between male and female runners. Significance was set a priori at P<0.05. **RESULTS:** Males had a significantly higher ASR than females (1.46±0.36 vs. 0.89±0.21 L/h; p<0.001). Males and females did not differ for RSR (0.018±0.004 vs. 0.014±0.004 L/kg/h; p=0.116). **CONCLUSION:** This observational study indicates males had a significantly higher ASR compared to females but similar RSR. Despite lack of significance in RSR, these results correspond with previous studies demonstrating sex differences due to differences in total body surface area. These results suggest sex should be a consideration when implementing different hydration strategies.

3494 Board #315 May 29 2:30 PM - 4:00 PM
Thermoregulatory Impairments Imposed By Men's Lacrosse Equipment In The Heat

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Exertional heat illness remains one of the leading causes of death in sport, especially in hot and humid conditions. Previous research has shown an impairment in thermoregulation while wearing American football and hockey equipment. However, the effects of men's lacrosse protective equipment have yet to be determined. **PURPOSE:** Investigate the effect of men's lacrosse equipment on thermoregulatory responses during simulated lacrosse exercise in the heat (30°C, 50% RH). **METHODS:** Sixteen male volunteers (21.8 ± 3.2y, 76.2 ± 8.9kg, 181.3 ± 6.1cm) with previous equipment intensive sport experience completed one trial while wearing protective lacrosse equipment (shoulder and elbow pads, gloves and helmet; EQ) and one trial without equipment (shorts and jersey; NEQ). Trials included 60-min of simulated lacrosse exercise separated into four 12-min sessions, each separated by four-min of rest. Hydration status was maintained by replenishing fluid loss throughout

trials. Rectal temperature (T_{rec}), heart rate (HR), mean weighted skin temperature (T_{skin}), rating of perceived exertion (RPE), and thermal sensation (TS) were assessed during rest breaks. Physiological strain index (PSI) was calculated as previously described. Paired samples t-tests or repeated measures analyses of variance, with Bonferroni post-hoc testing were used to identify significant differences (p≤0.05). **RESULTS:** There was no significant difference in T_{rec} between trials (p=0.084), however, maximum T_{rec} achieved was greater in EQ (39.3 ± 0.7°C) compared to NEQ (39.0 ± 0.7°C; p=0.016). Regardless of time point, HR (p≤0.001) and PSI (p=0.004) were significantly greater in EQ compared to NEQ. T_{skin} was significantly elevated in EQ compared to NEQ throughout trials (p≤0.001). Perceptually, EQ increased RPE (p=0.003) and TS (p=0.012) compared to NEQ throughout trials. Urine specific gravity (USG) following trials was not significantly different between trials (p=0.151). **CONCLUSION:** Trial differences in T_{rec}, HR and perceptual measures suggest a greater impairment in thermoregulation while wearing men's lacrosse equipment in the heat. Supervising entities for men's lacrosse should mandate heat acclimatization periods similar to those in place for American football to ensure athlete safety.

3495 Board #316 May 29 2:30 PM - 4:00 PM
Measured Versus Heart Rate-Derived Core Temperature During Outdoor Work In The Southeastern United States

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(No relevant relationships reported)

Climate change is increasing the number of hot days to which outdoor workers are exposed, thereby increasing their risk of heat illness. Currently, continuous monitoring of core temperature (T_c) is expensive, invasive, and impractical. The BioModule is a non-invasive physiological monitor that uses heart rate to provide an estimation of T_c, but its accuracy is unknown. **PURPOSE:** To test the association between measured gastrointestinal temperature (T_{GI}) and estimated core temperature (T_{c-est}) from the BioModule device during outdoor work in a hot environment. **METHODS:** Twenty groundskeepers (18 men; mean±SD age = 38±8 y, body mass index = 31.5±7.5 kg/m²) swallowed an ingestible temperature sensor and strapped on a BioModule before work. T_{GI} was collected every 15 minutes during the workday; T_{c-est} was determined by a 1-min average from the same time of day. Data collection occurred in Alabama during July and August (31.4±3.1 °C WBGT). Relationship between T_{GI} and T_{c-est} was quantified using the repeated measures correlation coefficient (r_{rm}). Agreement (bias±1.96 SD) between T_{GI} and T_{c-est} was evaluated using the Bland-Altman method for repeated observations. **RESULTS:** There was a moderate, positive relationship between T_{GI} and T_{c-est} (r_{rm} = 0.56, p < 0.001). Agreement analysis indicated that T_{c-est} overestimated T_{GI} (0.28±0.58 °C). The error between T_{c-est} and T_{GI} was larger at lower temperatures, as indicated by a strong negative trend (Pearson's r = -0.73). **CONCLUSION:** The BioModule provides an estimation of T_c that may be helpful as a guide during outdoor work in hot environments but should not be used for safety considerations or measurement of T_c. Funded by the Deep South Center for Occupational Safety and Health, a National Institute for Occupational Safety and Health Education and Research Center.

3496 Board #317 May 29 2:30 PM - 4:00 PM
Sweat Electrolytes: Influence Of Environment, Sex And Exercise Intensity

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Sweat electrolytes: Influence of environment, sex and exercise intensity. Mindy Millard-Stafford FACSM, Michael L. Jones, Teresa K. Snow, and Nicholas W. Shea. School of Biological Sciences, Georgia Institute of Technology, Atlanta, GA. Sweat rate and electrolyte loss are highly variable among individuals; but sources of intra-individual variability due to test conditions remain to be quantified. **PURPOSE:** To determine the impact of exercise intensity and environment on sweat electrolyte losses in men and women. **METHODS:** Twenty adult women and men completed two sessions during summer months: 3 x 20 min intermittent cycling beginning at low intensity (50/75 Watts) with 25 W increases in work rate under hot-humid (35°C, 60%RH) or hot-dry (35°C, 20%RH) conditions. Whole body sweat rate, regional sweat [Na⁺] and [K⁺] were obtained at each work rate. Sweat was acquired via Opsite (Brisson method) on the scapula. Electrolytes were measured using Horiba LAQUATwin Ion meters. **RESULTS:** Sweat rate and [Na⁺] was significantly higher (p<0.001) due to increased RH in the heat and incremental changes in exercise intensity. Compared to low exercise intensity, sweat [Na⁺] increased by 26 (72%) and 39 mmol (108%) with successive 25W increases, similar in relative magnitude to

sweat rate increases of 0.4 l/min (67%) and 0.6 l/min (100%) compared to low exercise intensity. However, $[Na^+]$ difference due to greater %RH of environment (60% vs. 20%RH) was only 7.7 mmol (14%) higher for all bouts combined. Sweat $[K^+]$ was not different ($p=0.4$) based on environment, but significantly higher ($p=0.003$) under low intensity exercise compared to higher work rates ($6.9 \pm 1.9 > 6.0 \pm 1.4$ mmol). When work rate was matched (75W) under humid conditions, no differences between men and women were observed in sweat rate (0.8 ± 0.3 l/min) or sweat sodium (49.2 ± 17.2 vs. 52.7 ± 30.0 mmol, respectively). **CONCLUSION:** At matched low intensity exercise, sex differences in sweat sodium and rate were not observed. Intra-individual variability in sweat sodium is influenced more by modest incremental changes (25 W) in exercise intensity than the ambient humidity in hot conditions. Sweat testing of athletes using field techniques should carefully consider the intensity of the training session to accurately translate results.

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3497 Board #318 May 29 2:30 PM - 4:00 PM
Abstract Withdrawn

3498 Board #319 May 29 2:30 PM - 4:00 PM
Core Temperature And Blood Lactate Kinetics After Graded Exercise Testing In The Heat

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(No relevant relationships reported)

Utility of a verification trial to confirm maximal oxygen intake (VO_{2max}) in the heat is unclear and initial studies are needed to explore recovery duration between the initial graded exercise test (GXT) and the verification trial to ensure verification trial fidelity.

PURPOSE: To compare the recovery kinetics of gastrointestinal temperature (T_{gi}) and blood lactate (BLA) after a GXT in the heat between trained and untrained cyclists. **METHODS:** Trained ($n=10$; age: 22.6 ± 2.2 y; body fat: $15.4 \pm 5.8\%$) and untrained ($n=11$; age: 23.4 ± 2.9 y, body fat: $21.1 \pm 5.8\%$) male cyclists volunteered. T_{gi}, BLA (finger prick), expired gases, and power output (watts; W) were continuously measured during the GXT in a heated chamber (39°C, 31%RH). After the GXT, subjects exited the chamber and rested in a temperate room (22°C, 40%RH) until T_{gi} returned to pre-GXT values (defined as "recovery") at which point BLA was re-assessed. Separate independent t-tests assessed differences in W, VO_{2max} , and recovery duration between groups. Separate 2 by 3 (training status [trained vs. untrained] time [pre-GXT, post-GXT, recovery]) repeated measures ANOVAs evaluated changes in T_{gi} and BLA with Tukey post hoc tests ($\alpha = 0.05$). **RESULTS:** As expected, the trained cyclists GXT was longer (709 ± 81 vs. 610 ± 98 s; $p=0.02$) and achieved greater peak power output (278 ± 32 vs. 238 ± 32 W; $p=0.009$) and VO_{2max} (57.2 ± 7.7 vs. 40.5 ± 5.5 mL/kg/min; $p<0.001$) than untrained. Recovery time was longer for trained subjects (50 ± 5.4 vs. 43.5 ± 10.2 min; $p=0.10$) but this difference did not reach significance. Pre-GXT and recovery T_{gi} was higher in untrained (37.5 ± 0.3 and $37.4 \pm 0.2^\circ C$) versus trained (37.1 ± 0.2 and $37.2 \pm 0.2^\circ C$; $p<0.01$) with both groups achieving similar post-GXT values (untrained: 37.8 ± 0.2 ; trained: $37.7 \pm 0.2^\circ C$; $p=0.37$). BLA at recovery (trained: 6.2 ± 0.7 ; untrained 7.0 ± 2.4 mmol/L) was lower than Post-GXT (trained: 12.8 ± 1.9 ; untrained 13.3 ± 2.9 mmol/L) but remained higher than Pre-GXT (trained: 2.3 ± 0.3 ; untrained 3.3 ± 1.5 mmol/L) in both groups ($p<0.001$) with no group main effects ($p \geq 0.08$). **CONCLUSIONS:** The thermoregulatory system managed the GXT-induced thermal load faster than the metabolic system cleared BLA. If verification trials in the heat are employed, extended recovery durations appear necessary regardless of training status.

3499 Board #320 May 29 2:30 PM - 4:00 PM
New Zealand Blackcurrant Extract Modulates Peripheral Blood Mononuclear Cell Response To Exertional Heat Stress

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Background. We have previously shown that 7d of New Zealand Blackcurrant (NZBC) supplementation reduces the gastrointestinal barrier permeability response that normally accompanies exertional heat stress. **Purpose.** To determine the effect of NZBC supplementation on inflammatory capacity and apoptotic drive in peripheral blood mononuclear cells (PBMC) collected before and after exertional heat stress. **Methods.** Twelve men (Age: 28 ± 6 years, Stature: 1.81 ± 0.07 m, Mass: 80.5 ± 9.8 kg, VO_{2max} : 56 ± 6 mL \cdot kg $^{-1}$ \cdot min $^{-1}$) ingested 2 capsules of CurraNZ™ (210 mg anthocyanin

day $^{-1}$) or a visually matched placebo (microcrystalline cellulose) for 7d prior to a 1h treadmill run (65% VO_{2max}) in hot ambient conditions (34°C / 40% RH). PBMC were isolated from EDTA plasma samples that were collected before (Pre), after (Post), 1h after (1-Post) and 4h after (4-Post) exercise. Inflammatory capacity was calculated as the ratio between phosphorylated and total NF- κ B content in cell lysates. Apoptotic drive was calculated as the ratio between BAX and BCL-2 in cell lysates. Caspase 9 was measured to provide additional confirmation. Western blot data were analysed with two-way (Condition x Time) RM-ANOVA with Duncan post-hocs. **Results.** The p-NF- κ B:NF- κ B ratio was reduced following 7d NZBC supplementation (-46%, $p=0.03$). Post hoc analysis indicated p-NF- κ B:NF- κ B content at 4-Post had fallen below values at Post (-24%, $p=0.02$) and 1-Post (-60%, $p=0.04$). The BAX:BCL-2 ratio was increased following 7d NZBC supplementation (+106%, $p<0.01$). Post hoc analysis indicated the BAX:BCL-2 ratio increased from Pre to Post exercise (+119%, $p=0.01$) in NZBC and remained elevated (above Pre) at 1-Post (+77%, $p=0.04$) and 4-Post (+59%, $p=0.04$). Caspase 9 content also increased following 7d NZBC supplementation ($p<0.05$). Post hoc analysis indicated elevated Caspase 9 content at PRE in NZBC (+86%, $p<0.01$), with differences between conditions being resolved by 4-Post exercise ($p=0.94$). **Conclusions.** Study data suggest 7d NZBC supplementation may reduce inflammatory capacity and increase apoptotic drive in PBMC. This might call nascent leukocytes into circulation to ensure maintenance of the putative inflammatory response that accompanies exertional heat stress. However, the exact physiologic relevance of these changes remains to be determined.

3500 Board #321 May 29 2:30 PM - 4:00 PM
Muscle Temperature During Exercise Under Whole-body Heating And Limb Heating Conditions

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Prior studies suggest that moderate whole-body heating (WBH), which raises internal temperature (T_{core}) ~0.6-1.0 deg C, alters the exercise pressor reflex. It is speculated that elevated muscle temperature (T_{muscle}) alters the sensitivity of muscle afferents. However, less is known about the effects of passive WBH on the limb T_{muscle} during exercise. **PURPOSE:** To determine limb T_{muscle} during exercise under passive WBH and limb heating conditions. **METHODS:** Forearm T_{muscle} was measured with a needle probe (thermocouple) in 8 healthy subjects (57 ± 3 yrs). Mean skin temperature (T_{sk}), T_{core} (telemetric pill), the arm skin temperature (T_{armskin}, not covered by suits), blood pressure (BP) and heart rate (HR) were measured during WBH with water perfused suits. After T_{core} rose ~0.6 deg C, subjects performed a fatiguing handgrip exercise followed by post exercise circulatory occlusion (PECO). In a separate visit, the forearm was heated with a water perfused sleeve. After the T_{muscle} rose ~1 deg C (i.e. similar to that seen during WBH), the exercise paradigm was repeated. **RESULTS:** Passive WBH significantly raised T_{sk} (3.2 ± 0.3 deg C), T_{armskin} (1.9 ± 1.0 deg C), T_{muscle} (0.96 ± 0.15 deg C) and HR. The increases in T_{muscle} were positively correlated with the increases in T_{core} ($R = 0.75$, $P < 0.05$). Limb heating raised T_{muscle} (0.98 ± 0.11 deg C), T_{armskin} (2.3 ± 0.6 deg C), and did not alter T_{sk}, T_{core} or HR. There was no significant difference in the grip force, grip time, or the change in HR with handgrip between the trials. The increases in T_{muscle} during the last min of grip (0.37 ± 0.07 vs. 0.92 ± 0.17 deg C, $P < 0.03$) and PECO ($P = 0.01$) were significantly lower during WBH than during the limb heating trial. **CONCLUSION:** Although local limb heating and WBH induced similar elevations in T_{muscle}, the responses in T_{muscle} to exercise were different between these two heating conditions. Supported by NIH R01 HL141198 (Li and Cui) and UL1 TR002014 (Sinoway), and AHA Award #15GRNT24480051 (Cui).

3501 Board #322 May 29 2:30 PM - 4:00 PM
Verification Bout Criteria In The Heat: A Training Status Comparison

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(No relevant relationships reported)

The use of verification bouts (VRF) to confirm maximal oxygen consumption (VO_{2max}) in thermoneutral conditions is well established. Less is known about the utility of VRF in the heat. The impact of a hot environment may affect trained and untrained subjects differently. Data demonstrating the impact of heat on repeat bouts of high-intensity exercise may be useful for individuals performing an unaccustomed activity in the heat. **PURPOSE:** To compare VO_{2} , heart rate (HR), and rating of perceived exertion (RPE) from a graded exercise test (GXT) vs. VRF in trained vs. untrained subjects. **METHODS:** Aerobically trained (T) ($n=10$) and untrained (UT) ($n=11$) college-aged males volunteered. Baseline gastrointestinal temperature (T_{gi})

and resting $\dot{V}O_2$, RPE, and HR values were collected then subjects rested in a heated chamber (39°C, 31% relative humidity) for 20 min before completing the GXT. Post-GXT, subjects exited the chamber and rested in a thermoneutral room (22°C, 40%RH) until Tgi returned to baseline. Subjects re-entered chamber and repeated pre-GXT procedures prior to VRF. For VRF, subjects warmed-up cycled at 60% maximal wattage (W_{max}) from GXT and then cycled at 110% W_{max} until exhaustion. $\dot{V}O_2$, HR, and RPE values from the last complete min were used for comparison. A 2×2 [(T vs. UT) \times (GXT vs. VRF)] mixed-factor ANOVA with Bonferroni post hoc tests and an alpha of 0.05 was used for analysis. **RESULTS:** $\dot{V}O_2$: trained cyclists $\dot{V}O_{2max}$ was greater than untrained (56.4 \pm 8.6 vs. 40.1 \pm 5.9 mL \cdot kg $^{-1}$ \cdot min $^{-1}$, $p < 0.001$); $\dot{V}O_2$ during GXT was greater than VRF for both groups ($p = 0.013$, $\eta^2 = 0.29$). HR: subjects had significantly higher HR during GXT vs. VRF (T:188 vs. 178 bpm; UT:189 vs. 181 bpm; $p < 0.001$, $\eta^2 = 0.74$) and HR was not significantly different between groups ($p = 0.77$). RPE: There was a significant trial \times training interaction ($p = 0.04$, $\eta^2 = 0.21$), and a significant main effect for training status with trained cyclists expressing higher RPE than untrained in GXT & VRF (19 vs. 18; 19 vs. 17; $p = 0.002$). **CONCLUSION:** The results indicated that RPE may be tied to $\dot{V}O_2$ more than HR in the heat in trained subjects. $\dot{V}O_2$ during VRF in the heat was less than $\dot{V}O_{2max}$ in all subjects during GXT which may confirm $\dot{V}O_{2max}$ or indicate premature fatigue due to heat. Thus, a VRF may not be necessary for the determination of $\dot{V}O_{2max}$ in the heat for untrained subjects.

3502 Board #323 May 29 2:30 PM - 4:00 PM

Post-exercise Passive Heating Strategies Improve $\dot{V}O_{2max}$, Running Economy, And Lactate Threshold

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$\dot{V}O_{2max}$, running economy, and lactate threshold have long been established as physiological determinants of endurance performance. Strategies to optimally improve these parameters have therefore been of much interest to endurance athletes. **PURPOSE:** To determine the effects of post-exercise passive heating strategies with hot water immersion and sauna suits on $\dot{V}O_{2max}$, running economy, and lactate threshold. **METHODS:** Participants (see table for physical characteristics) were randomized into three standardized 3wk exercise training groups: 1) exercise training alone - control (N=10), 2) exercise training with immediate post-exercise hot water immersion (N=10), and exercise training with immediate post-exercise sauna suit (N=10). At baseline and post-program participants completed a running economy protocol and maximal exercise testing protocol to measure $\dot{V}O_{2max}$ and lactate threshold. The running economy protocol consisted of three consecutive 5-minute stages: stage 1 = 4.6 mph, stage 2 = 5.0 mph, and stage 3 = 5.4 mph. **RESULTS:** After 3wk, mean $\dot{V}O_{2max}$ and lactate threshold changes in the sauna suit and hot water immersion groups were significantly greater ($p < 0.05$) when compared to the control group (see table). The hot water immersion group showed significant within-group improvements ($p < 0.05$) in economy between baseline and 3wk for all three stages (see table), although there were no between group differences ($p > 0.05$). **CONCLUSION:** Both post-exercise passive heating strategies were equally effective at increasing $\dot{V}O_{2max}$ and lactate threshold values. Additionally, despite the absence of between-group statistical significance, preliminary evidence suggest post-exercise hot water immersion may be a more effective strategy at improving running economy relative to wearing a sauna suit after exercise.

Table. Physical and physiological characteristics at baseline and 3wk for control, sauna suit, and hot water immersion groups. (Values are mean \pm SD).

Parameter	Control group (N=8)		Sauna suit group (N=7)		Hot water immersion group (N=9)	
	Baseline	3wk	Baseline	3wk	Baseline	3wk
Age (yr)	26.6 \pm 11	—	24.8 \pm 17	—	22.9 \pm 11	—
Height (cm)	165 \pm 29	—	168.6 \pm 30	—	177.7 \pm 3	—
Body mass (kg)	64.7 \pm 30.2	64.7 \pm 31.7	65.1 \pm 38.8	64.3 \pm 36.7	72.9 \pm 39.4	72.8 \pm 36.4
Economy - stage 1 (mL \cdot kg $^{-1}$ \cdot min $^{-1}$)	24.3 \pm 2.3	23.1 \pm 4.4	24.5 \pm 3.4	24.0 \pm 2.4	24.8 \pm 1.8	22.3 \pm 3.8*
Economy - stage 2 (mL \cdot kg $^{-1}$ \cdot min $^{-1}$)	27.6 \pm 3.9	26.5 \pm 4.5	28.2 \pm 2.4	27.3 \pm 3.0	28.0 \pm 1.9	26.1 \pm 3.4*
Economy - stage 3 (mL \cdot kg $^{-1}$ \cdot min $^{-1}$)	29.7 \pm 3.8	29.0 \pm 5.8	31.2 \pm 1.7	29.6 \pm 3.5	30.2 \pm 2.2	28.1 \pm 3.5*
Lactate threshold (% $\dot{V}O_{2max}$)	59.8 \pm 4.4	62.8 \pm 5.4*	57.3 \pm 4.0	65.2 \pm 4.7**	58.6 \pm 6.9	67.0 \pm 7.7**
$\dot{V}O_{2max}$ (mL \cdot kg $^{-1}$ \cdot min $^{-1}$)	39.4 \pm 15.2	40.5 \pm 15.9	42.2 \pm 10.6	45.5 \pm 12.9**	46.3 \pm 25.4	49.7 \pm 26**

* Within-group change is significantly different from baseline, $p < 0.05$; ** Change from baseline is significantly different from control group, $p < 0.05$.

3503 Board #324 May 29 2:30 PM - 4:00 PM

Endurance Exercise Capacity & Heat-loss Responses Are Greater In The Late Evening Than Morning

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Various major sporting events in the heat of summer start from not only in the morning but also in the late evening. However, to date rationales for differences in endurance exercise capacity and thermoregulatory responses to exercise in the heat between morning and late evening have not been reported. **PURPOSE:** The current study investigated the diurnal effects of exercise in the late morning and evening on endurance exercise capacity and thermoregulatory responses during a time-to-exhaustion test in the heat. **METHODS:** Ten male participants cycled at 70% peak oxygen uptake until exhaustion in the heat (30°C, 50% relative humidity). Participants commenced exercise in the late morning at 10:00 h (AM) or evening at 21:00 h (PM). Upon cessation of exercise, participants completed a 30 min post-exercise recovery. **RESULTS:** Time to exhaustion was 28 \pm 13% (mean \pm SD) longer in PM (49.1 \pm 16.3 min) than AM (38.7 \pm 14.6 min; $P < 0.001$). Rectal temperature before and during exercise were higher in PM than AM (both $P < 0.01$) in accordance with the diurnal variation of core temperature (T_c). The rates of rise in rectal temperature (AM 0.030 \pm 0.012°C/min; PM 0.021 \pm 0.008°C/min), mean skin temperature (AM 0.095 \pm 0.042°C/min; PM 0.068 \pm 0.028°C/min), thermal sensation and rating of perceived exertion during exercise were slower in PM than AM (all $P < 0.05$). Rectal temperature at the point of exhaustion was not different by time-of-day (AM 38.3 \pm 0.4°C; PM 38.6 \pm 0.5°C). Dry and evaporative heat losses and an increase in skin blood flow during exercise were greater in PM than AM (all $P < 0.05$). During 30-min post-exercise recovery, the rates of fall in rectal temperature (AM 0.013 \pm 0.004°C/min; PM 0.019 \pm 0.010°C/min) and skin blood flow were faster and thermal sensation was lower in PM than AM (all $P < 0.05$). Heart rate during exercise and recovery were not different between trials. **CONCLUSION:** This study indicates that endurance exercise capacity is greater and heat-loss responses to control T_c during and following exercise in the heat are more effective in the late evening than morning. Moreover, perceived fatigue during exercise and thermal perception during and following exercise are lower in the late evening than morning.

3504 Board #325 May 29 2:30 PM - 4:00 PM

Effect Of Heat On Serum And Plasma Brain-derived Neurotrophic Factor During Aerobic Exercise

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Exercise has been found to promote the release of brain-derived neurotrophic factor (BDNF). Literature suggests that BDNF is upregulated in the periphery post aerobic exercise. There is evidence that shows BDNF plays a role in temperature regulation, however, it is still unclear if BDNF will rise in the heat as compared to thermoneutral conditions following aerobic exercise. Evidence has also shown that plasma and serum BDNF may be independent of each other. Therefore, investigating this difference may lead to a better understanding of the post aerobic exercise BDNF response. **Purpose:** The purpose of this study was to examine temperature related effects on BDNF during aerobic exercise in different environmental conditions along with differences between serum and plasma BDNF. **Methods:** Six recreationally active college aged men (26 \pm 3 years) completed a $\dot{V}O_{2max}$ test (48.6 \pm 5.7 mL/kg/min) and performed experimental trials in 35°C at 45% humidity (HT/MH) and 22°C at 45% humidity (MT/MH). During each trial, participants cycled for 60-minutes at 60% of $\dot{V}O_{2max}$, rested for 15-minutes, cycled until exhaustion at 90% $\dot{V}O_{2max}$, then recovered for 60-minutes. Blood was obtained before exercise (PRE), after 60 minutes of cycling (60), after the TTE (90), and after recovery (REC). Serum and plasma BDNF were assessed via ELISA, while data was analyzed using a mixed model regression, with significance defined as $\alpha < 0.05$. **Results:** There was no significant condition by time interaction ($F = 0.602$, $p = 0.618$) nor main effect of condition ($F = 1.792$, $p = 0.189$) or time ($F = 1.949$, $p = 0.139$) for serum BDNF concentrations. There was also no significant condition by time interaction ($F = 0.272$, $p = 0.845$) nor main effect of condition ($F = 0.415$, $p = 0.523$) or time ($F = 1.070$, $p = 0.373$) for plasma BDNF concentrations. **Conclusions:** This data suggests high temperature does not have an effect on the BDNF response in serum or plasma concentrations. Nor does this study give evidence to an upregulation of BDNF concentrations due to aerobic exercise, though further work is warranted. *This study was partially funded by the Kent State University Research Council.*

3505 Board #326 May 29 2:30 PM - 4:00 PM

The Effect Of Hydration Status And Ice Water Dousing On Heart Rate Variability Prior To And During Intermittent Exercise In The Heat

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PURPOSE: Determine the effect of hydration status and ice water dousing on heart rate variability (HRV) prior to and during intermittent exercise in the heat.

METHODS: Ten team sport athletes (mean [M]± standard deviation [SD]; age, 21±1; body mass, 69.8±7.7kg; height, 175.0±7.3cm; VO_{2max} , 54.5±6.8ml·kg⁻¹·min⁻¹) performed a soccer simulated intermittent exercise treadmill protocol in the heat (ambient temperature, 33°C; relative humidity, 50%) with four conditions: Euhydrated without dousing (EuND), Dehydrated without dousing (DeND), Euhydrated with dousing (EuD), and Dehydrated with dousing (DeD). Resting HRV (LnRMSSD) was measured prior to (PRE) and between intermittent exercise (MID) for 5 min. Repeated measures ANOVA was used to examine the differences of HRV in each condition followed by post-hoc with LSD. 95% confidence intervals (95%CI) were calculated. Significance was set a-priori p<0.05.

RESULTS: Percent body mass loss for each condition at MID was MID-EuND (-0.9±1.8%), MID-DeND (-3.3±1.7%), MID-EuD (-0.8±1.1%), and MID-DeD (-2.4±2.2%). There were no differences between PRE-EuND (M±SD, 1.7±0.5 ln ms), PRE-DeND (M±SD, 1.8±0.9 ln ms), PRE-EuD (M±SD, 2.0±0.6 ln ms), and PRE-DeD (M±SD, 19.7±0.2 ln ms) (p>0.05). However, MID-EuND (M±SD, 1.9±0.8 ln ms) was significantly lower than MID-EuD (M±SD, 2.8±0.6 ln ms, 95%CI=-1.7- -0.2, p=0.021) and MID-DeND (M±SD, 1.6±0.5 ln ms) was significantly lower than MID-DeD (M±SD, 2.8±0.7 ln ms, 95%CI=-1.8 - -0.6, p=0.002). Furthermore, MID-DeND was significantly lower than MID-EuD (95%CI=-1.8 - -0.7, p=0.001) and MID-EuND was significantly lower than MID-DeD (95%CI=-1.9 - -0.1, p=0.037). **CONCLUSIONS:** There were no differences in HRV between euhydration and dehydration prior to exercise. However, ice water dousing increased HRV regardless of hydration status at the middle of intermittent exercise. Thus, ice water dousing, which is practical and time efficient, might lead to improved recovery at the middle of intermittent exercise in the heat.

3506 Board #327 May 29 2:30 PM - 4:00 PM

INFLUENCE OF HYDRATION STATUS ON RUNNING PERFORMANCE IN HIGH SCHOOL CROSS COUNTRY RUNNERS

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Adequate hydration is crucial for athlete's health and performance. Although the impact of hypohydration on professional athletes have been well characterized, there is a dearth of information on the effect of hypohydration on younger populations, such as high school athletes, specifically cross-country runners in a hot and humid environment. **Purpose:** To characterize the effects of hydration status on running performance in high school cross-country runners and determine if a simple hydration plan can improve hydration status. **Methods:** 15 high school cross-country runners (9 males, 6 females; 15.5 ± 1.2 yrs) participated in this study. The study took place over a two-week period with baseline testing (V1, V3) and a 5km running performance trials (V2, V4) occurring after school during normal practice hours, with V1 (V3) and V2 (V4) separated by 3 days. A simple hydration strategy of 32oz. of water in the morning and evening preceding the 5km performance trial was implemented to enhance the hydration status of the athletes. Changes in performance between V2 and V4 were determined by 5km completion time, and hydration status was determined by pre- and post-run urine specific gravity using a spectral refractometer. Changes in core temperatures in response to 5km runs were measured on V2 and V4 using core temperature pills. **Results:** Participants were significantly hypohydrated at rest (USG; V1 = 1.031 ± 0.008, V2 = 1.033 ± 0.006, V3 = 1.030 ± 0.007), but the simple hydration strategy implemented after V3 significantly improved hydration in V4 (resting USG = 1.024 ± 0.008; p<0.001). The average 5km performance times were not significantly different between V2 and V4 (V2:1613.3±224.4 sec, V4:1716.2±176.1 sec), however changes in resting hydration status between V2 and V4 were significantly correlated with improvements in 5km performance time (p=0.02, Pearson's r=0.63). Changes in core temperature from pre- to post-practice was significantly lower in V2 than V4 (V2:+0.79±0.7 °C, V4:+0.86±1.35 °C; p=0.04). **Conclusion:** High school cross-country runners are hypohydrated, and a simple

hydration plan can improve hydration status. Improved hydration was correlated to lower performance times in our cohort of young athletes. The findings support that high school athlete's hydration status is of concern and should be monitored.

3507 Board #328 May 29 2:30 PM - 4:00 PM

The Effects Of Acute Thermoneutral And Hot Water Immersion On Cerebrovascular Reactivity

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(No relevant relationships reported)

Repetitive hot head-out water immersion increases peripheral vascular function and non-immersion cerebral artery blood velocity. However, it is not known if an acute bout of hot head-out water immersion (HOWI) improves cerebrovascular function (i.e., cerebrovascular reactivity (CVR)). **PURPOSE:** We tested the hypothesis that CVR is greater during and following hot (HOT) vs. thermoneutral (TN) HOWI. **METHODS:** Twelve healthy participants (age: 22±2 y, 6 females) completed two randomized trials which consisted of 30 min of HOT (39°C) or TN (35°C) HOWI. Beat-to-beat blood pressure (MAP), middle cerebral artery blood velocity (MCAv), and the partial pressure of end-tidal CO₂ (PETCO₂) were recorded continuously. After 5 min of seated baseline, participants breathed hypercapnic gas (3, 5, and 7% CO₂ for 3 min each) in a stepwise fashion. CVR testing was completed pre, 30 min into HOWI (during), and immediately post-HOWI. CVR was calculated as the slope of the linear regression line by plotting MCAv versus PETCO₂. **RESULTS:** MAP (HOT: 84±6 vs. TN: 83±9 mmHg; P=0.95), MCAv (HOT: 66±10 vs. TN: 66±14 cm/s; P=0.50), PETCO₂ (HOT: 43±2 vs. TN: 43±3 mmHg; P=0.41) and CVR (HOT: 1.66±0.30 vs. TN: 1.82±0.50 cm/s/mmHg; P=0.16) were not different between HOT and TN at baseline. MAP was different between HOT and TN during (HOT: 80±9 vs. TN: 89±12 mmHg; P<0.01) and post (HOT: 84±9 vs. TN: 95±9 mmHg; P<0.01). MCAv was not different between HOT and TN during (HOT: 64±12 vs. TN: 71±13 cm/s; P=0.48) and post (HOT: 67±13 vs. TN: 70±15 cm/s; P=0.79). PETCO₂ was not different between HOT and TN during (HOT: 44±3 vs. TN: 45±3 mmHg; P=0.69) or post (HOT: 43±3 vs. TN: 43±3 mmHg; P=0.74). CVR was not different between HOT and TN during (HOT: 1.62±0.4 vs. TN: 2.01±0.61 cm/s/mmHg; P=0.22) and during post (HOT: 1.51±0.69 vs. TN: 1.77±0.64 cm/s/mmHg; P=0.43). **CONCLUSION:** These preliminary data indicate that cerebrovascular reactivity is not improved during an acute bout of hot water immersion compared to thermoneutral water immersion. Further investigations should examine if repetitive hot water immersion improves cerebrovascular reactivity. Supported by Office of Naval Research Award N00014-17-1-2665

3508 Board #329 May 29 2:30 PM - 4:00 PM

Cerebral Autoregulation Is Not Different Between Hot And Thermoneutral Head-Out Water Immersion In Healthy Participants

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(No relevant relationships reported)

Recurring hot head-out water immersion (HOWI) enhances peripheral vascular function and cerebral blood velocity during non-immersion conditions (i.e., rest, aerobic exercise, and heat stress). However, it is not known if an acute bout of hot HOWI alters cerebrovascular function (i.e., cerebral autoregulation). **PURPOSE:** We tested the hypothesis that dynamic cerebral autoregulation is improved during and following an acute bout of hot (HOT) vs. thermoneutral (TN) HOWI. **METHODS:** Seventeen healthy participants (age: 23±2 y, 5 females) completed two randomized trials which consisted of 30 min of HOT (39°C) or TN (35°C) HOWI. Beat-to-beat blood pressure (MAP), middle cerebral artery blood velocity (MCAv), and end-tidal CO₂ tension (PETCO₂) were recorded continuously. After 5 min of seated rest, participants breathed through a respiratory impedance device for 5 min while maintaining PETCO₂ values to assess cerebral autoregulation using Fourier transformation (n = 11). Cerebral autoregulation testing was completed pre, 30 min into HOWI (during), and immediately post HOWI. Values are reported as a change from baseline (α: mean ± SD). **RESULTS:** MAP, MCAv, PETCO₂, gain, and phase were not different between HOT and TN at pre (P > 0.23 for all). αMAP was lower in HOT vs. TN during (-3±6 vs. 9±5 mmHg; P<0.01) and post (0±5 vs. 10±7 mmHg; P<0.01). αMCAv was lower in HOT vs. TN during (-3±5 vs. 4±4 cm/s; P<0.01) and post (-5±7 vs. 0±5 cm/s; P<0.01). αPETCO₂ was lower in HOT vs. TN during (1±2 vs. 2±2 mmHg; P<0.01) and post (-3±2 vs. -1±2 mmHg; P<0.01). αGain was not different between HOT and TN during (HOT: -0.03±0.15 vs. TN: -0.08±0.05 cm/s/mmHg; P=0.18) or post (HOT: 0.04±0.12 vs. TN: -0.03±0.07 cm/s/mmHg; P=0.18). αPhase

was not different between HOT and TN during (HOT: 2.9 ± 9.0 vs. TN: $1.0 \pm 8.8^\circ$; $P=0.74$) or post (HOT: -1.2 ± 12.8 vs. TN: $-2.0 \pm 9.7^\circ$; $P=0.74$) **CONCLUSION:** These data indicate that an acute bout of hot water immersion attenuates cerebral blood velocity vs. thermoneutral water immersion. This response is likely due to the differences in arterial blood pressure and/or arterial carbon dioxide between conditions. However, cerebral autoregulation during and following hot water immersion is not different compared to thermoneutral water immersion in healthy participants. Supported by Office of Naval Research Award N00014-17-1-2665

3509 Board #330 May 29 2:30 PM - 4:00 PM
Do The National Institute Of Occupational Safety And Health Recommendations Prevent Hyperthermia And Dehydration?

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 (No relevant relationships reported)

The National Institute of Occupational Safety and Health (NIOSH) recommendations for work in the heat suggest consuming 237 mL of water every 15-20 min and rest intervals are not necessary for work if conditions are not extreme. The efficacy of these recommendations to protect against hyperthermia (rise in core temperature) and dehydration (percent body mass loss) has not been tested. **PURPOSE:** To test the effectiveness of the NIOSH guidelines to prevent body temperature from exceeding 38.0°C and dehydration greater than 2% of body mass. **METHODS:** Seven men walked for 2 hours at 6.4 kph in the highest thermal stress NIOSH allows before recommending work-to-rest ratios (34°C , 30% relative humidity). Participants drank 237 mL of water every 20 minutes while rectal temperature (T_{re}) monitored. Body mass and urine specific gravity (USG) were measured before and after exertion. T_{re} was extrapolated out to four- and eight-hour workdays based on the rate of T_{re} rise in the last hour of exertion. Percent dehydration was extrapolated out to four- and eight-hour workdays based on body mass lost and planned hydration during exertion. **RESULTS:** T_{re} rose from baseline ($36.8 \pm 0.3^\circ\text{C}$) to the completion of exertion ($38.1 \pm 0.6^\circ\text{C}$, $p < 0.001$), with two subjects reaching the 38°C threshold. Four- and eight-hour predicted T_{re} were $38.6 \pm 1.1^\circ\text{C}$ and $39.6 \pm 2.1^\circ\text{C}$, respectively, with 5 subjects predicted to exceed T_{re} threshold at 4hr and 6 subjects at 8hr. Subjects began work euhydrated (USG: 1.013 ± 0.005) and dehydrated $0.03 \pm 0.48\%$ during the work protocol, with no subjects reaching 2% dehydration. Four- and eight-hour predicted percent dehydration were $0.05 \pm 0.95\%$ and $0.10 \pm 1.90\%$, respectively. **CONCLUSIONS:** Adherence to the NIOSH recommendations may be insufficient to prevent workers from reaching the hyperthermia threshold but would protect against dehydration during heavy intensity work in the heat. Adjustments to NIOSH work-to-rest ratio recommendations should be explored to maintain worker safety.

3510 Board #331 May 29 2:30 PM - 4:00 PM
Human Intestinal Microbiota Heat Production Is An Unmeasured Quantity In Thermal And Metabolic Studies

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The human intestinal microbiota (IM) contains a diverse array of micro-organisms from more than 1,000 species that inhabit the surface and contents of the gastrointestinal tract. The number of bacterial cells (10^{13} - 10^{14}) is approximately the number of cells in the entire human body. Most research ignores the contributions of this biomass to human metabolic and physiologic responses. **PURPOSE:** To examine influences of the IM on research measurements of metabolism and calculations of heat balance. **METHODS:** This prospective study combined data from 9 IM, 4 small animal, and 6 human peer-reviewed publications. Our analyses compared IM versus human metabolism and heat production. **RESULTS:** We calculated the rate of IM heat production in the human colon to be 32 kcal/h for fecal bacteria (based on 46 g dry weight of colonic fecal bacteria and a median *Lactobacillus* heat production of 800mW/g dry weight during anaerobic fermentation). This calculated rate of IM heat production is considerable, when compared to both the resting metabolic rate (RMR) of men (42% of 76 kcal/h) and women (52% of 62 kcal/h), as well as the 24-h energy expenditure (RMR + energy expenditure during activities) of men (23% of 140 kcal/h) and women (34% of 94 kcal/h). The heat production of bacteria residing within the intestinal mucosa is unknown and adds to that of fecal bacteria. Diet contents (e.g., resistant starch) are primary determinants of IM heat production. Considering Acceptable Macronutrient Distribution Ranges published by the National Academy of Sciences, USA, the fermentation of plant material generates 69.3 - 264.6 Kcal/24h during metabolism of a 2200 kcal/24h diet. **CONCLUSIONS:** Because IM metabolic and thermal effects are sufficiently large to have a measurable impact on research, we

conclude that the IM represents an uncontrolled, unmeasured factor in the experimental design of human studies. Resting experimental protocols will incur a larger percent error than protocols involving exercise and elevated metabolic rate. Finally, researchers should acknowledge the IM as a study limitation and control those factors which strongly affect IM metabolism such as exercise, antibiotics, diet, and prebiotics.

3511 Board #332 May 29 2:30 PM - 4:00 PM
Wearable Technologies For Real-time Monitoring Of Body Core Temperature Under Heat Stress Conditions

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 (No relevant relationships reported)

Athletes and workers are at risk of heat illness whenever they work for a prolonged duration in outdoor extreme temperatures due to their metabolic demands. Safe performance limits under heat stress conditions are currently determined using predictive models for ambient temperature and exercise intensity. Wearable technology is now being adopted, but a system that accurately measures core temperature using wearable devices has yet to be reported. **PURPOSE:** To develop a new wearable patch-type sensor system that predicts core temperature based on heat-flux data from the chest. **METHODS:** We performed experiments that compared our predicted temperatures (T_{pre} , using a revised algorithm from the dual-heat-flux method), with the actual temperatures in both esophageal (T_{es}) and rectal (T_{rec}) sites during exercise in three heat conditions. Thirty-two volunteers walked for 60 min at 4-5 km/h at 30°C , 35°C , or 40°C . T_{pre} was monitored using a smartphone application receiving wirelessly transmitted data from the patch-type sensors ($65 \times 45 \times 8$ mm) on the chest. **RESULTS:** In the 40°C condition, T_{es} , T_{rec} , and T_{pre} increased from $37.2 \pm 0.2^\circ\text{C}$, $36.9 \pm 0.2^\circ\text{C}$, and $37.3 \pm 0.2^\circ\text{C}$ to $38.2 \pm 0.3^\circ\text{C}$, $37.9 \pm 0.3^\circ\text{C}$, and $38.0 \pm 0.2^\circ\text{C}$ (mean \pm standard deviation), respectively, during exercise. The difference between T_{pre} and T_{es} was $-0.10 \pm 0.15^\circ\text{C}$ and that between T_{pre} and T_{rec} was $0.02 \pm 0.19^\circ\text{C}$, using data sampled at 5-min intervals during exercise. In the 35°C condition, T_{es} , T_{rec} , and T_{pre} increased to $37.9 \pm 0.3^\circ\text{C}$, $37.8 \pm 0.3^\circ\text{C}$, and $37.9 \pm 0.2^\circ\text{C}$ after exercise. In this case, the difference between T_{pre} and T_{es} was $-0.06 \pm 0.17^\circ\text{C}$ and that between T_{pre} and T_{rec} was $0.04 \pm 0.14^\circ\text{C}$. In the 30°C condition, the differences were $-0.13 \pm 0.24^\circ\text{C}$ ($T_{\text{pre}} - T_{\text{es}}$) and $0.06 \pm 0.25^\circ\text{C}$ ($T_{\text{pre}} - T_{\text{rec}}$). Body mass, fat percentage, and sex did not affect the T_{pre} algorithm, but skin temperature changes during exercise yielded errors. **CONCLUSIONS:** The error ranges for our system are slightly superior to those in previous studies involving noninvasive core temperature measurements. Our system uses simple wearable devices and can provide real-time, subject-specific, and accurate body core temperature estimates under heat stress conditions. In combination with other physiological and environmental parameters, this early warning system will reduce the risk of heat illness.

3512 Board #333 May 29 2:30 PM - 4:00 PM
Abstract Withdrawn

3513 Board #334 May 29 2:30 PM - 4:00 PM
Effects Of Polyester Wicking Versus Cotton Fabric T-shirt On Sweat Rate In Obese Males

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 (No relevant relationships reported)

The effects of different t-shirt fabrics on thermoregulation during exercise remain to be elucidated. **PURPOSE:** This crossover study investigated the effects of cotton (C) versus polyester (P) t-shirts on sweat rate and skin temperature at the torso (chest, back) and peripheral (forearm, forehead) regions of physically active, obese males. **METHODS:** Seven participants (21.7 ± 1.7 yr; 35.7 ± 6.7 kg m^{-2}) completed 4 visits (separated by 48 hrs); visit 1 was to complete the informed consent, ACSM health questionnaire, PAR-Q, and body composition assessment using air displacement plethysmography. Visit 2 was a $\text{VO}_{2\text{max}}$ test (30-sec averaging for expired gas analysis), followed by two treadmill walking sessions (30 min at $30 - 39\% \text{VO}_{2\text{serv}}$) in either C or P t-shirt (randomized, counterbalanced sequence) on the third and fourth visits. Exercise was performed in a hot and dry (27°C , $10 \pm 2\%$ relative humidity) environment. Sweat rate was determined as Δ nude body weight (pre- minus post-exercise body weight) using a digital scale. Skin temperature was measured during exercise using a skin thermometer. Torso skin temperature (T_{torso}) was the sum of $0.5T_{\text{chest}} + 0.5T_{\text{back}}$. Peripheral site skin temperatures were analyzed separately. A dependent t-test was used to compare sweat rates. Separate two-way ANOVAs were performed to investigate fabric type, time, and their interactions on skin temperature by body region. **RESULTS:** On average, participants' $\text{VO}_{2\text{max}}$ and body fat were 36.8 ± 8.7 mL \cdot kg $^{-1}$ \cdot min $^{-1}$ and $34.7 \pm 4.3\%$, respectively. There was no difference between C and P conditions in sweat rates (Δ body weight = $-35 \pm .11$ kg; $-37 \pm .20$ kg,

respectively, $p = .754$). A significant interaction effect was detected between $T_{skinoso}$ and fabric ($p = .022$) with $C > P$. Interaction effects of skin temperature in the peripheral regions (forearm, $p = .195$; forehead, $p = .057$) were nonsignificant. **CONCLUSION:** Though the sweat rate was similar across cotton and polyester trials, polyester appears to be effective for temperature regulation, especially in the torso region during low intensity aerobic exercises in young, obese males. Future research should explore the impact of C vs. P fabric on sweat rate and skin temperature during different intensities and modalities of exercise.

3514 Board #335 May 29 2:30 PM - 4:00 PM
Upper Body Heat Dissipation Wearing A Novel Synthetic Material Shirt During Exercise In The Heat
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Sports clothing potentially limits evaporation from the skin due to an inhibitory microclimate between the skin and the environment. New materials and aeration systems are being developed to negate this limitation from current clothing.

PURPOSE: To determine the effects of t-shirt fabric (standard vs. novel) material on body temperature during exercise in a warm environment with and without simulated wind (fan vs. novel ventilated vest).

METHODS: Eight healthy male participants were recruited in the study (age: 25 ± 3 yr; height: 171.6 ± 7.4 cm; weight: 79.2 ± 14.2 kg). Participants performed 4 exercise trials in a cross-over randomized design: standard+fan (S+F), novel+fan (N+F), standard+vest (S+V), and novel+vest (N+V). Participants exercised for 60-min on a cycle ergometer in a heated, humidity-controlled chamber ($29.4 \pm 0.4^\circ\text{C}$ and $32.0 \pm 2.6\%$ RH; temperature and RH $p > 0.05$ for all trials). During the first 30min, participants exercised in the trial specific shirt with no external wind. In the second 30min, the fan was used to simulate wind speed equivalent to 2m/s applied to the chest or the vest was worn to simulate wind to chest and back. Heart rate (HR), skin temperature (T_{skin}), and core temperature (T_{core}) were recorded every 5min. T_{core} was measured by ingestible sensor 4-5 hours before exercise and T_{skin} was assessed at 5 sites: upper chest, mid-chest, forearm, upper back, and mid-back. The vest had 10×15 cm ventilation area that covered mid-chest and mid-back. Rating of perceived exertion (RPE) and feeling (+5 good; -5 bad) were assessed every 5min.

RESULTS: Mean weighted T_{skin} was lowest in N+F ($31.3 \pm 1.2^\circ\text{C}$) compared to other trials in final 30min. T_{skin} of averaged mid-chest and mid-back was lower in the final 30min ($32.1 \pm 1.9^\circ\text{C}$) exercise compared to the first 30min in N+V ($33.0 \pm 1.3^\circ\text{C}$; $p < .001$). However, T_{skin} of averaged upper chest and back (outside of ventilation area) remained the same in final 30min as first 30min ($\sim 34^\circ\text{C}$). No significant differences were found in T_{core} and HR across the trials. N+F had lowest RPE and best overall feeling compared with other trials in the final 30min.

CONCLUSIONS: N+F had greatest impact on upper body heat dissipation, mainly appearing in lower chest T_{skin} and RPE. In addition, novel ventilation vest successfully decreased the T_{skin} of mid-chest and back in final 30min exercise.

3515 Board #336 May 29 2:30 PM - 4:00 PM
Abstract Withdrawn

F-70 Free Communication/Poster - Medical Management and Injury Risk

Friday, May 29, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

3516 Board #337 May 29 2:30 PM - 4:00 PM
Novel Factors Associated With Adverse Mental Health In Elite Para Athletes In South Africa
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 (No relevant relationships reported)

Para-athletes (PA) may have specific mental health (MH) challenges that, together with the demands of high-level sport performance, could put them at risk for MH disorders. However, research in this population is limited. **PURPOSE:** To investigate factors associated with MH in South African PA. **METHODS:** In this descriptive, cross-sectional study, 124 athletes (93 males; 31 females) with a mean age $26.7 (\pm 9.2)$ competing in the 2019 National Champs were recruited. Demographic, medical history and sleep-related variables were included in bivariate analyses to assess their association with MH. Between-group differences were analysed using the Mann-Whitney U or T-tests. Variables significantly associated in the bivariate analyses

were included in multiple regression analyses for mental health. Mental health was measured with the State/Trait Anxiety Inventory (STAI) and the Kessler Psychological Distress Scale (K-10 Questionnaire). Sleep quality, sleepiness and chronotype were measured with the Pittsburgh Sleep Quality Index (PSQI), the Epworth Sleepiness scale and Morningness-Eveningness Questionnaire (MEQ-SA). **RESULTS:** The model explained 40% of the variance in MH ($F = 12.04$, $p < 0.001$). Compared to athletes with 'good' sleep quality, K-10 and STAI scores were significantly higher (indicating poorer MH) in athletes with 'poor' sleep quality ($U = 2.6$, $p < 0.001$; $t(116.8) = -4.30$, $p < 0.001$). 'Poor' sleep quality (B:0.8; 95%CI 0.4 to 1.3), moderate to severe daytime sleepiness (B:4.2; 95%CI 1.1 to 7.3) intermediate (B:3.5 95%CI 0.4 to 6.6) and evening chronotypes (B:12.0 95%CI 5.0 to 19.1), the presence of allergies (B:3.9 95%CI 0.1 to 7.6) and male gender (B:3.3 95%CI 0.1 to 6.5) were most strongly associated with high STAI scores. **CONCLUSIONS:** This study identified novel factors associated with adverse MH in elite PA. As some of these factors are modifiable, further research towards prevention strategies is warranted.

3517 Board #338 May 29 2:30 PM - 4:00 PM
Investigating The Effect Of Mouth Guard Use On Aerobic Performance In Amateur Boxers.

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 (No relevant relationships reported)

Purpose – To assess if wearing a mouth guard effects maximal aerobic capacity in amateur boxers.

Methods – 13 amateur boxers took part in a prospective crossover study to assess maximal aerobic capacity achieved during the 20m Multi Stage Fitness Test (MSFT). Each participant completed the MSFT 7 days apart, under control (no mouth guard – C) and intervention conditions (mouth guard – MG). The order of tests was determined via a coin toss on day 1, and two primary outcomes measures were recorded: (1) the estimated maximum oxygen uptake ($\text{VO}_2 \text{max}$ – kg/mL/min) and (2) distance run (meters – m). Data on height, weight, and type of mouth guard were recorded. Complete datasets on Rate of Perceived Exertion (RPE) were available for 10 boxers. **Results** – Mouth guard use was shown to reduce estimated $\text{VO}_2 \text{max}$ and distance run during the 20m MSFT from 56.31 kg/mL/min to 54.12 kg/mL/min and 2572 m to 2380 m respectively, ($P > 0.05$). All 13 participants recorded lower $\text{VO}_2 \text{max}$ scores when wearing a mouth guard, (Mean = -2.43 mL/kg/min , Range = 4.2 – 0.9 mL/kg/min). 10 participants submitted data on RPE and reported a 32.3% increase in mean RPE scores when completing the MSFT in mouth guards compared to control conditions, ($P > 0.05$).

Conclusions – Mouth guard use was shown to significantly reduce aerobic performance in amateur boxers and increase the perceived rate of exertion during the 20m MSFT.

3518 Board #339 May 29 2:30 PM - 4:00 PM
The Relationship Between Flourishing, Pain, And Injury In Collegiate Athletes

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Flourishing encompasses a holistic representation of physical, psychological, and social health. However, pain and injury can negatively affect health. Currently, there is little research on flourishing within collegiate athletes.

Purpose: To evaluate the relationship of pain and injury with flourishing in NCAA athletes and to compare by division.

Methods: NCAA division 1 (D1), 2 (D2), and 3 (D3) athletes were given a questionnaire incorporating the flourishing scale and the Oslo Sports Trauma Research Center Overuse Injury Questionnaire (OSTRC). Athletes were further classified by OSTRC scores into overuse and substantial overuse injuries. Multivariable regressions with logarithmic transformations and ANCOVAs were performed to investigate the relationship between flourishing and OSTRC pain and flourishing, overuse and substantial overuse injury. Confounders controlled for included age, gender, history of orthopaedic surgery and major injury, hours of sleep, and non-steroidal anti-inflammatory use. Unadjusted and adjusted effect size and 95% confidence intervals (95% CI) were reported.

Results: 253 athletes (Age: 19.43 (1.18) years; Male: 70; D1: 102, D2: 74, D3: 77; 7-8 hours of sleep: 157) participated. Mean flourishing scores were D1: 48.59 (10.43), D2: 50.08 (5.31), and D3: 48.58 (8.09). The median OSTRC score was 0 (0-22). 124 reported an overuse injury and 47 a substantial overuse injury. There was a unadjusted negative relationship between OSTRC total score and flourishing (-5.2%

(95% CI: -10%, 1%), $p=0.037$); however there was no relationship after controlling for confounders (0.1% (95% CI: -2.6%, 2.7%), $p=0.989$). There was no relationship between overuse injury and flourishing (-0.23 (95% CI: -2.57, 2.11), $p=0.848$). There was an unadjusted negative relationship between substantial overuse injuries and flourishing (-2.77 (95% CI: -5.43, -0.12), $p=0.042$), but there was no relationship after controlling for confounders (1.97 (95% CI: -4.95, 1.01), $p=0.196$). These relationships were similar by division.

Conclusion: College athletes have high flourishing, and have similar flourishing between all NCAA divisions. Pain and injury have a negative relationship to flourishing; however, these relationships are confounded by surgical and injury history, and lifestyle.

3519 Board #340 May 29 2:30 PM - 4:00 PM
Characterization Of Normal Biomarkers Of Muscle Damage In Collegiate Athletes

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Exertional rhabdomyolysis is a serious clinical condition in which skeletal muscle is rapidly broken down, potentially leading to life-threatening systemic complications. Clinicians often diagnose rhabdomyolysis based on elevations in circulating creatine phosphokinase (CPK) and symptomatology. Normal CPK and other biomarker concentrations following intense exercise are unknown. **Purpose:** This study aimed to determine reference concentrations for selected biomarkers that suggest muscle damage in athletes and examine the time-course of muscle damage biomarker responses after strenuous exertion. **Methods:** 20 collegiate NCAA I football players were enrolled in the study. Serum and urine samples were collected immediately and 24 hours post strenuous practice (0h and 24h, resp). Serum samples were analyzed for biomarkers of muscle damage including a Chem26 metabolic and chemistry panel and myoglobin. Urine samples were analyzed for creatinine and myoglobin concentrations. Participants were also given Physical Symptoms Questionnaires to obtain subjective measures of symptoms that may be related to severe muscle damage, or rhabdomyolysis. **Results:** A total of 28 samples were collected with 9 repeats. CPK levels were elevated at 0h (958.2 ± 544.1 IU/L), but trended down 24h post practice (751.0 ± 410.5 IU/L, $p=0.059$). LDH was acutely elevated at 0h (217.9 ± 30.6 IU/L) compared to the 24h timepoint (170.3 ± 35.5 IU/L, $p<0.0001$). Average serum myoglobin was higher post-practice (1.31 ± 1.57 ng/mL), but decreased 24 h post-exercise (0.36 ± 0.71 ng/mL, $p<0.001$). Similarly, urine creatinine concentrations were higher 0h post practice (390.1 ± 164.2 mg/mL), and decreased 24h post (214.2 ± 99.4 mg/dL, $p<0.0001$). Urine myoglobin was also elevated at 0h post practice (18.18 ± 36.7 ng/mL), but decreased 24h post (0.66 ± 1.43 ng/mL, $p=0.001$). The Physical Symptoms Questionnaires did not reveal any symptoms related to severe muscle damage. **Conclusion:** Biomarkers of muscle damage were elevated immediately post strenuous exercise, but dropped 24 hours post-practice. Serum and urine biomarkers of muscle damage collected immediately post strenuous exercise are unlikely to be specific markers of rhabdomyolysis, but rather of transient exercise-induced muscle damage in a highly trained athletic population.

3520 Board #341 May 29 2:30 PM - 4:00 PM
Abstract Withdrawn

3521 Board #342 May 29 2:30 PM - 4:00 PM
The Effectiveness Of Warmup Programs For Lower Extremity Injury Prevention In Basketball: A Systematic Review

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 Reported Relationships: A.C. Davis: Industry contracted research; National Basketball Association.

PURPOSE: Given the many benefits of sports participation, leading experts have called for attention to factors that might inhibit youth participation. Basketball is the most popular team sport among youth in the US; the popularity of basketball translates to a large absolute number of basketball related injuries. The objective of this review is to evaluate the evidence to support the effectiveness of neuromuscular warmup-based strategies for preventing lower extremity injuries (LEIs) in basketball. **METHODS:**

We conducted a systematic review of the literature. We searched the PubMed and Cochrane Library databases, and focused on English-language randomized controlled trials, non-randomized comparative trials, and prospective cohort studies. We included studies that tested neuromuscular and/or balance-focused warmup interventions among basketball players, and that assessed at least one type of LEI as a primary outcome. We critically appraised the quality of the included studies and abstracted data on the interventions, populations, exposures and outcomes. We contacted the authors of five of the studies to obtain details about the interventions or outcome data specific to basketball athletes. **RESULTS:** Thirteen studies testing neuromuscular interventions for LEI prevention in basketball athletes were included in this review. They reported significant protective effects for the following LEIs: ankle injuries (significant in 4/9 studies that assessed this outcome); ACL injuries (2/4 studies); a general knee injury outcome (1/5 studies); and overall LEIs (composite; 5/7 studies). Non-significant results were almost universally directionally favorable. **CONCLUSIONS:** Neuromuscular interventions that require minimal equipment are an appealing injury prevention strategy in youth sports. In soccer, the FIFA 11+ warmup program has been rigorously studied and proven effective when adoption and adherence is strong. Overall, the evidence is supportive of warmups for LEI prevention in basketball. However, most studies are underpowered, intervention components are varied, and adoption and adherence is often low. More work is needed to validate the necessary and sufficient warmup activities, and to maximize adoption and sustained adherence to these strategies over time.

3522 Board #343 May 29 2:30 PM - 4:00 PM
Time Course Of The Acute Effects Of Static Stretching On Passive Stiffness In Elderly Men

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 (No relevant relationships reported)

The time course of passive stiffness responses after an acute bout of static stretching has received little research attention, particularly in older adults. **PURPOSE:** To determine the time course of the acute effects of static stretching on hamstring passive stiffness in elderly men. **METHODS:** Fifteen elderly men (70 ± 7 yrs.) underwent one passive straight-leg raise (SLR) assessment before (Pre) and at 0 (Post0), 5 (Post5), and 10 (Post10) min after two randomized conditions that included a control treatment (quiet resting for 2 min) and a stretching treatment. During the SLR, participants laid in a supine position with the knee braced in full extension. Each SLR was administered manually by the primary investigator who applied force against a load cell attached to the heel, while the leg was moved toward the head. All SLR assessments were performed on the right leg to the point of discomfort, but not pain as indicated by the participant, which was regarded as the max range of motion (ROM). An electrogoniometer was used to measure the hip joint angle. For the stretching treatment, four 15-s SLR static stretches were completed in the same manner as the SLR assessments; however, when max ROM was reached, the leg was held at this position for 15 s. Each 15-s stretch was separated by 15 s of rest. Passive stiffness was calculated during each SLR assessment as the slopes of the initial and final phases of the angle-torque curve. **RESULTS:** Passive stiffness (collapsed across phase) was lower at Post0 (0.92 ± 0.27 Nm^{-0.1}; $P=0.029$) and Post5 (0.95 ± 0.19 Nm^{-0.1}; $P=0.042$) but not Post10 (1.03 ± 0.26 Nm^{-0.1}; $P>0.999$) compared to Pre (1.07 ± 0.23 Nm^{-0.1}) for the stretching treatment. There were no significant differences ($P>0.999$) in passive stiffness between any of the time points (Pre = 1.07 ± 0.25 Nm^{-0.1}; Post0 = 1.10 ± 0.36 Nm^{-0.1}; Post5 = 1.09 ± 0.24 Nm^{-0.1}; Post10 = 1.06 ± 0.24 Nm^{-0.1}) for the control. **CONCLUSION:** These findings showed that hamstring passive stiffness in elderly men decreased after four 15-s SLR static stretches but returned to baseline values within 5-10 min. Given the transient nature of these changes in stiffness, we recommend that acute bouts of SLR static stretching be performed on older adults 5 to 10 min prior to physical activity or exercise, as this may ensure lower stiffness and perhaps, greater performance at the start of the event.

3523 Board #344 May 29 2:30 PM - 4:00 PM
The Effect Of Injuries And Pain On Athletic Identity Across NCAA Divisions

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 (No relevant relationships reported)

There is a high prevalence of pain and injury in collegiate athletes, which can affect playing time and performance. Previous studies have observed that surgery and concussions can affect athletic identity. Currently, there is a paucity of research investigating how current pain and injury affect athletic identity.

Purpose: To determine how current collegiate athlete pain and injury affect athletic identity and how these relationships differ across NCAA divisions. **Methods:** NCAA division I (D1), 2 (D2), and 3 (D3) athletes were administered a questionnaire through an encrypted database. The Athletic Identity Questionnaire (AIM) and Oslo Sports Trauma Research Center Overuse Injury Questionnaire (OSTRC) were used within the survey. AIM estimates self-perceived athletic identity while OSTRC measures level of participation, training volume, performance, and pain. Athletes were further classified by OSTRC scores into overuse and substantial overuse injuries. Multivariable and logistic regressions assessed the relationship between Aim, OSTRC scores, and overuse injury. Models were adjusted for age, gender, NCAA division, history of orthopedic surgery, and history of major injury, with unadjusted and adjusted coefficients and Odds Ratios (OR) with 95% confidence intervals (95% CI). **Results:** 252 athletes (age of 19.4 years (1.2); female: 181, male: 70; D1: 101, D2: 74, D3: 77) participated. Mean AIM scores were D1: 37.98 (7.61), D2: 37.03 (37.03), and D3: 38.86 (6.98). The OSTRC median score was 0 (IQR: 0-22). 127 (50%) athletes had an overuse injury while 47 (19%) had a substantial overuse injury. Adjusted total OSTRC score was -0.67 (95% CI: -2.4, 1.1; p=0.474). Adjusted OR for OSTRC overuse injury was 1.00 (95% CI: 0.97, 1.04; p=0.589) and substantial overuse injury was 0.95 (95% CI: 0.91, 0.99; p=0.036). Similar results were observed between gender and division subgroups. **Conclusion:** After adjusting for confounding variables, it was determined that substantial overuse injuries negatively affected athletic identity, regardless of gender or NCAA division. Sports medicine professionals need to consider the possibility of lost athletic identity when an athlete sustains an injury. Measures should be taken to ensure that athletes continue to have meaningful contribution to sport following pain or injury.

3524 Board #345 May 29 2:30 PM - 4:00 PM
Subjective Well-Being Outcomes Before, During, And After In-Season Competitive Soccer Matches
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Subjective well-being is related to injury in soccer athletes, but little is known about how these variables change around a single athletic competition. Continued athletic participation combined with negative well-being may lead to tissue overload and subsequent injury. **Purpose:** The purpose of this study was to identify the differences in daily well-being measures before, during and after the day of each match. **Methods:** Thirty female soccer (age: 19.8 ± 1.1 years, height: 1.6 ± 0.05 m, mass: 64.9 ± 6.6 kg) players provided daily measures of readiness, physical fatigue, mental stress, and soreness intensity over the course of a competitive season. Subjective well-being was taken on standard practice days (P), game days (D0), and on days one (D1) two (D2) following games. One-way within subject analysis of variance was used to compare the subjective well-being variables between each time point. Post-hoc analysis was performed with a Bonferroni adjustments. **Results:** A significant main effect was present for readiness (F=52.96, P<0.01). Post-hoc testing revealed readiness on D1(68.5 ± 12.4) was significantly more negative than readiness on P (77.9 ± 8.0, p<0.01), D0 (83.4, 8.9, p<0.01), and D2 (77.1 ± 8.8, P<0.01). A significant main effect was present for fatigue (F=41.8, p<0.01). Post-hoc testing revealed fatigue on D1 (0.5 ± 1.6) was significantly more negative than fatigue on P (1.7 ± 1.4, P=0.01), D0 (2.3 ± 1.4, p<0.01), and D2 (1.7 ± 1.5, p=0.01). A significant main effect was present for stress (F=3.8, p=0.01) and soreness (F=15.1, p=0.01), but after accounting for multiple comparisons, there was no differences between times. **Conclusions:** Self-reported readiness to train and physical fatigue are decreased for a full day following competitive soccer competition. Coaches, strength coaches, and athletic trainers may use this information to tailor training programs to promote recovery and limit injury risk, as previous literature indicates that negative outcomes on subjective scales may be indicative of injury. Future research should incorporate training load assessments into this analysis to understand if these changes are correlated to the frequency, intensity, or volume of soccer training and participation.

3525 Board #346 May 29 2:30 PM - 4:00 PM
Reduction Of Injury And Related Costs After Implementation Of An Injury Prevention System In Division I Athletes
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Purpose: At the collegiate level, the estimated cost per year from sports injuries has been reported to be in the billions in the United States. Injury prevention programs are often assessed by injury reduction; there is little evidence on the associated reduction

in health care cost. The purpose of this study is to investigate the change in health care costs at a Division I university from sports injuries after the implementation of an injury prevention system.

Methods: Data was obtained from 3 academics years prior and 2 years after the implementation of an injury surveillance and prevention system (Sparta Science). This system assesses kinematic variables gathered from vertical jumps; this information is used to flag athletes who are at higher risk of sustaining an injury, which guides intervention. Teams were designated as "users" (U) versus "non-users" (NU) based on their utilization of the surveillance system. Total number of injuries, total cost of injuries, and volume and cost by discipline (surgery, physician office visits, imaging, and physical therapy (PT)) was compared for the U versus the NU groups.

Results: Total injuries decreased from 179 to 177 for the U group, and total charges decreased by 19%; the NU group had a 12% increase in injuries and 8% increase in total charges. The U group demonstrated a 29% reduction in the number of surgeries and a 45% decrease in surgery charges; the NU group had a 3% reduction in surgeries, but a 33% increase in surgery charges. The U group had a 23% reduction in office visits and an associated 48% reduction in charges; the NU group showed a 14% increase in visits, but no change in charges. The U group had a 7% reduction in the quantity of imaging ordered, and a 1% reduction in imaging costs; the NU group had no change in the quantity of imaging, but an 83% increase in imaging charges. There was a 6% increase in PT courses of care and 13% increase in PT charges for the U group, versus a 33% and 35% increase in courses of care and charges, respectively, for the NU group.

Conclusion: A reduction was seen in total billed claims, surgery costs, and office costs in the U group. This group also demonstrated a decrease in the number of surgeries, number of office visits, number of imaging procedures.

3526 Board #347 May 29 2:30 PM - 4:00 PM
Abstract Withdrawn

3527 Board #348 May 29 2:30 PM - 4:00 PM
Sport Players Exhibit Less Muscle And Bone Mineral Content With Higher Body Fat Than Controls
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(No relevant relationships reported)

PURPOSE: To investigate activity levels, body composition, and bone mineral content in collegiate eSports players as compared to age-matched controls. **METHODS:** Twenty-four male collegiate eSport players and non-eSport players between 18-25 years of age underwent body composition and bone mineral content testing using a GE DXA absorptiometry scan. Daily activity (step count) and sleep duration were measured for two weeks using a Fitbit Charge™ and a questionnaire assessing their physical activities and computer usage was administered. Body mass index (BMI) was calculated on all subjects. **RESULTS:** The step count in the eSports players was significantly lower than the age matched controls (p=.0004; 6040.2 ± 3028.6 to 12843.8 ± 5661.1). ESport players exhibited greater body fat percentage (p=.05), less lean body mass (p=.003) and less bone mineral content (p=.03), despite no difference in BMI between the eSport and non-eSport players. **CONCLUSION:** As compared to non-eSport players, collegiate eSport team players were significantly less active and had a higher body fat percentage with lower lean body mass and bone mineral content. BMI is a common marker of health and obesity, yet this index showed no difference between the two groups. Considering the eSport athletes displayed significantly worse numbers, which are all correlated with potential health issues, use of the BMI is not capturing this difference and should not be considered an accurate measure of health in competitive eSport players.

F-71 Free Communication/Poster - Function and Cancer

Friday, May 29, 2020, 1:30 PM - 4:00 PM
 Room: CC-Exhibit Hall

3528 Board #349 May 29 2:30 PM - 4:00 PM
Balance And Functionality In Breast Cancer Survivors: Does Improvement In Balance After Exercise Intervention Improve Functional Test Outcomes?

Dean Amatuli, Chad W. Wagoner, Jordan T. Lee, Kirsten A. Nyrop, Hyman B. Muss, Brian C. Jensen, Claudio L. Battaglini, FACSM. *UNC-Chapel Hill, Chapel Hill, NC.* (Sponsor: Claudio Battaglini, FACSM)
(No relevant relationships reported)

Balance and Functionality in Breast Cancer Survivors: Does Improvement in Balance After Exercise Intervention Improve Functional Test Outcomes?

Dean J. Amatuli, Jordan T. Lee, Chad W. Wagoner, Kirsten A. Nyrop, Hyman B. Muss, Brian C. Jensen, Claudio L. Battaglini, FACSM. University of North Carolina, Chapel Hill, Chapel Hill, NC.

PURPOSE: Postural control is necessary for proper functionality, independence, and quality of life. Breast cancer survivors (BCS) is a population that has displayed challenges in postural control post-treatment (Wampler et al. 2007). This study evaluated changes in balance and functionality following an exercise intervention which included balance training. **METHODS:** BCS who completed major anti-cancer treatments within the past year participated in an intervention including aerobic, strength and balance exercises, 3 days/week for 16 weeks. Training progressed in intensity and volume and incorporated movements that challenged whole-body balance. Functionality was measured using the 6 Minute Walk Test (6MWT), dynamic balance using Timed Up and Go (TUG), and balance using the NeuroCom Sensory Organization Task (SOT). Dependent samples t-test using pre and post intervention scores were used to evaluate the impact of exercise on functionality and balance. Pearson correlations were used to assess the relationship between physical function and balance outcomes. **RESULTS:** Thirty-two BCS (54±12 years) participated. 6MWT distance significantly increased (34.7±48.9m, p<.001) & TUG times significantly improved (-.55±1.0s, p = .005) from pre/post intervention. SOT composite balance scores also improved (4.0±9.3, p=.025). There was a strong correlation between pre-testing scores of TUG & 6MWT (r = -.703, p<.001). **CONCLUSION:** A 16-week exercise intervention improves physical function evaluated using 6MWT and TUG and balance using SOT composite scores. However, no relationship was observed between improvements in physical function and balance; possibly due to the differences in the dynamic nature of the physical function and static assessment of balance. Future studies should consider the evaluation of balance using dynamic tasks in order to further examine the relationship between physical function and balance in BCS. Funded by Breast Cancer Research Foundation (New York, NY)

3529 Board #350 May 29 2:30 PM - 4:00 PM
Effects Of A Lifestyle Intervention On Simulated Activity Of Daily Living Performance In Prostate Cancer Patients Undergoing Androgen Deprivation Therapy

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(No relevant relationships reported)

The adverse effects accompanying androgen deprivation therapy (ADT) compromise prostate cancer (PCa) patients' ability to complete activities of daily living (ADL) requiring muscular strength and mobility. Although emerging evidence suggests lifestyle interventions combining modification of exercise and dietary intake (EX+D) result in improvements in mobility in PCa patients undergoing ADT, the effects of EX+D interventions upon simulated ADL performance has yet to be delineated. **PURPOSE:** The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of a lifestyle EX+D intervention, implementing a group-mediated cognitive behavioral (GMCB) approach, relative to standard of care (SC) among PCa patients undergoing ADT. In the current study, we evaluated the effects of the EX+D intervention on performance of a simulated ADL task at the end of the intensive phase of the intervention. **METHODS:** A total of 32 PCa patients (M age = 65 years) on ADT were randomly assigned to the EX+D (n = 16) or SC (n = 16) interventions.

Assessments of simulated ADL performance, measured using a lift and carry task, were obtained at baseline and 2 month follow-up assessments. **RESULTS:** A total of 32 PCa patients (M age = 65 years) on ADT were randomly assigned to the EX+D (n = 16) or SC (n = 16) interventions. Assessments of simulated ADL performance, measured using a lift and carry task, were obtained at baseline and 2 month follow-up assessments. **RESULTS:** Results of intention to treat ANCOVA analysis of residualized change scores yielded a significant Treatment main effect for (p<0.01) demonstrating that the EX+D intervention resulted in superior improvements in lift and carry performance (d = 1.01) relative to the SC intervention at 2 months. **CONCLUSIONS:** Findings from the IDEA-P trial suggest that the intensive phase of the EX+D intervention, implementing a GMCB approach designed to promote adoption and adherence to lifestyle behavior change, resulted in superior changes in a simulated ADL performance task relative to SC. These results underscore the utility of lifestyle interventions promoting change in both exercise and dietary behavior for preserving mobility and functional health among PCa patients undergoing ADT.

3530 Board #351 May 29 2:30 PM - 4:00 PM
Effects Of High Intensity Interval Training On Patient-reported Outcomes And Physical Function During Anthracycline Chemotherapy

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PURPOSE: Breast cancer patients treated with anthracycline chemotherapy experience negative anthracycline-related side effects, including poor quality of life and impaired physical function. However, it is unclear whether high intensity interval training (HIIT) improves quality of life and physical function in breast cancer patients undergoing anthracycline-based chemotherapy. The purpose of this study was to examine the effects of HIIT on patient-reported outcomes and physical function in breast cancer patients with anthracycline-based chemotherapy. **METHODS:** Thirty breast cancer patients were recruited prior to initiating anthracycline-based chemotherapy and randomized into the HIIT group (n=15) or control (CON) group (n=15). The HIIT group attended the HIIT session for 3 days per week for 8 weeks. The CON group was asked to maintain their current level of physical activity and offered the same HIIT intervention after the 8-week study period. Patient-reported outcomes were assessed by the Functional Assessment of Cancer Therapy-Breast Cancer (FACT-B), Multidimensional Fatigue Inventory with 20 questions (MFI-20), and the 15-item Five-Facet Mindfulness Questionnaire (FFMQ-15). Physical function was assessed using the timed up and go (TUG), 30-second sit-to-stand (30STS), Margaria-Kalamen stair climb test, and 6-minute walk test (6MWT). Repeated measures ANCOVA and paired t-tests were performed to assess changes in the outcome measures. **RESULTS:** Thirty breast cancer patients completed the 8-week study with 82.3% adherence to the intervention among the HIIT group. Post-intervention, significant improvements were found for the functional Margaria-Kalamen Power Test (-3.39%; P=0.013) and 6MWT (+11.6%; P=0.008) in the HIIT group compared baseline and to the CON group. No changes in patient-reported outcomes, TUG, and 30STS were found following the 8-week study period in both groups (P>0.05). **CONCLUSIONS:** HIIT may be an effective strategy to improve physical function and possibly maintain quality of life in breast cancer patients undergoing the anthracycline-based chemotherapy.

3531 Board #352 May 29 2:30 PM - 4:00 PM
Effects Of Exercise On Disablement Process Outcomes In Prostate Cancer Patients Undergoing Androgen Deprivation Therapy: An Updated Systematic Review

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(No relevant relationships reported)

Although androgen-deprivation therapy (ADT) is a foundation of treatment for prostate cancer (PCa) patients, adverse effects of ADT may accelerate functional decline. Whereas exercise improves muscular strength and functional performance in PCa patients, evidence of the benefits of exercise for alternative disablement process outcomes remain equivocal. **PURPOSE:** To update the findings of our previous systematic review of the effects of exercise on disablement process outcomes in PCa patients undergoing ADT. The purpose of this study is to determine the extent to which exercise interventions produce meaningful improvements in the specific impairment domain outcome of body composition (BC) in PCa patients on ADT. **METHODS:** A comprehensive literature search was conducted of all relevant published studies

from December 2013-present. Data were extracted on BC outcomes from 8 published exercise intervention studies involving 307 PCa patients on ADT. The magnitude of pre- to post-intervention change was examined. To isolate the effects of exercise, studies combining other interventions were excluded. Weighted, bias-corrected Cohen's *d* effect sizes were calculated for change in each outcome and averaged across included studies. **RESULTS:** Results revealed that exercise yielded small average improvements in lean body mass ($d = 0.09$), appendicular lean mass ($d = 0.08$), trunk fat mass ($d = -0.03$) and visceral fat mass ($d = -0.11$). All other measures of whole-body and regional BC showed negligible average effects of exercise. **CONCLUSIONS:** The findings of this updated systematic review suggest that while exercise attenuates the established adverse effects of ADT on BC, the magnitude of exercise-induced improvements in BC outcomes is small and inconsistent across studies. These findings have important implications for delineating the effect of exercise on disablement process outcomes and underscore the potential utility of complementing exercise with targeted nutritional approaches in the supportive care of PCa patients on ADT.

3532 Board #353 May 29 2:30 PM - 4:00 PM
Dynapenic Obesity: Strength, Body Composition, And Physical Function In Women Diagnosed With Breast Cancer

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 (No relevant relationships reported)

Background: Breast cancer survivors (BCS) report more limitations performing activities requiring strength compared to women without a cancer history. Combined with obesity, BCS with dynapenia (poor muscle strength) may have greater risk of physical function (PF) difficulties; however, the prevalence and impact of dynapenic obesity (DO) in BCS remains unknown. **Purpose:** This study aimed to: 1) prospectively determine the prevalence of DO; 2) evaluate associations among DO, clinical factors, and resistance training (RT); and 3) determine if DO predicts PF in BCS from diagnosis to 2-year follow-up. **Methods:** DO was operationalized as waist circumference (WC) ≥ 88 cm and poor grip strength, measured via dynamometry and categorized using ACSM normative values. RT participation was determined via interview and categorized as meeting/not meeting RT guidelines for cancer survivors. PF was self-reported as level of difficulty with tasks including standing in place, walking 2 blocks, and lifting objects. Assessments were conducted at diagnosis and repeated at 1- and 2-years post-surgery during scheduled oncology visits. Data were analyzed using descriptive statistics and linear regression. **Results:** BCS (N=396, $Age=57.1 \pm 11.6$ years, $MBMI=29.2 \pm 6.2$ kg/m²) had a mean WC of 96.2 ± 17.6 cm and combined grip strength of 50.0 ± 11.5 kg. The prevalence of DO was 18.3% at diagnosis, 28.2% at 1-year, and 34.5% at 2-year follow-up. DO was not associated with clinical factors (e.g., diagnosis stage, receipt of chemotherapy) at diagnosis. A weak, positive association between DO and age was observed at baseline ($p=.009$). Meeting RT guidelines at diagnosis was inversely associated with DO at baseline ($p=.008$) and 1-year ($p=.05$). Controlling for age and RT participation, DO at diagnosis significantly predicted PF difficulty at 1-year ($\beta=.26$, $p=.007$) and significantly predicted PF difficulty at 2-year follow-up ($\beta=.15$, $p=.09$). **Conclusions:** A significant proportion of BCS had high central adiposity and poor muscle strength from diagnosis to 1- and 2-year follow-up. DO significantly predicted PF difficulty after surgery, indicating the importance of strength and body composition prior to treatment. RT may be protective against DO; therefore, greater efforts to increase RT engagement in BCS are critically needed.

3533 Board #354 May 29 2:30 PM - 4:00 PM
Manual Therapy And Dynamic Splint Use For Trismus In Head And Neck Cancer Survivors

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Head and neck cancer (HNC) accounts for 3-5% of cancer cases in the United States. A known complication of oncological treatments for HNC is trismus, defined as limited mouth opening of less than 35mm. Trismus occurs in 6-86% of survivors. There is no standardized treatment for trismus, however, commonly used conservative interventions include manual therapy (MT), active exercises and assistive stretching devices. These interventions have shown promise as means to improve jaw mobility and alleviate symptoms. Without early detection and intervention, trismus is often chronic and progressive in nature. **PURPOSE:** To determine the feasibility of study

processes, including recruitment rate, completion rate, adherence to protocol, and to establish processes for the dynamic splint mouthpiece fitting and intervention protocol. **METHODS:** A single subject design was used in this pilot feasibility study. Participants underwent a treatment protocol involving MT, exercises, and use of a dynamic splint at home for eight weeks. Multiple maximal interincisal opening (MIO) measures were performed at baseline testing, before and after each treatment session, and at the end of the intervention period. Researchers documented participant adherence to supervised sessions and dynamic splint use, and subjective responses to treatment after each session. **RESULTS:** 70% of participants had an improvement in their MIO after eight weeks, with an average increase of 3.0mm (range: -2.0 to 7.5mm). 90% of participants had 100% adherence to supervised sessions and 70% adherence to home use of the dynamic splint. Two participants were unable to be fitted with a dynamic splint mouthpiece due to insufficient mouth opening and, therefore used the flat plate of the device. Two participants required special adaptation of the mouthpiece, one due to dental pain and the other due to being edentulous. Treatment protocols required tailoring to facilitate comfort and adherence. **CONCLUSION:** Home use of a dynamic splint with MT shows promise as an intervention to address trismus in HNC survivors. The need for adaptations to the mouthpiece and treatment protocol should be anticipated, and a longer intervention period is recommended to optimize outcomes. Supported by: Faculty of Rehabilitation Medicine

3534 Board #355 May 29 2:30 PM - 4:00 PM
BODY COMPOSITION, PHYSICAL FUNCTION AND QUALITY OF LIFE ACROSS DIFFERENT STAGES OF PROSTATE CANCER: A CROSS-SECTIONAL ANALYSIS

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PURPOSE: Androgen deprivation therapy (ADT) has detrimental side effects, but changes between localized and advanced prostate cancer are unclear. The purpose is to determine body composition, physical function, and quality of life (QoL) differences across progressive stages of men with PCa on ADT. **METHODS:** Men with localized (PC, n=43, age 67 ± 6.4 y) or metastatic castration-resistant prostate cancer (mPC, n=21, age 72 ± 8.3 y) and non-cancer controls (CON, n=37, age 69 ± 6.1 y) completed total body DXA scans (% fat, lean and fat mass), physical function testing (6m walk, chair stands, timed up and go (TUG), stair climb), and QoL questionnaires (FACT-P). **RESULTS:** Percent fat differed between all groups, along with greater fat mass in mPC vs. CON. Both stair climb and TUG were slower in mPC compared to both CON and PC, whereas chair stands and 6m walk were only slower in mPC vs. CON. There were trends for lower QoL scores in mPC and PC vs. CON for overall FACT-P, Social Well-Being, and Trial Outcome Index vs. CON. Total length of ADT was similar between mPC and PC (mPC: 30 ± 34 months, PC: 37 ± 38 months, $p=0.536$). **CONCLUSIONS:** Body composition and physical function appear to deteriorate in advanced prostate cancer. As the length of ADT is similar between groups, this suggests that the additional forms of ADT for mPC appear to be influencing these changes. However, increases in body fat and reduced functional capacity with ADT do not translate into lower QoL for mPC. Exercise interventions targeting these outcomes are warranted to minimize the side effects of anti-cancer therapy.

Table 1. Between group differences in body composition, functional tasks, and quality of life questionnaires in men with various stages of prostate cancer

	CON (n=37)	PCa (n=42)	mPC (n=21)	P Value
Body Composition				
% Fat	26.1 (5.6)	29.9 (8.9) [^]	34.5 (5.6) ^{^#}	<0.001
Total Fat Mass (kg)	22.2 (7.8)	27.9 (12.1)	32.2 (11.7) ^{^*}	0.003
Functional Tasks				
Stair Climb (sec)	4.7 (1.0)	4.8 (1.0)	6.1 (2.4) ^{^#}	0.006
TUG (sec)	6.1 (1.3)	6.0 (1.5)	10.4 (9.0) ^{^#}	0.011
Chair Stands (sec)	9.3 (2.2)	10.6 (3.1)	12.8 (4.9) ^{^*}	0.007
6m Walk (sec)	3.9 (0.7)	3.9 (0.4)	4.7 (1.5) ^{^*}	0.018
Quality of Life				
FACT-P	138.6 (13.3)	121.8 (20.7)	120.0 (18.5)	0.050
Social Well-Being	27.0 (5.1)	21.8 (4.4) [^]	22.9 (3.4)	0.006
Trial Outcome Index	91.8 (6.9)	80.2 (14.8)	77.6 (3.7) ^{^*}	0.044

Data reported are mean (standard deviation)
 Indicate significant results ($p < 0.05$):
^{*}mPC vs. CON; [#]mPC vs. PCa; [^]PCa vs. CON

3535 Board #356 May 29 2:30 PM - 4:00 PM
Cancer Patients Who Exercise In Pairs Gain Greater Fitness Compared To Individually Trained Patients
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While individualized exercise training improves physical and psychosocial health, paired exercise training may result in similar improvements at a reduced patient-to-staff ratio. **PURPOSE:** To compare the effect of paired vs. individualized exercise training on physical and psychosocial health in cancer patients. **METHODS:** Twenty-five female cancer patients (mean±SD: 62±8 years) were assigned to exercise in pairs (n=13) or individually (n=12). They completed 36, 90-min sessions consisting of cardiovascular, resistance, balance and flexibility training according to standardized guidelines. Cardiorespiratory fitness (VO_{2peak}), muscular strength (1-repetition max), endurance (chair squat test), balance (single leg stance), and flexibility (sit-and-reach) were measured pre- and post-exercise. Psychosocial health was assessed pre-, mid- and post-intervention (Functional Assessment of Cancer Therapy-General (FACT-G), Insomnia Index, Brief Fatigue Index, Patient Health Questionnaire-9). Two-way ANOVAs (Factors: Group, Time) were used to identify main effects or interactions; differences were detected with *post-hoc* tests. Significance was set at p<0.05. **RESULTS:** Improvements in physical fitness were similar between paired (P) and singly (S) trained patients. VO_{2peak} significantly increased from 26.6±9.2 to 31.0±7.2 ml·kg⁻¹·min⁻¹ (S) and 26.0±6.3 to 29.1±7.1 ml·kg⁻¹·min⁻¹ (P). Upper and lower body strength increased by 20.0% (S) and 19.6% (P); 15.9% (S) and 20.8% (P), respectively. Paired patients exhibited larger improvements in lower body endurance (S: 24.0% vs. P: 52.3%), flexibility (S: 5.3% vs. P: 11.0%), and balance (S: 17.8% vs. P: 36.8%). A significant main effect (Time) was detected in the functional dimension (FACT-G) but not in social (p=0.200), emotional (p=0.054), or physical well-being (p=0.075). Time (main effect) was not significant for insomnia for either group (p=0.0778), but paired patients had significant improvements in sleep from pre- to mid-intervention (9.8±6.9 vs. 7.2±6.3). **CONCLUSION:** The social aspect associated with paired exercise sessions may have increased motivation, resulting in enhanced improvements in fitness and mental well-being in the paired group. These data suggest that exercising in pairs is a promising approach to cancer rehabilitation.

3536 Board #357 May 29 2:30 PM - 4:00 PM
Relationship Of Health-related Quality Of Life To Functional Fitness In Rural Cancer Survivors
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Health-related quality of life (HRQoL) is of high interest in exercise oncology due to decreases in HRQoL during and following cancer treatments. Functional fitness assessments (FFA) are also commonly assessed in this population due to the treatment-related side effects that may impact the patient's ability to perform activities of daily living (ADLs). However, the relationship between these variables has not been previously explored. **Purpose:** To examine the relationship between HRQoL and FFA in a group of rural cancer survivors. **Methods:** Fifteen (Females, n=8; Males, n=7) subjects with a previous diagnosis of cancer aged 62.0 ± 8.5 years and BMI of 21.8 ± 7.9 kg/m² were assessed in several areas of FFA including waist circumference, body fat percentage, fat free mass (FFM), timed up and go (TUG), and 30 second chair stand (30CS). They were also given the Functional Assessment of Chronic Illness-Fatigue (FACIT-F) with subscales in physical well-being (PWB), social/family well-being (SWB), emotional well-being (EWB), functional well-being (FWB), and fatigue. The types of cancer and staging were diverse. Treatment types included chemotherapy, radiation, and surgery. FFA were completed and the FACIT-F completed at home and returned at the following session. **Results:** Pearson Correlations were significant between SWB and TUG (r = -0.844, p = 0.000), SWB and 30CS (r = 0.715, p = 0.003), and between fatigue and FFM (r = 0.668, p = 0.006). A correlation trending toward significance was seen between FWB and TUG (r = -0.504, p = 0.055). No other significant correlations were found. **Conclusion:** Moderate-to-strong relationships were observed between SWB, TUG time, and 30CS. This shows cancer survivors who are more mobile may have a greater ability to engage in social tasks and ADLs. In addition, higher amounts of FFM were moderately correlated with having less fatigue meaning cancer survivors with more FFM may have less fatigue.

3537 Board #358 May 29 2:30 PM - 4:00 PM
Role Of Joint Loosening Yoga In Management Of Aromatase Inhibitor-Induced Arthralgia In Breast Cancer Survivors
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PURPOSE: Aromatase inhibitor hormonal therapy causes joint pain in up to half of women, and up to 20% become non-compliant with the 5-10 year treatment schedule due to pain and discomfort. Non-compliance affects patient prognosis and survival. This pilot study investigated the efficacy of joint loosening yoga in improving aromatase inhibitor-induced joint pain and evaluated the feasibility of delivering the intervention on Facebook. **METHODS:** Breast cancer patients undergoing treatment with aromatase inhibitors with self-reported arthralgia were recruited via an IRB-approved announcement posted in two closed breast cancer support groups on Facebook to participate in a yoga study delivered on Facebook. Participants completed BPI, DASH, PRAI and WOMAC questionnaires online before and after the study. Intervention consisted of 12 joint loosening exercises performed in a chair, once daily for 12 minutes, Monday-Friday for 4 weeks. Asynchronous video demonstrations were available in a secret Facebook group and viewing confirmed by typing "done" (time-stamped) in comments. **RESULTS:** 200 women responded. 38 met the inclusion criteria/consent, 26 completed the online consent, interventions and pre/post questionnaires. Participants were based in US, Canada and UK. Paired simple t tests results showed significant (P < 0.05) improvement in all the pain measures and quality of life parameters after yoga intervention compared to baseline. **CONCLUSIONS:** This study provides the first evidence that it is feasible to teach joint loosening yoga to patients on Facebook and that the intervention significantly improves aromatase inhibitor-induced arthralgia. Teaching yoga via social media may provide better access to this therapeutic modality to patients at all points in the cancer care continuum globally.

Variable	Pre Mean	Post Mean	% Change	P Value
BPI_PSS	4.26±1.79	2.3±1.45	-46.00%	P<.05
BPI_PIS	3.9±2.32	1.81±2.00	-53.58%	P<.05
DASH	30.54±15.26	13.72±14.86	-55.07%	P<.05
PRAI	2.69±1.55	1.36±1.13	-49.44%	P<.05
WOMAC 1	6.76±3.67	3.24±2.20	-52.07%	P<.05
WOMAC 2	4.04±1.76	2.40±1.15	-40.59%	P<.05
WOMAC 3	22.64±13.11	13.±8.83	-42.57%	P<.05

3538 Board #359 May 29 2:30 PM - 4:00 PM
The Impact Of Sports Science-based Prehabilitation On Spontaneous Physical Activity After Major Abdominal Cancer Surgery
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Complex surgery for abdominal cancer often leads to postoperative complications that may prevent post-surgical rehabilitation in old, frail, or malnourished patients. Prehabilitation is an emerging alternative strategy that has the potential to speed recovery and may be analogous to athletic preparations for gamened. For optimal physiological improvement to occur in a limited time period prior to the surgery, cancer patients undergoing prehabilitation interventions must work closer to their maximal physiological capacity (albeit a very low level) in a manner similar to that of competitive athletes. **PURPOSE:** To determine the effect of a 4-week sports science-based prehabilitation program on spontaneous physical activity in cancer patients who undergo major abdominal surgery. **METHODS:** Twenty-two cancer patients (63±11 years) who underwent major abdominal surgery were studied. Fourteen patients participated in a 4-week exercise and nutrition prehabilitation program prior to abdominal surgery. The sport-science based program comprised of an interdisciplinary approach, including blood flow restriction exercise and a daily sports nutrition supplement containing L-citrulline, creatine monohydrate, and whey protein. The remaining 8 patients served as controls. Physical activity of both groups was monitored

for 5 days after surgery. Accelerometers were used to quantify number of steps, energy expenditure, and sedentary time. **RESULTS:** The prehabilitation group recorded 47.4% more total steps for 5 days after abdominal surgery than the control group (16,032±5,194 vs. 10,877±5,182 total steps/5 days, $p=0.037$). The prehabilitation group had a greater amount of total energy expenditure than the control group (5,555±3,400 vs. 2,971±1,572 total kcal/5 days, $p=0.028$). There was no significant difference in total sedentary time between the two groups (5,064±597 vs. 5,414±514 min/5 days). **CONCLUSIONS:** This prehabilitation program composed of cutting-edge sports science practices significantly improved spontaneous physical activity after major surgery in older patients with abdominal cancers.

3539 Board #360 May 29 2:30 PM - 4:00 PM

Improved Physical Function And Quality Of Life In People With Blood Cancer After An Exercise Intervention

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(No relevant relationships reported)

In blood cancer, aerobic physical activity may improve fatigue and depression, though its effect on quality of life and physical function is less clear. Assessment of Fit to Thrive (FTT), a community-based individualised, supervised exercise program for people with blood cancer, may assist with future recommendations.

Purpose: To assess the effect of the FTT program on physical function and quality of life (QoL) in people with blood cancer.

Methods:

The 12-week FTT program utilised progressive aerobic and resistance training, supervised by an Accredited Exercise Physiologist, in small groups ($n=6$), twice weekly, for 8 weeks, with associated psychosocial and peer support. Physical function was assessed via the six minute walk (6MW), functional forward reach (FFR) and 5 times-sit-to-stand (5TSTS) tests. QoL was measured using the 36-item Short Form Survey Instrument (SF-36) and the Functional Assessment of Cancer Therapy General (FACT-G). Minimally important differences (MID) involved a change of 2 points for the SF-36, 3 points for the FACT-G and +50m for 6MW.

Results:

Participants ($n=106$) who attended the FTT program between 2014 and 2016 were included. Significant improvements in functional measures were observed for 6MW (+54.7m [95% CI 40.5, 69.0] $p<0.001$), 5TSTS (-1.9 sec [95% CI -2.5, -1.2] $p<0.001$) and FFR (+2.7cm [95% CI 1.5, 4.0] $p<0.001$), with the MID achieved by 56% for the 6MW. The SF-36 physical component summary (PCS) significantly increased (+4.99 [95% CI 3.29, 6.68] $p<0.001$) immediately following the intervention, with 68% ($n=72$) achieving the MID. The improvement in the SF-36 mental component summary (MCS) also achieved statistical significance (+2.81 [95% CI 0.54, 5.08] $p=0.02$), with 51% ($n=54$) achieving the MID. FACT-G scores improved significantly from pre- to post-intervention (+5.50 [95% CI 2.52, 8.47], $p<0.001$) with 58% ($n=62$) meeting the MID. MID improvements in PCS and FACT-G were maintained in 77% ($n=20/26$) and 95% ($n=19/20$) of participants 3 months following completion of the program.

Conclusion:

The FTT program was effective in improving physical function and QoL, with some evidence for long-term effects. An individually-prescribed exercise program supervised by an Accredited Exercise Physiologist should be considered as part of standard care in people with stable blood cancer.

F-72 Free Communication/Poster - Human Studies: Mechanisms in Exercise Oncology

Friday, May 29, 2020, 1:30 PM - 4:00 PM

Room: CC-Exhibit Hall

3540 Board #361 May 29 2:30 PM - 4:00 PM

Novel Biomarkers Of Treatment-Induced Muscle Damage, Exercise And Fatigue: An RCT In Breast Cancer Patients

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(No relevant relationships reported)

Radiation and hormone therapy may damage skeletal muscle and lead to cancer-related fatigue (CRF). Developmental myosin light chain 5 (MYL5) and myosin heavy chain 8 (MYH8) are required for normal muscle regeneration. Up-regulated serum levels of MYL5 and MYH8 resulting from radiation and hormone therapy may increase muscle degradation and lead to CRF, especially physical CRF—one of the multidimensional subcomponents of overall CRF. **PURPOSE:** To investigate the effect of a 6-week aerobic and anaerobic exercise intervention, called Exercise for Cancer Patients (EXCAP), on (1) CRF (overall and physical), (2) serum protein levels of MYL5 and MYH8, and (3) the association of CRF (overall and physical) with these novel biomarkers. **METHODS:** Ninety sedentary breast cancer patients (55.5±9.6 years, 79% white, 52% receiving radiation therapy, 48% receiving hormone therapy) were consented and participated in this phase II RCT. Patients were randomized into two arms: (1) standard cancer treatment (Control) or (2) standard cancer treatment plus EXCAP. Serum levels of MYL5 and MYH8 by ELISA assays and CRF (total and physical) by patient-report via the Multidimensional Fatigue Symptom Inventory were assessed pre- and post-intervention. **RESULTS:** T-tests showed significant reductions in overall CRF and physical CRF among exercisers (overall CRF: -4.9±2.6, $p=0.07$, physical CRF: -1.0±0.5, $p=0.05$) but not in controls, with significant group differences (overall CRF: -7.9±3.4, $p=0.02$; physical CRF: -1.9±0.7, $p<0.01$). T-tests also revealed statistical trends for down-regulation of MYL5 (-0.5±0.3, $p=0.17$) and MYH8 (-0.4±0.3, $p=0.17$) serum protein levels from pre- to post-intervention in exercisers, but not in controls. Spearman correlations also reveal statistical trends, in exercisers, where decreases in MYL5 and MYH8 serum protein levels are directly associated with decreases in total CRF (MYL5 $r=0.23$, $p=0.17$; MYH8 $r=0.30$, $p=0.07$) and physical CRF (MYL5 $r=0.29$, $p=0.08$; MYH8 $r=0.39$, $p=0.02$). **CONCLUSIONS:** EXCAP improves overall and physical CRF. EXCAP may also protect against cancer treatment-induced skeletal muscle damage via its effects on MYL5 and MYH8. Changes in these novel biomarkers may mediate changes in overall and physical CRF. Further phase III RCTs are needed to confirm these findings.

3541 Board #362 May 29 2:30 PM - 4:00 PM

The Influence Of Physical Activity And Body Composition On Gene Expression In Breast Adipose Tissue

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Higher physical activity levels and healthy body weights are associated with a lower risk of postmenopausal breast cancer. Little is known about the biological mechanisms underlying this association, but the microenvironment created in the breast tissue is of interest. Adipose tissue is recognized as an endocrine organ, responding to the local and systemic environment. **PURPOSE:** To explore the association between self-reported lifestyles factors, and breast adipose tissue and the microenvironment it creates. **METHODS:** Using a cross-sectional design, women undergoing reduction mammoplasty surgery were recruited. Participants completed standard questionnaires

about their usual physical activity, weight history, reproductive history, and past-year dietary intake. Body weight was abstracted from medical records. A sample of breast tissue was collected during surgery. An adipose-rich section was isolated under sterile conditions. Part of the sample was formalin fixed (sectioned at 7 μ m thickness for measurement of mean adipocyte size with Image J) and part was flash frozen for RNA isolation. Associations between mean adipocyte size and lifestyle variables were examined by multivariate analysis to determine associations between genes and lifestyle variables. **RESULTS:** Of 72 women recruited, RNA was isolated from 65 samples. Participants were a mean age of 43 years (range 19-70) and had a mean body mass index of 27.0 kg/m² (SD 5.0). BMI was positively associated with adipocyte size ($\beta = 0.06$, $p < 0.01$) and transportation physical activity was negatively associated with adipocyte size ($\beta = -0.25$, $p = 0.02$). Six genes, namely *SLC27A2*, *TTC36*, *WHSC1L1*, *AASS*, *MOCSI*, *GLYCK*, were found to be associated with adipocyte size. **CONCLUSION:** Adipose tissue biology is associated with lifestyle exposures in normal breast tissue. Our findings provide directions for future research into the impact of lifestyle on the microenvironment of healthy breast tissue.

3542 Board #363 May 29 2:30 PM - 4:00 PM
MICROVASCULAR OXYGENATION RESPONSE DURING PADDLING GRADED EXERCISE TEST IN BREAST CANCER SURVIVOR DRAGON BOAT RACERS
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(No relevant relationships reported)

Cancer treatment is associated with numerous peripheral pathologies including altered blood flow and vascular dysfunction. A pilot study was conducted to measure the peripheral microvascular oxygenation response during maximal exercise in a group of cancer survivors. **PURPOSE:** To investigate the differences that paddling side (paddling side, PS; non-paddling side, NPS) and treatment side (treatment side, TREAT; healthy side, HEAL) has on the near-infrared spectroscopy (NIRS) responses during a unilateral paddling graded exercise test in breast cancer survivor dragon boat racers. **METHODS:** Thirteen breast cancer survivors/racers (56 \pm 9 years, 1.65 \pm 0.06 m, 76.5 \pm 11.0 kg) performed a unilateral, discontinuous graded exercise test (2-minute exercise, 1-minute rest) on a stationary rowing ergometer to volitional fatigue. Tissue oxygenation saturation (StO₂) and total hemoglobin concentration ([THC]) were measured via NIRS from the posterior deltoid muscles during the graded exercise test. StO₂ and [THC] responses were averaged during the last 30 seconds of each exercise stage and normalized to baseline exercising data. Paired t-tests were used to examine if treatment side had an effect on StO₂ or [THC] and if paddling side had an effect on [THC] responses at maximal intensity. Due to non-normally distributed data, a Wilcoxon Signed Rank Test was used to determine if paddling side had an effect on StO₂ at maximal intensity. Significance was established *a priori* at $p < 0.05$. **RESULTS:** Paddling side did not significantly affect the StO₂ (PS = -5.2 \pm 15.7%, NPS = -13.5 \pm 21.7%, $p = 0.094$) or [THC] (PS = 0.14 \pm 0.19, NPS = 0.15 \pm 0.21, $p = 0.425$) responses. Treatment side had a significant, moderate (ES = 1.12) effect on the StO₂ response (TREAT = -0.006 \pm 16.1%, HEAL = -18.7 \pm 17.3%, $p = 0.008$). Treatment side did not significantly affect the [THC] response (TREAT = 0.13 \pm 0.20, HEAL = 0.16 \pm 0.19, $p = 0.313$). **CONCLUSION:** Based upon the pilot results, it would suggest that the exercising muscles on the breast cancer treatment side may have a residual impaired ability to use oxygen for energy production during maximal intensity exercise.

3543 Board #364 May 29 2:30 PM - 4:00 PM
The Role Of Aerobic Physical Training On Colon Tumor Metabolic Reprogramming
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(No relevant relationships reported)

PURPOSE: Tumor cells are known for marked growth and proliferation, however adequate energy support is required to sustain the growth and proliferation of cancer cells. Therefore, tumors have a large change in energy metabolism, for example, the glycolysis pathway is overactivated. These phenomena are linked to changes in metabolic genes expression, such as microRNA-33a and its gene target SIRT6. On the other hand, aerobic physical training (APT) is known to increase cellular respiration in tissues such as cardiac and skeletal muscle, unlike cancer. APT, also contributes to decreased tumor progression. **METHODS:** We first evaluated if a longer training time prior colon cancer cell inoculation (CT26) contributes to lower tumor progression, we observed that the time of APT is not a major factor since all cancer trained mice have lower tumor progression compared to the sedentary cancer group (SC). Thus, we proceeded to evaluate two groups: 1) group with cancer and 8-weeks training prior to inoculum (TR8), 2) and SC and 3) Wild type (WT). **RESULTS:** TR8 group presented longer survival ($p = 0.007$), cancer promoted decrease of fat mass (WT-7.3 \pm 0.7; SC-1.4 \pm 0.8; TR8-3.6 \pm 2.8; $p = 0.01$)

and increase of liver mass (WT-62 \pm 7.9; SC-91.7 \pm 11.9; TR8-81.5 \pm 11; $p = 0.01$) in sedentary e trained group compared with WT. SIRT6 (SC-100 \pm 12.1; TR8-88.8 \pm 27.9) and the microRNA-33a (SC-100 \pm 42.9; TR8-78.2 \pm 30.6) expression in tumor tissue was not different between the groups. However, we observed differences in HIF1a expression (SC-100 \pm 21.4; TR8-74 \pm 13.4 - $p = 0.01$), which was decreased due to APT, as well as the GLUT1 (SC-100 \pm 32.4; TR8-69.6 \pm 36.2; $p = 0.07$), PDK (SC-100 \pm 20.9; TR8-76.8 \pm 22.6; $p = 0.05$), LDHa (SC-100 \pm 26.2; TR8-65.4 \pm 35.7 $p = 0.03$) expression also decreased due to APT. **CONCLUSIONS:** Our results show that APT decreases tumor progression and increases survival. Also, our results suggest that APT plays an important role in metabolic reprogramming. In conclusion, we showed that APT decreases the glycolytic pathway enzymes gene expression that is related to increased proliferation and malignancy of colon cancer.

3544 Board #365 May 29 2:30 PM - 4:00 PM
Combined Aerobic And Strength Exercise Maintains Circulating Fgf-21 In Asian Breast Cancer Patients
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PURPOSE
 Combined aerobic and resistance training improves systemic inflammation and muscle mass in breast cancer survivors. However, whether combined exercise modulates novel metabolic hormones and alarmins is unknown. FGF-21 was reported to modulate glucose metabolism in physically active adults, while IL-33, a recently discovered alarmin, is prognostic for breast cancer outcomes. This study aimed to determine the effects of 3 months of combined aerobic and strength exercise on systemic FGF-21, FGF-23, IL-33 and cytokines in Asian breast cancer patients.

METHODS
 Patients with early stage (I-II) breast cancer underwent curative breast surgery and were randomized into a combined aerobic and strength exercise group (Age: 55.3 \pm 9.2 years; BMI: 26.7 \pm 3.8; N = 23) or observation group (Age: 49.3 \pm 8.7 years; BMI: 24.7 \pm 4.6; N = 20) that spanned 3 months. Antecubital blood was collected at baseline, 3 months and 6 months. Serum concentration of cytokines (IL-10, IL-12, IL-33, IFN- γ , TNF- α) and myokines (FGF-21, FGF-23) were quantified using a customized magnetic bead panel (Milliplex®) and read with a Luminex 200™ instrument. Biomarker data were assessed by a 2-way [group (exercise vs. observation) by time (baseline, 3 months, 6 months)] analysis of variance (ANOVA). Data are reported as means \pm SD, with significance set at $P < 0.05$.

RESULTS
 A significant main effect of intervention was observed for FGF-21 ($P < 0.01$), with patients in the exercise group presenting with higher FGF-21 at 3 months (73.16 \pm 54.05 pg/mL vs. 46.47 \pm 25.33 pg/mL) and 6 months (66.67 \pm 50.03 pg/mL vs. 41.79 \pm 33.81 pg/mL), compared with the observation group. A significant main effect of exercise on IFN- γ ($P < 0.05$) was observed, with lower serum IFN- γ in the exercise group at 3 months (3.85 \pm 4.34 pg/mL vs. 5.43 \pm 7.28 pg/mL) and 6 months (3.89 \pm 4.58 pg/mL vs. 5.32 \pm 8.1 pg/mL), compared with controls. No significant differences were observed between groups in other outcome measures.

CONCLUSIONS
 A 3-month aerobic and strength exercise program preserves serum FGF-21, possibly associated with better glucose control in breast cancer patients. Lower serum IFN- γ after exercise training may suggest an attenuated pro-inflammatory response, which may be linked to better immune outcomes.

3545 Board #366 May 29 2:30 PM - 4:00 PM
Acute Inflammation And Hormonal Response To Strength Training In Breast Cancer Survivors: A Preliminary Study
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There is increasing interest in the use of strength training (ST) exercise in cancer survivors. Aside from the direct beneficial effects on muscle, ST has the potential to chronically attenuate some of the negative alterations commonly seeing in the immunological and hormonal physiology of cancer survivors. However, the acute effects of a high intensity ST session on hormonal and inflammatory responses have not been well documented. **PURPOSE:** To examine the acute hormonal and inflammatory responses of one high intensity traditional ST session in breast cancer survivors (BCS). **METHODS:** Eight BCS (47 \pm 6 years; 67.75 \pm 5.90 kg; 169.5 \pm 6.28cm)

participated in this study. BCS completed one traditional session of ST consisting of 3 sets of 10-12 repetitions to maximal concentric failure with 120 seconds of rest between sets. The exercises included: 1) leg extension, 2) deadlift, 3) leg press, 4) machine bench press, 5) latpull down, and 6) sit ups. Venous blood samples were obtained to assess biomarkers of exercise-induced inflammation (C-reactive protein), and hormonal response (Cortisol, and IGF-1). Measurements were assessed before and immediately after the ST session. Dependent samples t-tests were used to compare pre and post blood biomarkers.

RESULTS: No significant changes in C-reactive protein (pre 2.61 ± 2.78 , post 2.46 ± 2.99 mg/L, $p=0.056$), cortisol (pre 9.55 ± 3.12 , post 7.61 ± 1.90 μ g/dL, $p=0.062$), and IGF-1 (pre 150.38 ± 37.913 , post 154.88 ± 40.336 ng/mL, $p=0.125$) were observed after one session of traditional ST.

CONCLUSIONS: Although in healthy people one-time high intensity strength training has been associated with increases on different inflammatory and hormonal biomarkers, our results showed that in BCS one session of ST does not appear to significantly increase C-reactive protein, cortisol or IGF-1 concentration levels. These results may be attributed to the lower absolute force production and physiological stress during the ST session in this population. Furthermore, selective estrogen receptor modulators (SERMs), a class of drugs often used to treat certain types of breast cancer can have a suppressive effect on adrenal corticosteroid release, suggesting disrupted HPA-axis feedback inhibition processes contributing to low cortisol release during exercise.

3546 Board #367 May 29 2:30 PM - 4:00 PM

Combined HIT/HIRT Induces Beneficial Molecular Adaptations In BRCA1-mutation Carriers: A Pilot Study

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(No relevant relationships reported)

PURPOSE: BRCA gene mutation carriers have a 55-60% higher incidence to develop breast cancer than non-mutation carriers, whereas exercise is able to reduce cancer risk in BRCA competent women. Because of growing evidence that BRCA also plays a pivotal role in the regulation of skeletal muscle metabolism and the response to anti-oxidative stress, we examined the influence of regular exercise in human BRCA gene mutation carriers on BRCA1 gene/protein expression and inflammatory/oxidative response.

METHODS: 16 BRCA-mutation carriers without clinical manifestation (13 w, 3 m) were either assigned to an intervention (IG, $n=10$, 35.5 ± 10.5 yrs) or control group (CG, $n=6$, 46.3 ± 5.3 yrs). IG received a six-week long combination of high intensity (interval) strength and endurance training (HIRT/HIT), whereas CG only did low intensity activity. Before (T0) and at the end of the intervention (T1), muscle biopsy, physiological performance, blood withdrawal and anthropometry were determined. Parameters included: muscle BRCA1 gene and protein expression, inflammatory and oxidative stress (i.e. cytokine and malondialdehyde (MDA)), anti-oxidative capacity (i.e. Thiol status, C-reactive protein (CRP)), peak oxygen capacity (VO_{2peak}) and 1-repetition maximum (1-RM) at six different training machines. Data were analysed by 1-way ANOVA with repeated measures and t-test to determine statistical significance and effect size (ES).

RESULTS: VO_{2peak} ($p=0.001$) and 1-RM ($p_{mean}=0.007$) of IG were increased at T1 compared to T0, whereas CG performance parameters remained unchanged. BRCA1 protein concentration increased in IG from 46.32 ± 18.78 to 64.83 ± 22.53 pg/ml ($p<0.001$) with small ES as well as anti-oxidative capacity (CRP $p=0.05$; Thiol $p=0.009$) with medium ES, whereas gene expression was unaltered. IG inflammatory and oxidative damage reflected by cytokine and MDA formation, respectively, did not differ between time points. CG physiological and molecular parameters remained unchanged during the intervention.

CONCLUSIONS: Combined HIRT/HIT training increases the performance of BRCA-mutation carriers with positive influence on BRCA1 protein expression as well as anti-oxidative status without increased inflammatory response and thus might be a prospective prevention method to reduce long-term cancer risk.

3547 Board #368 May 29 2:30 PM - 4:00 PM

Association Between Systemic Inflammation And Skeletal Muscle Mass Following Exercise In Breast Cancer Survivors

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INTRODUCTION: Reductions in skeletal muscle mass contribute to reduced physical function and poorer prognosis among breast cancer survivors (BCS). Elevated pro-inflammatory markers stimulate catabolic pathways in skeletal muscle, and have been associated with muscle loss in overweight individuals and older adults. This evidence suggests that elevated pro-inflammatory markers such as IL-6, TNF-alpha, and C-reactive protein (CRP) may explain subsequent muscle loss in BCS. While we previously found exercise reduces inflammation and increases skeletal muscle mass in overweight or obese BCS, an associative investigation is warranted. **PURPOSE:** The purpose of this secondary analysis was to determine whether associations between post-exercise inflammatory markers and skeletal muscle mass exist among overweight/obese BCS. **METHODS:** Sedentary, overweight/obese BCS (BMI ≥ 25 kg/m²; Stages I-III) were randomized to exercise (EX; $n=50$) and control (CON; $n=50$) groups. EX participated in a supervised 16-week moderate-vigorous intensity aerobic and resistance exercise intervention. CON was asked to maintain current levels of activity. Appendicular Skeletal Muscle Index (ASMI), calculated as \sum extremity lean mass (kg)/height (m²), was obtained from a whole-body scan using Dual Energy X-Ray Absorptiometry. CRP, IL-6, and TNF- α were measured using enzyme-linked immunosorbent assays from fasting blood samples. Pearson's correlations assessed associations between post-exercise ASMI and inflammatory biomarkers. **RESULTS:** On average, BCS were 53.5 ± 10.4 years old, postmenopausal (60%), and Hispanic (55%) with a BMI of 33.5 ± 5.5 kg/m². Post-intervention, EX experienced an increase in ASMI (8.3%; $p=0.001$), and reductions in CRP (-47.8%; $p=0.001$) IL-6 (-73.6%; $p=0.001$) and TNF- α (-25.1%; $p=0.001$). No significant changes were seen in CON ($p>0.01$). There were significant correlations between ASMI and IL-6 ($r=-0.78$; $p=0.02$), CRP ($r=-0.91$; $p=0.01$), and TNF-alpha ($r=-0.82$; $p=0.03$). **CONCLUSIONS:** This secondary analysis provides preliminary evidence to support the relation between changes in skeletal muscle mass and inflammation among BCS, and supports the implementation of exercise to maintain muscle mass during survivorship.

3548 Board #369 May 29 2:30 PM - 4:00 PM

Physical Fitness As A Determinant Of Leukemia Cell Biology In Treatment-Naïve Chronic Lymphocytic Leukemia (CLL)

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PURPOSE: Chronic lymphocytic leukemia (CLL) is the most common leukemia in older adults. CLL patients are at an increased risk of frailty, secondary malignancies, and infectious diseases. The aim of this study was to determine the role of physical fitness and function on biological mediators of tumor control and progression.

METHODS: We collected blood from sixty two (68 ± 11 yrs.) men and women with treatment naïve CLL [CLL-IPI: median 1.5 (range: 0-7)] and were asked to complete a comprehensive battery of physical fitness and functional tests. The 10 most fit (FIT: estimated VO_{2peak} 34 ± 3 mL/kg/min) and 10 least fit (UNFIT: 25 ± 3 mL/kg/min) adults were matched on age and gender. We completed immunophenotyping of blood leukocytes, NMR-spectroscopy of lipoprotein particles, and sequencing of exosomal micro-RNA (miRNA). The human CLL-like OSU-CLL cell line was co-cultured with autologous plasma and assessed for cell growth and death.

RESULTS: The FIT group had 6% fewer CD4+ ($p=0.019$) and 4% fewer CD8+ ($p=0.015$) T-cells than the UNFIT group. The FIT group had 15% fewer NKG2A+ NK-cells ($p=0.032$), and 10% more cytotoxic NKG2A-/KIR+ NK-cells capable of recognizing HLA+ tumor cells. The FIT group had 63% lower concentrations of triglycerides ($p=0.025$), and 250% fewer large triglyceride rich lipoproteins ($p=0.011$), and 20% more HDL cholesterol ($p=0.04$), with no differences for LDL cholesterol. Greater concentrations of triglycerides and large lipoproteins were associated with increased OSU-CLL cell counts ($r=0.497$, $p=0.03$) and less OSU-CLL cell death ($r=-0.632$, $p=0.003$). A total of 32 miRNA signatures were significantly different between FIT and UNFIT groups (all $p<0.05$). Of these, 7 distinct miRNAs were positively

correlated with OSU-CLL tumor cell growth (e.g. miR-451a: $r=0.606$, $p<0.001$), and 6 miRNAs negatively correlated with OSU-CLL tumor cell growth (e.g. miR-24: $r=-0.669$, $p=0.002$).

CONCLUSIONS: Physical fitness in CLL patients appears to beneficially modify T-cells and NK-cells, plasma lipoproteins and exosomal miRNAs. Certain lipoproteins and miRNAs are associated with tumor cell growth and death. Further studies will hope to define the possible beneficial effects of exercise training for CLL patients.

Supported by Internal Duke Funds

G-19 Thematic Poster - Environmental Determinants of Physical Activity and Sedentary Behavior

Saturday, May 30, 2020, 9:00 AM - 11:00 AM
Room: CC-2007

3618 May 30 9:00 AM - 11:00 AM
Chair: Eric J. Shiroma. *National Institutes of Health, Bethesda, MD.*
(No relevant relationships reported)

3619 Board #1 May 30 9:00 AM - 11:00 AM
Do Environmental Factors Predict Changes To Physical Activity And Sedentary Behaviour Equally?
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Purpose

To investigate environmental determinants of change to sedentary behaviour (SB), light-intensity physical activity (LPA) and moderate-to-vigorous intensity physical activity (MVPA) in those at risk of diabetes.

Methods

Cohort of 808 adults recruited from family practice (age = 63 years, BMI = 32 kg/m², women = 36%) followed up annually over 3 years. Participants were included based on being above the 90th percentile of the Leicester Diabetes Risk Score, indicating a high risk. SB, LPA and MVPA were measured by accelerometer (Actigraph GT3X) using the Freedson cut-points with at least 4 valid days of data. Geographical and air pollution mapping were used to link environmental data to participant's home address. Data were analysed using a repeated measures design assessing determinants of change to SB, LPA and MVPA. Results are presented as mean (SD) or mean (95% CI).

Results

At baseline, accelerometers were worn for an average of 649 (83) minutes/day, during which an average of 27 (25) minutes/day, 288 (77) minutes/day and 543 (100) minutes/day were spent in MVPA, LPA and SB respectively. Across the study period, wear time did not change, whilst SB increased by 9 (7, 10) minutes/day per year, matched by a decrease in LPA and MVPA of 7 (5, 8) and 2 (1, 2) minutes/day per year respectively. Less green space, higher road connectivity (busier traffic), greater air pollution and a higher density of fast food restaurants were all determinants of increasing SB and decreasing LPA (See Table 1), but none were associated with change to MVPA. Environmental factors were stronger determinants of change to SB and LPA than an overall index of social deprivation.

Conclusion

In this high risk population, a less healthy environment predicted greater annual increases in SB and decreases in LPA, but not MVPA. Policies and interventions aimed at improving the liveable environment may therefore act to slow the trajectory of increasing SB and decreasing LPA in populations at risk of diabetes.

Table 1: Association between environmental factors and annual change to SB, LPA and MVPA

Environmental determinant	Change in sedentary time (minutes/day per year) for a given unit difference in the corresponding environmental factor	Change in light-intensity physical activity (minutes/day per year) for a given unit difference in the corresponding environmental factor	Change in moderate-to-vigorous physical activity (minutes/day per year) for a given unit difference in the corresponding environmental factor
Greenspace (% within 800m radius)	-2.34 (-4.30 to -0.38)	2.00 (0.26 to 3.74)	0.32 (-0.22 to 0.86)
Road density (km of road within 800m radius)	0.96 (-0.35 to 2.26)	-0.78 (-1.95 to 0.38)	-0.16 (-0.52 to 0.20)
Footpath density (km of footpath within 800m radius)	1.06 (-4.85 to 6.96)	-0.97 (-6.22 to 4.28)	-0.06 (-1.68 to 1.56)
Intersections that are connected (% within 800m radius)	6.41 (1.19 to 11.64)	-6.43 (-11.07 to -1.79)	-0.045 (-1.39 to 1.48)
Air pollution (prevailing outdoor nitrogen dioxide and particulate matter concentrations with 800mx 800m area: NO ₂ , PM2.5 and PM10/µg·m ³)	1.42 (0.34 to 2.50)	-1.25 (-2.20 to -0.29)	-0.16 (-0.46 to 0.14)
Fast Food (restaurants within 1km radius)	1.09 (0.38 to 1.80)	-1.00 (-1.63 to -0.47)	-0.09 (-0.28 to 0.11)
Social deprivation (index of multiple deprivation score)	0.04 (-0.09, 0.18)	-0.06 (-0.19, 0.07)	0.02 (-0.02, 0.06)

Data as mean (95% CI). Adjusted for age, sex and ethnicity. Bold indicates significance (p < 0.05)

3620 Board #2 May 30 9:00 AM - 11:00 AM
Differences In College Student Physical Activity Relative To Living Environment
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BACKGROUND: Physical activity (PA) levels are decreasing among college aged individuals in the US. To develop healthy behavior-change strategies for these individuals, a better understanding of their living environment is needed. **PURPOSE:** This study compared PA trends of college students relative to their living environment. **METHODS:** A volunteer sample of students (n = 338) from a large northeastern US university completed an online survey. Demographics, height/weight, frequency/mode of active travel to/from campus, and amount of self-reported weekly PA were obtained. Students were dichotomized into groups depending on their self-reported walking time to campus (≥15 or <15 minutes), never walk or walk ≥ once/week to campus, and if they have a bus pass or not. An equipment index was created using the participants self-reported responses to their access of multiple types of recreational facilities/equipment at their home (e.g. treadmill, pool, etc.). These groups were compared to moderate PA (MPA), strength training (ST), vigorous PA (VPA) minutes, and walking time to campus using t-tests. **RESULTS:** Participants were primarily white (n = 182, 60.3%) and majority were female (n=153, 50.5%). Students that live ≥ 15 minutes from campus had significantly lower levels of weekly MPA (p = .024), METS (p = .021), and ST (p = .002). Weekly MPA, METS, and ST (p < .05) were also significantly lower in students who did not walk to campus at least once a week. Students that had access to a bus pass showed lower amounts of MPA, METS, and ST per week (p < .05). Students who did not walk once a week to campus and those who lived ≥ 15 minutes away from campus had significantly higher accessibility to exercise equipment. **CONCLUSIONS:** There were significant differences in the amount of weekly PA for those living further from campus. Even though students showing higher

accessibility to exercise equipment live further away, they are more likely to use non-active travel methods. Active travel, especially in college students, is shown to be an important and significant variable to increase and meet weekly PA levels.

3621 Board #3 May 30 9:00 AM - 11:00 AM
Age-difference In The Association Of Built Environment With Walking In Older Adults

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PURPOSE: It remains unclear whether the relationship between built environment and walking behavior differ by age groups. Therefore, this study aimed to examine age-related differences in associations of built environmental attributes with walking in older Taiwanese adults. **METHODS:** This study was based on a cross-sectional telephone survey using a computer-assisted telephone interviewing, targeting 1,068 older Taiwanese adults (over 65 years) in 2017. Time spent in walking was measured by the short version of the International Physical Activity Questionnaire. Built environmental attributes were assessed by geographic information systems (GIS), including population density, street connectivity, sidewalk availability, leisure destinations, utilization destinations & access to public transportation. Adjusted binary logistic regression models adjusting for potential confounders were employed to examine the relationships between the seven built environment variables & walking time in total sample, and stratified for young (65-74 year) & old (75+ years) older adults. **RESULTS:** A total of 1,040 respondents provided complete information for analysis. The mean age (SD) of the respondent was 73.04 (\pm 6.13) years. 68.8% achieved 150 min of walking in a week. In total sample, only one GIS-derived environmental attribute - leisure destinations was positive associated with the 150 min of walking in a week (odds ratio (OR)=1.34, 95% confidential interval (CI)=1.02-1.75). After stratifying by age groups, among 65 to 74 age group, population density was negative associated with the 150 min of walking in a week (OR=0.65, 95%CI=0.46-0.93) and number of leisure destination was positive associated with the 150 min of walking in a week (OR=1.55, 95%CI=1.10-2.19). However, no significant associations were observed between all built environmental attributes and walking in old adults who aged over 75 year. **CONCLUSIONS:** These results showed that age could be a potential moderator between built environment and walking in older adult population. High-density neighborhoods with favorable leisure destinations can be supportive for walking among young older adults (65-74 year). However, for old older adults (over 75 years), it is critical to further explore other multi-level factors related to their walking behavior.

3622 Board #4 May 30 9:00 AM - 11:00 AM
Physical Fitness And Neighborhood Design - Walkability, Cardiorespiratory Fitness, Muscular Strength, And Flexibility In Adults

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 (No relevant relationships reported)

Regular physical activity can improve physical fitness levels and promote health. Consistent evidence suggests an association between the neighborhood built environment and physical activity exists, yet few studies have investigated the contribution of the neighborhood built environment to fitness levels in adults. **PURPOSE:** To investigate the associations between objectively-determined and self-reported neighborhood walkability and perceived cardiorespiratory fitness, muscular strength, and flexibility. **METHOD:** We recruited a random sample of 592 adults (\geq 18 years of age) from Calgary (Canada). Participants provided complete data to an online questionnaire capturing perceived cardiorespiratory fitness (CRF), muscular strength (MS), and flexibility, frequency of moderate-to-vigorous physical activity (MVPA), frequency of strength training, and sociodemographic characteristics. The questionnaire also captured participant's perceptions of their neighborhood's walkability (Physical Activity Neighborhood Environment Scale; PANES) and the physical activity supportiveness of neighborhood parks (Park Perceptions Index; PPI). Objectively-measured walkability was estimated using Walk Score® assigned to each participant's residential postal code. Covariate-adjusted linear regression estimated the associations between the built environment and perceived fitness variables. **RESULTS:** The average age of participants was 46.6 (14.8) years and 67.2% were female. Participants, on average, participated in at least 30-minutes of MVPA on 3.4 (2.1) days/week and reported strength training 2.0 (1.8) days/week. Walk Score® was not associated with any fitness variables. The PANES index was positively associated ($p < .05$) with CRF, MS, flexibility and overall fitness and the PPI was positively

associated ($p < .05$) with all fitness variables except MS. **CONCLUSION:** Our novel findings suggest the neighborhood built environment has the potential to support and promote higher fitness levels in adults.

3623 Board #5 May 30 9:00 AM - 11:00 AM
Features Of Neighborhood Parks Associated With Use And Physical Activity In Knoxville, Tn

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Visits by people to local neighborhood parks for moderate-to-vigorous physical activity (MVPA) may relate to the design of the park. The number, and condition, of facilities and amenities integrated into the park design can create a variety of potential activity zones for MVPA. **PURPOSE:** To understand how park users acquire MVPA across a variety of park features within the City of Knoxville, a mid-sized city in the Appalachian region. **METHODS:** Physical activity, both active and passive, was assessed at 12 parks equally distributed across the City of Knoxville Parks and Recreation Planning sectors. The System for Observing Play and Recreation in Communities (SOPARC) was used to directly observe activity over two weeks, a week in October 2018 and a week in March 2019. Observations covered 4 days of the week at three different time points. Across all parks, 42 scan zones were identified and categorized into 6 physical activity zones (athletic field, athletic court, playground, open space, pavilion + athletic field, and pavilion + open space). Demographic profiles of users, their observed physical activity types, and average MET-intensity across zones were calculated. SPSS (version 25) was used to contrast observations. **RESULTS:** In total, 1,548 activity zone scans observed 3,961 residents using the parks. Users were predominately male (53.8%), adult (55.2%), and white (66.5%). During the scans, 70.5% of the zones were empty. In zones with users (N=477), the most commonly observed primary activity was walking (25.1%). The activity zones with the lowest level of users were athletic fields (13.5%), open spaces (16.1%), and athletic courts (17.3%). Playgrounds (32.2%) had the highest level of use. Related to intensity, zones with moderate or above intensity levels included: athletic fields (3.9 METs), athletic courts (3.8 METs), and playgrounds (3.16 METs). **CONCLUSIONS:** Park features with the greatest potential for MVPA (athletic courts/fields) attract the fewest number of park users. As recreation and public health officials strive to attract more users who are physically active when they visit a park, they should consider other features, especially those that promote walking.

3624 Board #6 May 30 9:00 AM - 11:00 AM
Effects Of Home Environment On Physical Activities With Different Intensity In High School Students

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Except school, home is the second largest place for students to encounter their daily lives, so physical and social environment of the family can contribute either positively or negatively to lifestyle behaviors of students. **PURPOSE:** This paper will quantitatively study the effects of home environment on different physical activities (PA) of high school students. **METHODS:** We conducted the research on 314 Chinese high school students and their parents. The home environment survey includes 39 items divided into four scales (PA availability, PA accessibility, Parental role modelling of PA, Parental policies to support PA). The PA of students divided into three different intensity (Sedentary Behavior, Light intensity, Moderate and Vigorous intensity) were measured by Actigraph GT3X+ device. The data was analyzed using the multiple linear regression. **RESULTS:** A one standard deviation (SD) increase in PA accessibility, mother role modelling of PA, mother policies to support PA was associated with a reduction in SB (minutes/week) by 65.44 ($p < 0.05$), 116.87 ($p < 0.01$) and 175.42 ($p < 0.01$) respectively. A one SD increase in PA accessibility, mother policies to support PA was associated with an increase in LPA (minutes/week) by 12.65 ($p < 0.01$) and 16.91 ($p < 0.01$) respectively; an increase MVPA (minutes/week) by 81.11 ($p < 0.01$) and 52.21 ($p < 0.05$) respectively. **CONCLUSIONS:** With the development of PA accessibility, the modeling and supportive policies of mother, the SB of high school students can be reduced significantly. And the PA accessibility and supportive policies of mother can evidently improve students' LPA and MVPA.

Table 1. Characteristics of sample

	Total	Male	Female	Range
N	314	178	136	
Characteristics, mean (SD)				
Age (year)	15.70(0.62)	16.08(0.47)	15.38(0.54)	14-19
Height (cm)	165.87(7.65)	175.9(5.82)	162.18(4.13)	155-183
Weight (kg)	62.63(12.72)	70.36(13.28)	59.79(11.24)	43.4-105.1
PA, mean (SD)				
SB (min/week)	7177.55(1872.00)	7590.31(952.20)	6637.33(2533.30)	2202.83-10149.23
LPA (min/week)	338.03(215.60)	446.71(178.62)	195.79(173.16)	199.16-832.72
MVPA (min/week)	1585.24(896.22)	2071.63(760.90)	948.64(618.84)	64.13-3492.83
Home environment, mean (SD)				
Home physical environment				
PA availability	12.62(3.65)	12.88(3.63)	12.29(3.66)	4-20
PA accessibility	7.83(3.52)	9.48(2.84)	5.68(3.14)	0-15
Home social environment				
Parental role modelling of PA				
Father	15.69(5.28)	16.65(5.37)	14.45(4.89)	0-33
Mother	16.74(4.11)	17.37(4.76)	15.91(2.88)	0-29
Parental policies to support PA				
Father	22.29(6.62)	23.82(7.20)	20.29(5.15)	0-43
Mother	8.64(3.17)	9.45(3.38)	7.58(2.52)	0-17

Table 2. The relationship between home environment and different physical activity of sample

Variable	Male only		Female only		Total	
	Coefficient	95%CI	Coefficient	95%CI	Coefficient	95%CI
SB^a						
PA availability	-46.47	(-92.19, -0.75)	-62.49**	(-87.55, -37.43)	-46.95	(-87.44, -6.46)
PA accessibility	-9.32	(-14.83, -3.81)	-49.24	(-109.47, 10.99)	-65.44*	(-90.11, -40.77)
Parental role modelling of PA (father)	-44.95	(-66.85, -23.05)	-308.42*	(-570.01, -46.83)	-57.68	(-65.94, -49.42)
Parental role modelling of PA (mother)	-9.60	(-26.88, 7.68)	-317.76**	(-476.13, -159.39)	-116.87**	(-184.88, -48.86)
Parental policies to support PA (father)	-60.70*	(-81.74, -39.66)	-64.61	(-79.53, -49.69)	-4.68 ^o	(-12.81, 3.45) ^o
Parental policies to support PA (mother)	-16.63	(-25.26, -8.01)	-54.66*	(-97.08, -12.24)	-175.42**	(-236.98, -113.86)
LPA^c						
PA availability	10.41**	(1.82, 19.00)	18.39**	(10.48, 26.31)	-0.15	(-6.93, 6.63)
PA accessibility	-9.18	(-21.24, 2.88)	-10.07	(-19.62, -0.51)	12.65**	(5.28, 20.01)
Parental role modelling of PA (father)	-7.92	(-21.42, 5.58)	2.51	(-15.50, 20.53)	6.32	(-5.81, 18.45)
Parental role modelling of PA (mother)	3.55	(-5.34, 12.44)	-16.49	(-27.39, -5.58)	-6.50	(-14.12, 1.13)
Parental policies to support PA (father)						
Parental policies to support PA (mother)	4.70	(-8.20, 17.60)	12.89*	(3.63, 22.15)	16.91**	(5.53, 28.30)
MVPA						
PA availability	-34.81	(-71.42, 1.80)	70.85**	(41.83, 99.86)	4.21	(-23.03, 31.45)
PA accessibility	-0.27	(-51.622, 51.093)	-19.75	(-54.76, 15.25)	81.11**	(51.52, 110.70)
Parental role modelling of PA (father)	-37.56	(-95.06, 19.94)	31.33	(-34.70, 97.35)	23.95	(-24.80, 72.69)
Parental role modelling of PA (mother)	4.45	(-33.40, 42.30)	44.41*	(4.44, 84.39)	-24.04	(-54.67, 6.59)
Parental policies to support PA (father)	49.80*	(0.94, 98.67)	20.69	(-82.32, 40.93)	5.48	(-38.71, 49.66)
Parental policies to support PA (mother)	10.99	(-43.94, 65.93)	27.22	(-33.34, 87.78)	52.21*	(6.48, 97.93)

Notes: * p < 0.05; ** p < 0.01.

3625

Board #7

May 30 9:00 AM - 11:00 AM

Home Environment Factors Associated With Children's Physical Activity Levels In A Rural Population

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(No relevant relationships reported)

The physical and built environments are related to physical activity (PA) in adults and the relationship seems apparent in children. Child PA behavior often depends on parents in a variety of ways including involvement, facilitation, or role modeling. The home environment is one setting in which these relationships may be further examined. **PURPOSE:** To examine how facets of the home environment and parent perceptions of neighborhood safety may be associated with child total PA and moderate-to-vigorous (MVPA) levels in a rural sample.

METHODS: Baseline data were analyzed from NU-HOME, a childhood obesity prevention, randomized controlled trial in rural communities. 105 children (age=8.96±1.06 yrs) and their parents (age=37.91±5.42 yrs) reported on sociodemographics and home/neighborhood environments. Child daily PA (total and MVPA) was measured using accelerometers and, using SAS 9.4, associations were examined with home/neighborhood environment variables through multivariate regression models, both unadjusted and adjusted for economic assistance. Normality was not met for child daily MVPA therefore analyses used the log-transformed variable.

RESULTS: Mean child total PA was 259.08±58.22 min/day and MVPA was 44.95±18.58 min/day. In unadjusted analyses, access to PA equipment in the home (p=0.037) and neighborhood safety (p=0.049) were associated with total PA; however, no factors were statistically significantly associated with MVPA, although access to PA equipment (p=0.088) and family support for PA (p=0.062) were trending towards significance. For both total PA and MVPA outcomes, the regression models including all variables and accounting for economic assistance were statistically significant (p=0.026 and p=0.034, respectively). For each model, the individual effects of parent PA and PA equipment were statistically significant (p ranges from 0.008 to 0.037).

CONCLUSIONS: This study highlights the potential of the home/neighborhood environment as a space for interventions to increase PA in rural children. Only 14% of children in this rural sample met PA recommendations, so interventions to increase PA, particularly MVPA, are needed. Future studies should include multiple levels of a rural child's environment (i.e., school, town) to examine which may play the largest role in PA.

3626

Board #8

May 30 9:00 AM - 11:00 AM

Patterning Of Physical Activity And Sedentary Behavior At And Away From School In Preadolescent Children

Lexie R. Beemer, Erica Twardzik, Natalie Colabianchi, Rebecca E. Hasson, FACSMM. *University of Michigan, Ann Arbor, MI.* (Sponsor: Rebecca Hasson, FACSMM) Email: abeemer@umich.edu

(No relevant relationships reported)

BACKGROUND: Understanding *how* and *where* children accumulate their physical activity and sedentary minutes throughout the day has important implications for behavioral interventions. The purpose of this study was to examine the patterning of habitual physical activity (PA) and sedentary time (SED) at and away from school among preadolescent children. **METHODS:** Forty children ages 7-11 (55% girls; 60% non-white; 25% overweight/obese) participated in this study. Proportion of time spent in PA, moderate-to-vigorous physical activity (MVPA) bouts, proportion of time spent in SED, and SED bouts were examined on school days (in-school and out-of-school) and weekends via accelerometry. Accelerometers were worn on the right hip for one week. Data were downloaded into 60-second epochs and Evenson cut points were used to derive intensities. A MVPA bout was defined as consecutive minutes the accelerometer registered 2296 or more counts per minute, with a minimum of 5, 10, and 15 minutes or more of MVPA. A sedentary bout was defined as consecutive minutes the accelerometer registered less than 100 counts per minute, with a minimum of 30, 60, and 120 minutes or more of SED. **RESULTS:** In school days compared to weekend days, the proportion of time in vigorous PA was greater (0.9% (9.5 min.) vs. 0.6% (6.1 min.); p=0.02), but similar levels of light PA, moderate PA and SED (p's>0.05). When comparing school time with non-school time on school days, children accumulated a higher proportion of light PA [46.7% (3 hr.) vs. 33.8% (3.9 hr.), p=0.01] but similar proportions of moderate and vigorous PA (p's>0.05). There were no differences in the number of MVPA bouts accumulated in-school, out-of-school, on school days and weekends (p's>0.05). At school, the proportion of time spent in SED was less (48.8% (3.15 hr.) vs. 62.6% (7.28 hr.), p=0.01) and fewer children spent time engaged in prolonged sitting at school [uninterrupted sedentary time for 30 minutes (67.5% vs. 92.5%, p=0.006), 60 minutes (22.5% vs. 80.0%, p<0.001), and 120 minutes (7.5% vs. 42.4%, p<0.001)]. **CONCLUSIONS:** These findings suggest children are

the most active and least sedentary when at school, yet children only accumulated 17.5 minutes of MVPA in this environment. Thus, in-school and out-of-school interventions are needed to help children meet the daily recommended minutes of PA.

G-20 Thematic Poster - Physical Activity and Health Equity

Saturday, May 30, 2020, 9:00 AM - 11:00 AM
Room: CC-2009

3627 May 30 9:00 AM - 11:00 AM

Chair: Michelle Martin, FACSM. *University of Tennessee, Memphis, TN.*

(No relevant relationships reported)

3628 Board #1 May 30 9:00 AM - 11:00 AM

Influence Of Social Networks On Nutrition And Physical Function Of Ethnic Older Minorities Over Time

Evans A. Asamane, Carolyn A. Greig, Janice L. Thompson, FACSM. *University of Birmingham, Birmingham, United Kingdom.* (Sponsor: Janice L. Thompson, FACSM)
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(No relevant relationships reported)

BACKGROUND: Social networks (SN) are consistently shown to influence health outcomes in later life. However, relatively little is known about SN of ethnic older minorities, and how they impact on health outcomes over time. **PURPOSE:** To explore SN and their impact on nutritional intake and status, and physical function in ethnic older minorities (≥ 60 years) living in Birmingham, United Kingdom. **METHODS:** SN were assessed using the Wenger Practitioner Assessment of Network Types (PANT). Multiple-pass 24-hour dietary recalls and the Mini Nutritional Assessment-Short Form assessed nutritional intake and status, respectively. Short Physical Performance Battery (SPPB) and handgrip strength measured physical function. Correlation and regression analyses examined relationships between SN, physical function, nutrient intake and nutritional status. The influences of SN were captured through semi-structured interviews at baseline (N=92) and follow-up (N=81). Interviews were transcribed verbatim and analysed using directed content analysis. **RESULTS:** Of the 100 participants measured at baseline, 81 were followed up 8-months later. Mean age = 70.9 \pm 8.1 years (62% male) comprising African/Caribbean (65%), South Asian (28%), and other ethnicities (7%). Five SN were identified and grouped into two broad categories: integrated SN (locally integrated (44%) and wider community (8%)); and non-integrated SN (family dependent (25%), locally self-contained (17%), and private restricted (6%). At follow-up, SN declined in 19% and improved in 11%. There was an overall decrease in physical function (F(1))=9.73, P=0.03) and nutritional status (F(1))=6.04, P=0.016) over time. Participants in integrated SN compared with non-integrated SN at baseline were less likely to experience a decline in physical function at follow-up (OR: 0.17; 95% CI:0.04-0.63). Qualitative results indicate that participants with declines in SN perceived this as causing poorer physical function and eating behaviours. **CONCLUSION:** Changes in SN occurred over a relatively brief period in this sample, with integrated SN associated with better physical function, nutritional intake and status. These findings can inform interventions and community outreach programmes designed to enhance SN and the health status of this population.

3629 Board #2 May 30 9:00 AM - 11:00 AM

Acculturation And Leisure-time Physical Activity Among Asian American In The United States, 2011-2016

Xuanxuan Zhu, Jihong Liu, Maria Sevoyan, Russ R. Pate, FACSM. *University Of South Carolina, Columbia, SC.* (Sponsor: Russell R. Pate, FACSM)

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(No relevant relationships reported)

The Asian population has become the fastest growing ethnic group in the United States (US). However, less than a quarter of Asian Americans met WHO Physical Activity (PA) Guideline. Few studies have examined the association between acculturation and leisure-time PA among Asian Americans.

PURPOSE: To examine the association between acculturation and leisure-time PA among Asian American adults.

METHODS: Data concerning 1,989 Asian Americans aged 20 years and older, came from the 2011-2016 National Health and Nutrition Examination Survey (NHANES). Acculturation was assessed in three dimensions: the language preference at home (only Non-English language, both English and Non-English language, and only English), length of residency in the US (<10 years, 10-29 years, ≥ 30 years, US born), and

birth locations (US-born, foreign-born). Using self-reported minutes/day and days/week moderate and vigorous leisure-time PA, we calculated moderate-to-vigorous PA (MVPA) MET minutes/week. MVPA was analyzed as a continuous variable and a categorical variable (i.e., meeting WHO PA guidelines, ≥ 600 MET minutes/week) in multiple linear and logistic regression models after controlling for covariates, respectively.

RESULTS: Among participants, 24.5% of Asian Americans spoke only English at home, while 47.8% spoke only non-English at home. 13.0% of participants were born in the US. The odds of meeting PA guidelines were higher among Asians speaking only English (adjusted OR [AOR]=1.8, 95% confidence interval [CI]: 1.4, 2.4) and those speaking both non-English and English at home (AOR=1.6, 95% CI: 1.3, 2.0), compared to those who spoke only non-English at home. US-born Asians were more likely to meet PA guidelines than foreign-born Asians (AOR=1.8, 95% CI: 1.3, 2.6) and on average they performed 137 more minutes of leisure-time MVPA each week than foreign-born Asians. Asians in the US since birth had higher odds to meet PA guidelines than Asians stayed in US for less than 10 years (AOR=2.2, 95% CI: 1.5, 3.3).

CONCLUSIONS: More acculturated Asian Americans such as those who spoke more English at home and US-born Asians, perform more leisure-time MVPA than less acculturated Asian Americans. Interventions are needed to promote PA among non-English speaking Asian immigrants and those who stayed in the US for less than 10 years.

3630 Board #3 May 30 9:00 AM - 11:00 AM

Developing Smart Goals With Latinos To Address Their Life Concerns Surrounding Physical Activity And Recreation

Sharon E. Taverno Ross, Maria del Rosario Christophersen, Patricia I. Documet. *University of Pittsburgh, Pittsburgh, PA.* (Sponsor: Andrea Kriska, FACSM)

(No relevant relationships reported)

PURPOSE: Raices was a community health worker (promotore)-delivered intervention offering non-directive social support to improve healthcare access, physical activity, and healthy eating among Latinos living in an emerging community, an area with a small yet growing Latino population. The purpose of this study was to determine whether the intervention helped participants develop SMART (i.e., specific, measurable, realistic, attainable and time-bound) goals that addressed their life concerns, specifically highlighting those findings related to physical activity. **METHODS:** Promotores used an intervention tool assessing wellness in eight domains of participants' lives (e.g., family, physical activity/recreation) and supported participants in developing SMART goals to address their life concerns. The research team summarized participants' data and assessed whether the goals 1) met SMART criteria and 2) focused on participants' identified concerns. **RESULTS:** We recruited 192 Latino participants from South America (42%), Mexico (30%) Central America (11%) and other countries (10%). Participants ranked physical activity and recreation (18.2%) and eating habits (17.8%) as top areas that were concerning or very concerning. Overall, participants developed 195 goals after the first intervention visit. Most goals met the SMART criteria completely (35.4%) or partially (48.7). Of the 195 goals set, 30% of them focused on physical activity/recreation, and 91% of those goals met the SMART criteria completely or partially.

CONCLUSIONS: Promotores successfully elicited participant life concerns and assisted them in setting SMART goals to address these areas of concern, including a top concern of physical activity/recreation. The intervention would benefit from additional promotores training in developing SMART goals.

3631 Board #4 May 30 9:00 AM - 11:00 AM

Aging Effects Of A 12-month Period On Cardiometabolic Risks In Older Adults

Kivana Keane¹, Alexis Sides¹, Austin Anderson¹, Malli Fowler¹, Sarah Gingerich¹, Shannon Hinson¹, Adam Lavis¹, Jessica Martin¹, Benjamin Patterson¹, Colleen Pecoraro¹, Tommy Scott¹, L. Jerome Brandon, FACSM², Trudy Moore-Harrison¹. ¹UNC-Charlotte, Charlotte, NC. ²Georgia State University, Atlanta, GA. (Sponsor: L. Jerome Brandon, FACSM)
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(No relevant relationships reported)

PURPOSE: Aging is characterized by decreased functional ability and increased cardiometabolic (CMO) risks. Being physically active is believed to slow these diminishing characteristics in older adults. Therefore, the purpose of this study was to determine if CMO values would decline following a 12-month period in active older adults.

METHODS: The participants were 148 active older adults from the metropolitan area of a southern city. Activity ranged from participating in structured fitness classes

to participating in limited physical activity. Overall, the community was active. The participants were measured for CMO risks and morphological characteristics initially and 12 months later and two tests were statistically evaluated for differences.
RESULTS: The participants were obese based on body fat% (40%) and overweight based on body mass index (BMI - 29.1). Triglyceride (Trig- 150 mg/dL) on the posttest and systolic blood pressure (137 mmHg) on the pretest were the only variables that met risk classification based on metabolic syndrome risk criteria. High density lipoproteins (59 to 62 mg/dL) improved on the posttest. Generally, there was a trend toward improvement for the other CMO variables. The percent different (%diff) between the variables for the two tests ranges from 0 for DBP to 13.6% for Trig. Trig had the largest %diff, but also had the largest variability between assessments and therefore, was not significant.
CONCLUSIONS: Data suggest that CMO variables remained stable in a physically active community of older adults during a 12-month period. Efforts should be made to keep older adults active as they age.

3632 Board #5 May 30 9:00 AM - 11:00 AM
Bmi Influence On Quality Of Life Following Physical Activity Program For Women In Homeless Shelters
 Lori A. Thomas. *Lebanon Valley College, Annville, PA.*
(No relevant relationships reported)

BMI Influence On Quality Of Life following Physical Activity Program For Women In Homeless Shelters
 Lori A. Thomas, Jenna M. Marx, McKenna Lupold, Abigail Kinneman, Hayley McGlory, Tonya Y. Miller.
 Lebanon Valley College, Annville, PA.
PURPOSE: Examine if BMI category was associated with the outcomes of a 4-week physical activity educational program on the quality of life and physical fitness of nine women who were homeless and residing in urban environment shelters. **METHODS:** The educational program, Be Active Your Way, intervention incorporated educational sessions one time a week for four weeks led by student investigators. Researchers measured the programs' effectiveness with pre- and post- program assessment using the Healthy Days Core Module, Two Minute Walk Test (2MWT), Perceived Stress Scale (PSS), and the Acceptance and Action Questionnaire (AAQ-II). **RESULTS:** Women who were overweight and residing in homeless shelters showed a trend on the AAQ-II in the decreased number of days their health affected activity, but the trend was not significant (pre=7.6 days, post=4 days); $p > .05$. Women who were Class II obese residing in homeless shelters showed a decreased trend in their psychological inflexibility score, but the trend was not significant (pre=29.5, post =20.5); $p > .05$. There were no significant statistics or other noticeable trends among BMI classification data in relation to PSS or 2MWT. **CONCLUSION:** Findings from this study showed that BMI category did not contribute significantly to health-related quality of life outcomes following a physical activity program among women residing in a homeless shelter. Women residing in a homeless shelter may find an educational physical activity program beneficial, regardless of BMI category.

3633 Board #6 May 30 9:00 AM - 11:00 AM
IDENTIFYING DISPARITIES IN YOUTH HEALTHCARE ACCESS POST-SPORT RELATED CONCUSSION AND POST CONCUSSION SYNDROME
 Jeanette Faith Green. *University of Florida Health, Gainesville, FL.*
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(No relevant relationships reported)

Disparities in healthcare may occur when availability, accessibility, and quality of healthcare services differ. These factors influence health, resulting in differences in morbidity and mortality. Among injuries, concussion and post-concussion syndrome may lead to significant long-term impairments in up to 40% of youth, with a greater number of impairments seen in minority populations. During recruitment for a previous study, lack of population diversity prompted an exploration of our patient population. **PURPOSE:** The purpose of the study was to explore differences in race, ethnicity, and sex among youth and young adults who sought care for concussion or post-concussion symptoms within a large academic medical center to determine whether differences exist among sub-groups.
METHODS: Utilizing an Integrated Data Repository, i2b2, a query was performed to determine the number of individuals ages 10 to 34 years of age who sought care for concussion or PCS between 9/2015 and 6/2019 within a large academic health system. Over 3,270 youth, adolescents, and young adults (YAYA) sought healthcare and received a concussion or PCS diagnosis.
RESULTS: Among recipients of concussion care, there were 2, 226 (68%) non-Hispanic White, 720 (22%) African American/Black (AA/B), and 224 (.07%) Other. Post-Concussion Syndrome diagnoses among 1,143 YAYA of whom 796 (70%)

Caucasian, 210 (18%) AA/B, 17 (2 %) Biracial, and 103 (9%) Other. While males had more overall concussion diagnoses (n=1339, 60%), females had higher incidence of PCS (n=646, 56.5%).
CONCLUSIONS: Comparison of these results with community demographic data reveals AA/B and Hispanic YAYA seeking concussion care may be underserved within the trauma system. Additionally, higher incidence of female PCS deserves further exploration to ascertain whether individual, initial management, or delays in connecting with the healthcare system may be factors in persistent symptomatology post-TBI. Additional research is needed to ascertain health system factors that may address and reduce future disparities in TBI care delivery and patient outcomes, including geocoding to ascertain the impact of YAYA residence and proximity to the trauma center.

3634 Board #7 May 30 9:00 AM - 11:00 AM
Kids Fun, Food & Fitness: The Need For An Exercise And Nutrition Program For Children With ASD
 M Alysia Mastrangelo, FACSM¹, Mary Kientz², Joan Perks², Gabriele Bandelli¹, Carly Burnup², Kristin Cavorley², Emily Disbrow², Emily Sorochynskyj². ¹*Stockton University, Shamong, NJ.* ²*Stockton University, Galloway, NJ.*
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(No relevant relationships reported)

PURPOSE: Nationally, 1 in 59 children are diagnosed with an autism spectrum disorder (ASD) with NJ having the highest rates at 1 in 34 children. Children with ASD are more likely to experience health disparities that can impact quality of life. The disparities include an increase in type II diabetes, issues with food sensitivities, sensory processing impairments, and a decrease in time spent in moderate to vigorous physical activity (PA). The purpose of this study is to assess the need for a community/family-based exercise and nutrition literacy program for children ages 8-15 y.o. with an ASD.
METHODS: Participants (n=9) with an ASD diagnosis, ages 8-15 y.o. were assessed prior to initiation of the Kids: Exercise, Food and Fun program. The assessment included anthropometric measures, grip strength, plank, Stork test bilaterally, sit and reach and 6-minute walk. This study was approved by the Institutional Review Board for Human Subject at Stockton University.
RESULTS: At baseline the mean age of participants was 12.1 y.o. with 6 boys and 3 girls. The average weight was 55.1 Kg, and height was 149.4 cm. BMI was determined and subjects were categorized by CDC classification; n=3, healthy, n=1, overweight and n=5, obese. Waist circumference measures determined the majority (n=5) were at or above the 80th percentile for risk. Mean fitness measures are as follows; right grip strength =12.8 Kg, Stork test, right =12.80 sec and left =10.09 sec, plank =10.31 sec and sit and reach =22.44 cm. The mean distance for the 6MW was 366.19m.
CONCLUSIONS: These results indicate most participants were overweight or obese with an expected increased risk for comorbidities at baseline. Study participants demonstrated decreased grip strength, upper body strength and standing balance. They could benefit from an exercise and nutrition program with a parent or caregiver. The aim of the study will be to improve access to fitness activities and healthy food options. Sessions will consist of age appropriate PA and a cooking/nutrition class where participants will learn basic nutrition principles, food safety, and prepare a food to consume themselves. Post-assessment will evaluate body composition and fitness measures.

3635 Board #8 May 30 9:00 AM - 11:00 AM
Are Physical Therapists' Attitudes About Disability A Predictor Of Their Attitudes About Client-self-directed-mobility?
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Physical therapists (PTs) are expected to play a key role in supporting individuals with disabilities to lead independent, active, and healthy lifestyles. However, limited knowledge exists about dispositional factors that could influence PTs' motivation to provide healthcare that: (1) assist clients to overcome acute barriers to independent living and (2) supports clients to lead active, healthy lifestyles across the lifespan. **PURPOSE:** This study determined if PTs' attitudes about disability predicted their attitudes about client-self-directed mobility (i.e. independent mobility). **METHODS:** A convenience sample of 308 pediatric PTs were recruited from workshops held across 11 U.S. states between 2016 and 2017. Topics covered in the workshops included promoting and teaching ways to modify ride-on cars for young children with disabilities. Prior to their participation in the workshops, study participants completed two questionnaires: (1) the Attitudes Toward People with Disabilities Scale (ATDP; Cronbach $\alpha = .80$); and (2) the Attitudes Towards Self-Directed Mobility Scale

(ATSDM; Cronbach $\alpha = .72$). The lower the score on the ATDP, the more favorable the attitude. The higher the score on the ATSDM, the more favorable the attitude. Simple linear regression was used to test if ATDP scores predicted ATSDM scores. **RESULTS:** The ATDP M score was 2.4 ($\pm .45$), and the ATSDM M score was 4.4 ($\pm .42$). ATDP scores were a significant predictor of ATSDM scores ($\beta = -.12, p < .05$), but ATDP scores explained a minimal amount of variance in ATSDM scores, $R^2 = 0.016, F(1,306) = 4.938, p < .027$. **CONCLUSION:** PTs' attitudes about people with disabilities was a weak predictor of their attitudes about client-self-directed-mobility. Further, the ratio between the two attitudes was not one-to-one, suggesting context is an influential factor. The observed results could have been due to the self-beliefs participants held towards disability because of their occupational status as PTs and how they viewed disability (e.g., social model of disability). Future research is needed aimed at incorporating a broader range of predictors of attitudes about client-self-directed-mobility. Such work would add insight into PTs' dispositional factors that could influence the quality and type of healthcare that they provide to individuals with disabilities.

G-21 Thematic Poster - Physical Activity Children and Youth

Saturday, May 30, 2020, 9:00 AM - 11:00 AM
Room: CC-2010

3636 Chair: Tao Zhang. *University of North Texas, Denton, TX.*
(No relevant relationships reported)

3637 Board #1 May 30 9:00 AM - 11:00 AM
Evaluating Extension-supported Implementation Of A Classroom-based Physical Activity Program In Under-resourced Schools

Thomas Packebush, Katherine B. Gunter, FACSM, Tammy Winfield. *Oregon State University, Corvallis, OR.*
(No relevant relationships reported)

PURPOSE: Regular exposure to physical education (PE) increases children's physical activity, but access is not equitable, particularly in under-resourced schools. Oregon recently passed legislation requiring public elementary schools to provide PE for ≥ 150 minutes per week. BE Physically Active 2Day (BEPA 2.0) is a K-5 classroom-based physical activity program aligned to PE standards, developed to help under-resourced schools reach the mandated PE minutes. We evaluated BEPA 2.0 implementation among teachers in schools receiving BEPA 2.0 trainings. **METHODS:** County-based Cooperative Extension faculty were trained to deliver BEPA 2.0 teacher trainings. Trainings were conducted in 33 schools in fall 2018 and winter 2019 and 433 teachers attended trainings. Three to six months post-training, a brief survey assessing implementation factors was distributed to all teachers at trained schools. Descriptive and chi-square analyses were conducted to evaluate BEPA 2.0 use, and the relationship of training to use. **RESULTS:** A total of 212 teachers from 11 Oregon counties provided survey responses (49% response rate). Overall, 92.4% of teachers reported using BEPA 2.0, most commonly to provide classroom activity breaks (88.8%) and meet PE minute requirements (44.9%). Forty-four percent of teachers chose BEPA 2.0 for its alignment to state PE standards. Most teachers (74.2%) implement 1-2 times per week, with extra support from trainers (e.g., email prompts, booster trainings) reported among 66.9% of users. More trained (82.8%) versus untrained teachers (53.3%) reported using BEPA 2.0 ($p=0.006$). **CONCLUSIONS:** Results indicate a high rate of BEPA 2.0 use, particularly among trained teachers. This suggests training is an important component of the implementation process. Increasing trainings and support for teachers may increase frequency of use.

3638 Board #2 May 30 9:00 AM - 11:00 AM
Aggregated Impact Of Locally Implemented SNAP-Ed Programming On Physical Activity In Michigan Youth

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(No relevant relationships reported)

Equity in physical activity engagement is a critical issue. Supplemental Nutrition Assistance Program Education (SNAP-Ed) reaches low-income youth, with physical activity as one of the key foci. In Michigan, SNAP-Ed includes locally relevant programs selected and implemented by community organizations. Consistent evaluation is conducted across programs. **PURPOSE:** To evaluate state-level change in physical activity and sedentary behaviors of Michigan youth who receive locally relevant SNAP-Ed programming selected and implemented by community-based

organizations. **METHODS:** Participants were youth (grades 4th-8th) receiving SNAP-Ed programming that included evidence-based interventions with a physical activity component. Youth received a physical activity questionnaire pre- and post-intervention. Participant data were matched based on demographic indicators, and data were aggregated at the state-level. Descriptive statistics were calculated for all variables of interest, and Wilcoxon Signed Rank tests were used to compare differences pre- and post-intervention for physical activity and sedentary behaviors (i.e. weekday hours spent watching TV). **RESULTS:** Participants included 1,899 youth (grades 4th-8th) from SNAP-Ed programming delivered through 15 different community organizations across Michigan. The majority of participants were Caucasian (65.0%) and non-Hispanic (86.5%), and approximately one-half were male (49.9%). A statistically significant increase was found for the number of days that youth self-reported being physically active for at least 60 minutes pre- and post-intervention (pre: 4.18 ± 2.13 ; post: 4.43 ± 2.05 ; $p < 0.000$), and a statistically significant decrease was found for the number of hours youth reported watching TV on a weekday pre- and post-intervention (pre: 1.76 ± 1.55 ; post: 1.66 ± 1.49 ; $p = 0.012$). **CONCLUSIONS:** Implementation of locally relevant SNAP-Ed programming selected by community organizations can positively impact physical activity and sedentary behaviors. Future research should explore commonalities amongst locally relevant programs to identify key implementation characteristics for greatest impact and progress toward equity.

3639 Board #3 May 30 9:00 AM - 11:00 AM
Investigation On The Prevalence Of Scoliosis In Primary And Secondary School Students In Changzhou

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Purpose: With the increase of academic pressure, students spend more time in sedentary behaviour. Long-term wrong sitting posture will bring many health problems. To investigate the prevalence of scoliosis among primary and secondary school students in Changzhou City.

Methods: From May to July 2019, we measured the spine index of 10229 students (age: 10-13 years) from 7 primary and 3 middle schools in Changzhou City, including 5437 boys and 4708 girls, 84 of whom did not participate in the screening, and 10145 of whom were effectively screened. We screen scoliosis in three steps: 1: with examine back exposed and standing naturally, the examiner check if the shoulders are equal in height; whether lower scapular horn, bilateral lumbar fovea is symmetrical; whether bilateral ilium ridge is equal; the above has an anomaly positive, can be defined as posture abnormality. 2: positive result of first test, carry out Adam test, if Adam bending test has the above signs, measure the back with the spine, the maximum oblique part and angle of spine, if the deviation is more than 5 degrees, it is suspected scoliosis, if it is greater than 10 degrees, it can be defined as scoliosis. If the Adam bending test has the above signs, the spine is measured by the ruler. 3: the patients with suspected scoliosis were diagnosed as scoliosis by radiologist to take the full-length orthopedic radiography of the upright spine and measure the Cobb angle $\geq 10^\circ$.

Results: In first step, 4585 cases of abnormal posture, the incidence of bad posture was about 45.2%, the detection rate of high and low shoulders among the students was 35.2%, the detection rate of boys was 28.5%. The detection rate of female students was 38.8%. The incidence of pelvic rotation was 15.1% in boys and 17.9% in girls, and the incidence of lateral flexion in neck was 4% in boys and 9% in girls. The detection rate of scoliosis was 24.3%. Finally, some students carried out the third inspection, and the consistency between the third inspection and the second inspection reached 98%.

Conclusion: Through screening, it was found that the detection rate of abnormal posture was high. Therefore, the establishment of spine health records will help them pay attention to spine health. Supported by Social Science Foundation of Jiangsu Province (BE2018752), Science and Technology Support Plan of Changzhou (CE20195046).

3640 Board #4 May 30 9:00 AM - 11:00 AM
Physical Activity Contributions From An Outdoor Education Pre-kindergarten Program

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Traditional educational practices may contribute to the overall decline in physical activity (PA) and increases in sedentary behaviors (SB) that have been documented as children age. Beginning early in children's elementary education, unstructured activities, such as free play and outdoor time, are often replaced by activities that are more structured, teacher-led, indoors, and desk-based. Incorporating more outdoor

learning opportunities into traditional educational practices may improve children's PA profile. **Purpose:** The primary purpose of this study was to compare differences in Pre-Kindergarten children's PA and SB between a nature-based or traditional classroom setting. **Methods:** 26 children from one Pre-K program enrolled in this study. Data was collected using waist-mounted accelerometers worn for 8 days (2h45min/day) across two separate weeks in the winter and spring. During each four-day week, participants spent two days in a traditional classroom setting, and two days in a nature-based setting. Accelerometer data was analyzed using Butte (2013) cutpoints. One-tailed paired t-tests were used to detect significant differences ($p < 0.05$) in PA and SB between settings. **Results:** In a nature-based setting, significantly more time was spent in moderate- to vigorous-intensity PA during Unstructured (Diff: $8.0 \pm 9.9\%$ of Wear Time [WT]; $p < 0.001$) and Structured time (Diff: $1.4 \pm 2.9\%$ WT; $p = 0.011$). Significantly less time was spent in SB during Unstructured (Diff: $-3.1 \pm 7.1\%$ WT; $p = 0.017$) and Structured time ($-2.5 \pm 6.1\%$ WT; $p = 0.023$) in a nature-based setting. Significantly more time was spent outside (Diff: 35min; $p < 0.001$) in a nature-based setting, however significantly less time (Diff: -2.9 ± 3.0 min; $p < 0.001$) was allocated to Unstructured free play. There were no significant differences in the amount of time participants spent in Structured time (Diff: 1.4 ± 7.9 min; $p = 0.375$) between class settings. **Conclusion:** Children engaged in significantly more PA and less SB while learning outdoors compared with indoor learning, despite less time being allocated to free play. Modifying educational practices to include outdoor education has the potential to increase the quantity of in-school PA children accumulate while simultaneously reducing SB.

3641 Board #5 May 30 9:00 AM - 11:00 AM
Comparative Discrimination Of Obesity By Muscular And Cardiorespiratory Fitness: A Receiver Operating Characteristics Curve Analysis.

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 (No relevant relationships reported)

PURPOSE: Muscular and cardiorespiratory fitness are associated with adiposity and cardiovascular disease risk in youth. The degree to which these measures discriminate obesity is not lucid. This study investigated muscular and cardiorespiratory fitness capacities to discriminate obesity. **METHODS:** Participants (N = 210; 116 males) (9.7 ± 1.08 years; 138.6 ± 9.4 cm; 42.3 ± 14.4 kg) (84% Hispanic/Latino) muscular and cardiorespiratory fitness were assessed using the 20-meter Progressive Aerobic Cardiovascular Endurance Run (PACER) and 90° push-up test, respectively, per FITNESSGRAM® protocols. Weight status was classified using CDC Growth Charts. Non-obesity was coded as "0" and obesity was coded as "1." A Receiver Operating Characteristics (ROC) curve analysis was performed to identify the True Positive Rate (TPR) (i.e., Sensitivity) and False Positive Rate (FPR) (i.e., 1 - Specificity) using SPSS. The area under the curve (AUC) indicated the degree to which each fitness measure distinguishes between the presence and absence of obesity. The measurement threshold with the greatest TPR-FPR distance was considered optimally discriminative. Statistical significance was set at $P < .05$. **RESULTS:** Of the sample, 43% had obesity and 55% did not. PACER was fairly discriminative of obesity in girls (AUC = .748; $P = .000$; 95% CI [.651, .845]) and boys (AUC = .755; $P = .000$; 95% CI [.665, .845]). 90° push-up was fairly discriminative in girls (AUC = .732; $P = .000$; 95% CI [.632, .831]) and boys (AUC = .789; $P = .000$; 95% CI [.703, .876]). PACER thresholds of 8 and 8 laps were optimally discriminative in girls (TPR = .714, FPRs = .352) and boys (TPR = .635, FPRs = .190), respectively. 90° push-up thresholds of 7 and 5 repetitions were optimally discriminative in girls (TPR = .714, FPRs = .333) and boys (TPR = .692, FPRs = .175), respectively. **CONCLUSIONS:** Based on the probability of classifying individuals with and without obesity as having obesity (i.e., TPRs and FPRs, respectively), PACER and 90° push-up appear similarly discriminative of obesity. Notably, the optimal PACER threshold to discriminate obesity was considerably lower than cut-off scores (23 for boys and 15 for girls) for HFZ classification in the same age group. Cardiorespiratory-related disease risk may persist in subpopulations of Hispanic/Latino youth without obesity.

3642 Board #6 May 30 9:00 AM - 11:00 AM
Impact Of Schoolyard Green Space And Hardscape Design On Play Behaviors Of Urban Children

Elena Daniel, Nkese Jack, Marcella Raney. *Occidental College, Los Angeles, CA.*
 (No relevant relationships reported)

Previous studies have shown that large-scale schoolyard greening projects increase physical activity (PA) participation. However, the relative impact of nature access and schoolyard design on free play behaviors is unknown. **PURPOSE:** To determine how green space and specific schoolyard design features impact individual and population-level PA and social behaviors during recess. **METHODS:** Recess behaviors were recorded with the validated SOPLAY and SOCARP observation tools for one week at four urban Title I elementary schools (N = 2051): 1) 1.5% green space, 10

zones; 2) 0% green space, 8 zones; 28% green space, 10 zones; 4) 50% green space, 8 zones. Data was analyzed with linear mixed models and Pearson correlation at a significance value of 0.05. **RESULTS:** Sedentary levels were higher for older students at locations with fewer play areas regardless of green space square footage (1st-3rd grade: $49.5 \pm 2.9\%$; 4th-6th grade: $59.7 \pm 3.1\%$) and lower for younger students in green compared to asphalt schoolyards (52.8 ± 1.8 vs. $47.4 \pm 1.7\%$) ($p < 0.01$). More students were engaged in moderate-to-vigorous physical activity (MVPA) while playing tag ($71.2 \pm 4.1\%$) or gymnastics/climbing/jumping/dance ($58.1 \pm 3.3\%$) in green space and on play structures compared to traditional playground games (e.g. handball, 4-square, tetherball) on asphalt ($45.6 \pm 1.7\%$) ($p < 0.001$). Students spent more time in small groups (10.8 ± 0.7 vs. 9.3 ± 0.4 min, $p < 0.05$) and in vigorous PA in green space vs. hardscape (2.3 ± 0.2 vs. 1.1 ± 0.1 min, $p < 0.05$). Small group activity was positively correlated with the frequency of prosocial interactions ($r = .158$, $p < 0.001$). In asphalt schoolyards, students spent more time vigorous when more play options were available (2.1 ± 0.2 vs. 1.3 ± 0.1 min, $p < 0.05$). Although active minutes were similar between sexes in areas with trees, logs, and woodchips (girls: 4.8 ± 0.4 ; boys: 5.4 ± 0.7 min, $p > 0.05$), boys spent more time active in both hardscape (girls: 3.6 ± 0.2 vs. 4.9 ± 0.2 min) and green space (girls: 5.0 ± 0.8 ; boys: 6.9 ± 0.8 min) areas designed for sport ($p < 0.05$). **CONCLUSION:** Schoolyards that increase access to nature, provide diverse sport and non-sport play options, and present motor skill challenges optimize MVPA participation and positive peer interactions for both sexes and all age-groups in urban low-income elementary schools.

3643 Board #7 May 30 9:00 AM - 11:00 AM
Relationship Between Physical Activity Among Preschool Children And Their Parents

Keisuke Koizumi. *Chiba University, Chiba-city, Japan.*
 (No relevant relationships reported)

PURPOSE: The lack of physical activity among children is a global issue that requires attention. It has been suggested that a relationship exists between the lifestyles of children at an early age and that of parents. We quantified physical activity relationships among preschool children and their fathers and mothers.

METHODS: Forty-seven children (kindergarten level: aged 6.11 ± 0.267 years) and their parents (fathers: aged 43.1 ± 4.83 years, mothers: aged 41.1 ± 4.29 years) participated in this study. Each participant wore an activity tracker on the waist during waking hours to measure step counts and time of moderate-to-vigorous physical activity (MVPA). The data were divided into work/school day and day off and evaluated accordingly. Partial correlation coefficient was used to evaluate the physical activity relationships between children and fathers or mothers.

RESULTS: For the work/school days, there was a significant positive correlation of step count between children and mothers (children: $15,800 \pm 2,560$ steps; mothers: $9,450 \pm 2,590$ steps, $r = 0.322$, $p < 0.05$) and a nonsignificant correlation between children and fathers ($8,820 \pm 2,990$ steps, $r = 0.249$). For the days off, there was a significant positive correlation of step counts between children and fathers (children: $11,700 \pm 3,520$ steps, fathers: $8,190 \pm 2,790$ steps, $r = 0.473$, $p < 0.01$) but no significant correlation between children and mothers ($10,000 \pm 2,530$ steps, $r = 0.096$). There was a significant positive correlation in MVPA time for days off between children and fathers (children: 74.5 ± 25.9 min, fathers: 51.0 ± 22.5 min, $r = 0.487$, $p < 0.01$) but no significant correlation between children and mothers (55.9 ± 16.9 min, $r = 0.075$). There were no significant correlations in MVPA time for work/school days between children and fathers (children: 97.5 ± 23.8 min, fathers: 59.8 ± 18.3 min, $r = 0.503$) and between children and mothers (56.9 ± 13.7 min, $r = 0.131$).

CONCLUSIONS: These findings suggest that the children may have spent time with their mothers on work/school days, and with their fathers on days off. Thus, an increase in fathers' physical activities may lead to a corresponding increase in the physical activities of some children with modern Japanese lifestyles.

3644 Board #8 May 30 9:00 AM - 11:00 AM
Effects Of Four-day School Weeks On Physical Education Exposure And Childhood Obesity

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Schools are critical venues to support child health and wellbeing. One mechanism to influence these outcomes is via school-based physical activity, but substantial declines in funding have forced many school districts to consider cost-cutting measures that may impact physical activity exposure and related outcomes. Use of four-day school weeks (FDSWs) as a potential cost-saving strategy has increased substantially, particularly in rural areas, which contain ~90% of FDSW districts. However, evidence regarding impacts of FDSWs on child health and related factors is lacking. **PURPOSE:** To examine physical education (PE) exposure and childhood obesity prevalence in four- and five-day Oregon schools. We hypothesized lower PE exposure and higher obesity in four- versus five-day models given reduced school

environment exposure. **METHODS:** We linked longitudinal FDSW data to existing data that included 1) school-level PE exposure for all Oregon elementary schools in 2011-2012 and 2017-2018 (n=1296 and 1243 schools, respectively) and 2) child-level body mass index z-scores from a state representative sample of 1st-3rd graders (n=4,625 children, 2011-2012). Instructional time, enrollment, demographics, and pupil-teacher ratio also were examined. T-tests compared mean school-level factors between four- and five-day schools overall and in rural schools only; complex samples weighted t-tests clustered at the school-level compared mean obesity data across school models. **RESULTS:** Enrollment, instructional time, and pupil-teacher ratio were significantly lower in four- versus five-day schools. FDSW schools provided significantly more PE, both as an absolute measure (120 vs. 101 minutes/week in four- vs. five-day schools in 2017-2018, p<0.01) and relative to total instructional time (6.9% vs. 5.0% in four- vs. five-day schools, p<0.0001). There were no differences in obesity prevalence between school models. **CONCLUSIONS:** The increased PE exposure in FDSW schools was unexpected, but it is unknown if this increase was related to a lack of difference in obesity prevalence. Given the known health and educational disparities experienced in rural communities, it is critical to better understand how FDSW use impacts physical activity, obesity risk, and other related factors for children in rural schools.

G-22 Thematic Poster - Running Technique Interventions

Saturday, May 30, 2020, 9:00 AM - 11:00 AM
Room: CC-2011

3645 Chair: Irene S. Davis, FACSM. *Harvard Medical School Spaulding-Cambridge, Cambridge, MA.*
(No relevant relationships reported)

3646 Board #1 May 30 9:00 AM - 11:00 AM
The Effect Of Backward Running On Patellar Tendon Loading

Naghmeh Gheidi, Thomas W. Kernozek, FACSM, Alexis Mehr, Lauren Strommen, Carolyn Apfelbach. *UWL, La-Crosse, WI.*
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Patellar tendinopathy is experienced in nearly 5% of distance runners during their career. Backward running (BR) has been recommended as a good rehabilitation exercise for patellofemoral pain patients as an intermediate progression from walking to forward running (FR). However, no studies have compared how BR affect patellar tendon stress.

Purpose: Identify differences in patellar tendon (PT) stress during FR (heel strike pattern) and BR. **Methods:** Twenty healthy male runners (Age: 21 ± 6.9 years, Height: 1.8±0.6 m, Mass: 76.2±14.1 kg, weekly running distance: 22.3±7.6 km) participated in this study. Each performed 5 trials of over-ground FR (heel strike pattern) and BR with a running velocity of 2.8-3.4 m/s based on photoelectric timing. Kinematic data were collected at 180 Hz using a 15-camera motion capture system. Ground reaction forces (GRF) were collected at 1800 Hz using a force platform. The Newton- Euler inverse dynamics method was used to calculate the net knee joint moment. The average moment arm of each quadriceps muscles were determined using Graphics-Based Model. The net knee moment was then divided by this knee moment arm to determine quadriceps force. PT force was determined from summing quadriceps muscles forces (rectus femoris, vastus lateralis, medialis, and intermedius muscle). Static ultrasound imaging was performed for measuring PT cross sectional area (CSA). PT stress was estimated by dividing PT force by PT CSA. MANOVA with repeated measures, was performed to compare PT stress, PT force, vertical GRF, knee ROM, and knee moment in FR and BR. **Results:** There were differences between FR and BR for all variables, except for GRF (p<0.001). Knee moment (154.7 vs. 205.1 Nm), PT stress (47.42 vs. 60.06 MPa) and PT force (4335 vs. 5497 N) in BR were around 21-24% less than FR. In addition, knee joint (20.84 vs. 37.72 deg) exhibited near 45% less range of motion during BR. **Conclusion:** Larger knee ROM coupled with the larger knee moment occur during FR. This may be required to stabilize the tibia during stance phase placing a greater stress on the patellar tendon.

BR results in lower PT stress when compared to FR. The lower PT stress as well as higher coordination variability may make BR more suitable for rehabilitation in patients with patellar tendinopathy as a progression exercise to FR due to its lower PT stress.

3647 Board #2 May 30 9:00 AM - 11:00 AM
Influence Of Running Speed On Muscle Activity During Backward Running With Body Weight Support

Kenji Masumoto¹, John A. Mercer, FACSM². ¹*Kyushu University, Fukuoka, Japan.* ²*University of Nevada, Las Vegas, NV.* (Sponsor: Professor John A. Mercer, FACSM)
(No relevant relationships reported)

A change in running speed influences gait mechanics of running. **PURPOSE:** The purpose of this study was to investigate the influence of a change in running speed on muscle activity during forward and backward running at different body weight support (BWS) conditions. **METHODS:** Eleven participants (29.7 ± 12.3 years) ran forward and backward on a lower body positive pressure treadmill at 0%BWS, 20%BWS, and 50%BWS conditions. The running speed conditions consisted of forward and backward running at preferred speed (PS), PS+10%, and PS-10%. Muscle activity from the rectus femoris, biceps femoris, tibialis anterior, and gastrocnemius and stride frequency were measured. Muscle activity and stride frequency were analyzed using a 2 (running direction) x 3 (BWS) x 3 (running speed) repeated measures analysis of variance ($\alpha = 0.05$). **RESULTS:** Muscle activity from the rectus femoris (P<0.01) and gastrocnemius (P<0.01) were significantly different between running speeds. For example, muscle activity from the rectus femoris (P<0.05) and gastrocnemius (P<0.05) during running at PS were significantly greater than when running at PS-10%, regardless of running direction and BWS. Furthermore, muscle activity from the rectus femoris (P<0.01) and gastrocnemius (P<0.05) during running at PS+10% were significantly greater than when running at PS, regardless of running direction and BWS. Stride frequency was influenced by the interaction of running direction and running speed (P<0.05). Using the pairwise comparisons, stride frequency during running at PS was significantly higher than that of running at PS-10% only when running forward and backward at 0%BWS (e.g., 84.5 strides/min and 82.0 strides/min for backward running at PS and PS-10% conditions, respectively; P<0.05). Furthermore, stride frequency during running at PS+10% was significantly higher than that of running at PS during forward and backward running at 0%BWS (P<0.05). **CONCLUSIONS:** Muscle activity from the rectus femoris and gastrocnemius during running may increase with increasing running speed, regardless of BWS and running direction. However, unique biomechanical strategies for the increased muscle activity from the lower extremity may exist for running with BWS.

3648 Board #3 May 30 9:00 AM - 11:00 AM
The Effect Of Synchronous And Asynchronous Music On Treadmill Running Performance Of Recreational Athletes

Dimitrios Katsavelis, Isaac Burright, Megan Quast, Megan Ackerman, Erika Piper, Brooke Farmer, Terry Grindstaff. *Creighton University, Omaha, NE.*
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(No relevant relationships reported)

Background: Running with synchronous music tempo is associated with positive physiological and psychological effects that improve running performance as expressed by time to exhaustion. Changes in the music tempo may increase physiological efficiency (slow tempo) or improve motivation and mood (fast tempo), but there is no conclusive evidence whether asynchronous music tempo can influence distance covered or time to exhaustion. **Purpose:** To investigate the effect of different music tempo on running performance, force and cadence profiles of recreational athletes. **Methods:** Six college students (age = 21.2± 3yr; weight = 75.4± 12kg; height = 179.5± 10cm) participated in the study. The participants were tested five times over a period of three weeks. During the first visit, lactate threshold speed (LTS) was assessed via blood samples. During the second visit participants run at 5% above their LTS (3.5±0.4m/s) with no auditory stimuli until exhaustion. During the last three visits participants were randomly assigned to run on an instrumented treadmill in three different tempo conditions until exhaustion: slow, matched and fast. Time to exhaustion, vertical ground reaction forces (vGRF) and cadence were calculated through Matlab. **Results:** A one-way repeated ANOVA (4 conditions) showed that there was a main effect of music, with the no music condition resulting in a decrease in time to exhaustion by 18-21% when compared to all the music conditions, but no significant differences among the 3 music conditions. The vGRF during running at slow tempo (2.58 BW) were significantly lower when compared to fast tempo (2.62 BW), whereas there was an increase in cadence between slow (167 steps/min) and fast (170 steps/min) tempo conditions. **Conclusion:** The findings indicate that music – in general – has a positive effect on running performance, while asynchronous tempi can only cause significant but subtle changes (less than 2%) in the force and cadence profiles.

3649 Board #4 May 30 9:00 AM - 11:00 AM

Effects Of Lower Limb Light-weight Wearable Resistance On Running Biomechanics

Aglaja Busch¹, Karl Trounson², Peter Browne², Sam Robertson².
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 (No relevant relationships reported)

Resistance training is important to maintain an athlete's health and regain strength after injury. Light-weight wearable resistance allows loading in the context of sport specific movements and can lead to specific strength adaptations benefiting the athlete. However, limited knowledge of the associated biomechanical changes with such a training modality exists.

Purpose: To determine biomechanical changes during running with lower limb light-weight wearable resistance.

Methods: Fourteen healthy participants volunteered for the study (age: 28±4 years; height: 180±8 cm; body mass (BM): 77±6 kg). Participants wore shorts and calf sleeves allowing attachment of light loads and performed 4 x 2 mins 20-m over-ground shuttle running bouts at 3.3 m*s⁻¹, alternating by 3 mins rest. The first running bout was unloaded and the other three bouts under randomised loaded conditions. The loaded conditions consisted of 1 %, 3 % and 5 % additional loading of the BM. Loads were distribution on the legs with 2/3 on the thigh and 1/3 on the shank. Two force plates embedded in the floor at the 10-m mark of the runway recorded peak vertical ground reaction forces (vGRF) and ground contact time (GCT). Recorded kinetic data was filtered using a low-pass Butterworth filter at frequency 120 Hz and normalised to body weight. A repeated measures ANOVA ($\alpha \leq 0.05$) was used to determine differences between conditions and Cohens *d* was calculated with effect sizes defined as small ($d = 0.2$), medium ($d = 0.5$) and strong ($d = 0.8$).

Results: Peak vGRF decreased (-0.5 %) with additional loading of 1% BM ($d = 0.17$, $p = 1$) and slightly increased (+1.1 %) with 3% BM loading ($d = 0.13$, $p = 0.91$) compared to unloaded condition. Higher peak vGRF (+1.4 %) was also found during 5 % BM loading ($d = 0.19$, $p = 1$). Ground contact time showed no significant differences ($0.13 \leq d \leq 0.20$, $0.4 \leq p \leq 1$) between all conditions and only a slightly increased with 5 % BM loading (+1 %).

Conclusion: Small changes in peak vGRF and GCT during loaded running occurred. Maintaining targeted speed and running economically might result from kinematic adaptations, needing further evaluation. Additionally, examination of acute neuromuscular alterations, hypothesised by increased muscular output before gait pattern changes develop, are necessary for appropriate use of light-weight wearable resistance.

3650 Board #5 May 30 9:00 AM - 11:00 AM

An Investigation Into The Feasibility Of A Split-belt Instrumented Treadmill Running Protocol With Perturbations.

Andrew Quarmby, Mina Khajooei, Tilman Engel, Hannes Kaplick, Frank Mayer. University of Potsdam, Potsdam, Germany.
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 (No relevant relationships reported)

Unexpected disturbances to human gait can occur during daily life or sports performance. Compensating successfully for such disturbances or perturbations is crucial in maintaining effective postural control and avoiding potentially injurious events. Studies of perturbed walking protocols using instrumented treadmills have previously been validated, however the validation of and responses to perturbed running protocols remain less investigated. **PURPOSE:** To investigate the feasibility of a new instrumented treadmill-perturbed running protocol. **METHODS:** Fifteen participants (28±3years; 172±9cm; 69±10kg; 60% female) completed an 8-minute running protocol at a baseline velocity of 2.5m/s (9 km/h), whilst 15 one-sided belt perturbations were implemented (*pre-set perturbation characteristics: 150ms delay (post-heel contact); 2.0m/s amplitude; 100ms duration*). Perturbation characteristics and sEMG responses (right leg: gastrocnemius medialis (GM), tibialis anterior (TA), peroneus longus (PL), biceps femoris (BF), vastus medialis (VM); trunk bilateral: rectus abdominus (RA), erector spinae L3 (ES); Root Mean Square (RMS) normalized to unperturbed walking) were recorded. Bland-Altman analysis (BLA) was employed (bias±limits of agreement (LOA; bias±1.96*SD)) and intra-individual variability of repeated perturbations was assessed via Coefficients of Variation (CV) (mean±SD). **RESULTS:** On average, 9.4±2.2 of 15 intended perturbations were identifiable. Perturbation delay was 143±10ms, amplitude was 1.7±0.2m/s and duration was 69±10ms. BLA showed -7±13ms delay, -0.3±0.1m/s amplitude and -30±10ms duration. CV showed variability of 19±4.5% for delay, 58±12% for amplitude and 30±7% for duration. sEMG RMS amplitudes were 113±25% (GM), 225±73% (TA), 139±68% (PL), 134±34% (BF), 200±168% (VM), 332±305% (RRight), 324±162% (RAleft), 220±130% (ESright), 183 ± 122% (ESleft). **CONCLUSION:** This study showed that the application of sudden perturbations during running can be achieved, though with increased variability across individual perturbations. The perturbations

with the above characteristics elicited a detectable neuromuscular response during running, especially in the muscles of the trunk and anterior leg. Responses in the calf muscles were minimal.

3651 Board #6 May 30 9:00 AM - 11:00 AM

The Effect Of Verbal Cues On Lower Extremity Kinetics During Running

Allison Lieb¹, Quinn Garner¹, Nicholas Reynolds¹, Jennifer Bagwell², Terry Grindstaff¹. ¹Creighton University, Omaha, NE. ²California State University, Long Beach, Long Beach, CA.
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 (No relevant relationships reported)

Previous research indicates that verbal cues such as "push with your feet" can alter ankle and hip kinetics during walking. Clinicians often use cues such as "push with your hips" when working with runners, but the effect of such verbal cues on lower extremity kinetics during running remains poorly understood. **PURPOSE:** The purpose of this study was to determine the effect of verbal cues emphasizing use of hips and glutes or use of toes and ankles on lower extremity running kinetics.

METHODS: Ten healthy subjects (age 23±1 years, mass 67±16 kg, height 168±11 cm) participated. Subjects performed 3 running trials, at a self-selected pace, on an instrumented treadmill while collecting kinematics and kinetics. First, a baseline running gait was established, then each subject was given the instruction to "push yourself forward with your hips and glutes" or "push yourself forward with your toes and ankles" in a randomized order. After 1 minute to adapt to each condition, 30 seconds of data were recorded. Variables of interest included peak sagittal hip, knee, and ankle moments and positive, negative, and total sagittal work at the hip, knee, and ankle. One-way repeated measures ANOVAs were used to assess kinetic changes across conditions.

RESULTS: There was a significant main effect of running cue with respect to negative and total work at the ankle ($p=0.031$ and $p=0.002$). Post-hoc analyses indicated that ankle negative work was greater when running with the ankle cue compared to baseline running (-0.44 ± 0.17 J/kg vs -0.38 ± 0.14 J/kg; $p=0.031$) and ankle total work was greater when running with the ankle cue compared with baseline and hip cue running ($p=0.019$ - 0.008). There were no significant differences in any of the other lower extremity sagittal moments or work across tasks ($p>0.05$).

CONCLUSIONS: Subjects demonstrated increased negative and total work at the ankle in response to the ankle running cue. There was no change in positive work, which was anticipated with a cue emphasizing forward propulsion. Running kinetics remained largely unchanged in response to either running cue, possibly due to the quality of the cue (i.e. internal rather than external focus). These data suggest telling clients to "use your hip more to run" may not be an effective method to change running mechanics.

3652 Board #7 May 30 9:00 AM - 11:00 AM

Influence Of A Novel Music App On Spatiotemporal Mechanics During Running

Danielle Mannino, Matthew F. Moran. Sacred Heart University, Bridgeport, CT.
 (No relevant relationships reported)

An increased running step rate (i.e., cadence) can decrease lower extremity joint loads and potentially reduce running-related injury (RRI) risk. Many gait interventions have significantly increased a runner's cadence through a variety of external stimuli (e.g., metronome). Runners have been shown to spontaneously manipulate their cadence when listening to music with a tempo that differed ±3% from their baseline cadence. However, no study has determined whether a runner will subconsciously increase cadence > 3% when listening to up-tempo music. **PURPOSE:** To determine if music tempo (beats per minute, bpm) set 10% higher than baseline cadence affects spatiotemporal running mechanics. **METHODS:** Utilizing a blinded experimental design, twenty-two runners (15F, 7M, 18-40 yo) were recruited, granted informed consent, were randomly assigned to a control (C) or experimental (E) group, and picked four motivational songs. The Brunel Music Rating Inventory was used to rate song motivational level. Subjects ran three 5-min trials (5/10 effort) on a pressure-sensitive treadmill (Noraxon U.S.A., 100 Hz) with vertical ground reaction force and pressure recorded during the last 45 sec and lowpass filtered (40 Hz). Five-min of rest was given between trials. During the second trial, subjects listened to music via headphones with the bpm set to baseline cadence (C) or 10% higher (E). Music was administered via a novel smartphone application that permitted song tempo to be adjusted and maintained in one bpm increments. The last trial was completed without music with velocity held constant across all trials. A mixed design analysis of variance was run in JASP with a significance set a priori at 0.05. **RESULTS:** Baseline cadence was not significantly different between groups (C: 165.4±9.5 steps per minute, E 167.2±6.8, $p=0.61$). There was not a significant main effect ($p=0.54$, $p=0.32$, $p=0.152$, $p=0.70$) of music tempo between groups for cadence (F (1,20)=0.39), step width (F(1,20)=1.02), stance phase (F (1,20)=2.22), or foot rotation (F(1,20)=0.16).

CONCLUSION: Spatiotemporal running mechanics do not spontaneously adjust when runners listen to motivational music set at a tempo 10% greater than baseline cadence. Listening to up-tempo music should not be considered an effective external stimulus to promote increased running cadence.

3653 Board #8 May 30 9:00 AM - 11:00 AM
Lower Extremity Joint Work Following A Long Hilly Run In Conventional And Maximalist Shoes

Christopher Casillas, James Becker. *Montana State University, Bozeman, MT.*

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(No relevant relationships reported)

Trail running is a rapidly growing discipline which often contains uphill and downhill running segments. The varying elevation requires different muscular demands than level ground running and thus may influence how joint kinetics change following a long run. Many trail runners use highly cushioned maximalist (MAX) footwear. However, the influence of MAX footwear on joint kinetics following a long run is currently unknown. **PURPOSE:** To determine if there are differences in joint work following a long hilly run (LHR) in conventional (CON) and MAX footwear. **METHODS:** Twelve trail runners (sex: 10 M, 2 F; weekly mileage: 30.3 ± 14.9 miles) were randomly assigned to either a CON or MAX shoe and ran a 10-mile LHR which matched the elevation profile of a popular local trail run. 3D kinematics and ground reaction forces were collected during five-minute level ground running sections prior to and following the LHR. Sagittal plane positive (POS) and negative (NEG) joint work for the hip, knee, and ankle were calculated by integrating the POS and NEG portions of the joint power curves. Two-way mixed ANOVAs (shoe condition, time) were used to evaluate differences in joint work. **RESULTS:** There were no differences between groups in any joint work parameter before the LHR (Figure 1). Following the LHR, POS ($p = 0.014$) and NEG knee ($p = 0.041$) and NEG hip ($p = 0.014$) work increased in the MAX group. Compare to the CON group, the MAX group also had higher NEG knee work ($p = 0.009$) and was trending towards higher POS knee ($p = 0.072$). No differences were observed in ankle work or positive hip work. **CONCLUSION:** Proximal redistribution of joint work following a LHR was observed, but not to the extent reported in previous studies using level runs. However, the increased knee work in MAX footwear suggests the knee is being loaded more during a LHR compared to CON footwear. This may have implications for injury risk as higher knee loads are related to common running injuries.

Footwear provided by New Balance, Inc.

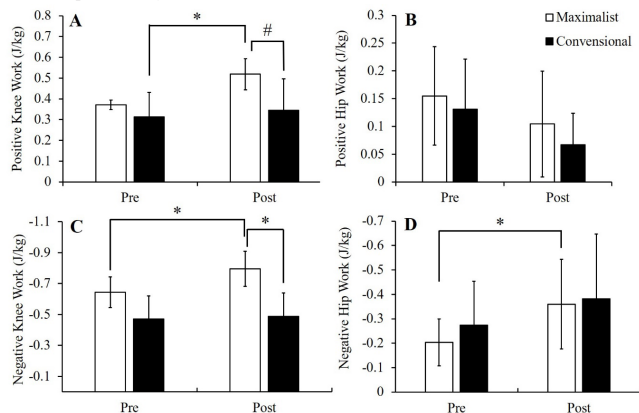


Figure 1: Mean and standard deviations for positive knee (A) and hip (B) joint work and negative knee (C) and hip (D) joint work prior to and following the LHR for the MAX and CON groups. * denotes statistically significant difference. # denotes data trending towards a statistical difference.

G-23 Clinical Case Slide - Medical Issues III

Saturday, May 30, 2020, 9:00 AM - 11:00 AM

Room: CC-2005

3654 Chair: Dennis Khalili-Borna, FACSM. *Kaiser Permanente, Chino Hills, CA.*

(No relevant relationships reported)

3655 Discussant: Sandy Hoffmann, FACSM. *Idaho State University, Hilton Head, SC.*

(No relevant relationships reported)

3656 Discussant: Nailah Coleman, FACSM. *Children's National Medical Center, Washington, DC.*

(No relevant relationships reported)

3657 May 30 9:00 AM - 9:20 AM
Abstract Withdrawn

3658 May 30 9:20 AM - 9:40 AM
Nutritional Intervention In A Male Olympic Swimmer: Adequation Of Carbohydrate Intake Based On Metabolic Profile

Humberto Nicastro¹, Victor Hugo Rosa de Oliveira¹, Claudia Czapski², Gerson Leite¹, José Alves Balestrin¹, Leonardo Prieto¹, Felipe Domingues³, Gustavo Schirru³, Luciana Setaro², Gustavo Magliocca¹. ¹CareClub Health Center, São Paulo, Brazil. ²Centro Universitário São Camilo, São Paulo, Brazil. ³Confederação Brasileira de Desportos Aquáticos, São Paulo, Brazil.

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(No relevant relationships reported)

HISTORY: Male Olympic swimmer (100 m breaststroke; 32 y, 96.0 kg, 185 cm) with recurrent hypoglycemia and -related symptoms (hand sweating, blurred vision) at rest and during training and expressive weight loss on training days.

PHYSICAL EXAMINATION: Subject underwent DEXA (body composition), pre and post training blood glucose measurements and indirect calorimetry.

DIFFERENTIAL DIAGNOSIS:

1. Hypoglycemia at rest and during training sessions;
2. Body fat percentage: 14,9%;
3. Low fat oxidation at rest (45% of basal metabolic rate).

TEST AND RESULTS: Basal metabolic rate was of 2.360 kcal with glycolytic predominance (55% of total energy expenditure), confirming that energy metabolism is highly dependent of carbohydrate intake. At the beginning and end of the week, morning weight was 96.0 and 93.0 kg, respectively. Blood glucose pre-exercise was 84.0 mg/dl and 60 mg/dl post-exercise.

FINAL WORKING DIAGNOSIS: Training-induced severe hypoglycemia and expressive weight loss across the week. It was hypothesized that such events occur since in response of the elevated activity of glycolytic pathway and consumes and consumption of high glycemic index supplements during training.

TREATMENT AND OUTCOMES:

1. We focused on nutritional intervention based on high calorie intake and substitution of high by low glycemic foods and supplements throughout the day;
2. Additionally, we recommended beta-alanine supplementation (4 x 1.6 g) to prevent metabolic acidosis;
3. After 2 weeks of intervention, no symptoms of hypoglycemia were reported at rest and during training sessions;
4. Weight loss was attenuated (- 1.6 kg) and blood glucose values did not decrease after training (pre: 80 mg/dl; post: 125 mg/dl).

3659 May 30 9:40 AM - 10:00 AM

You Only Get One Bite Out Of This Apple

Jonathan R. Guin, Thomas J. Bollaert, James B. Robinson.

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(No relevant relationships reported)

HISTORY: A 21-year-old collegiate tight end sustained anterior neck trauma from his chin strap during a regular season game. During the first quarter, the athlete was struck in his anterior neck by an opponent's face mask. The patient felt throat pain and states it felt like his "Adam's Apple is to the right". He then went back into the game because he noted the pain was only mild, and he was otherwise asymptomatic. The athlete was able to continue playing until the early part of the third quarter of the game. At that time, he was evaluated by the team physician and held from the rest of the game. He was then sent to the emergency department for further evaluation and imaging.

PHYSICAL EXAMINATION: Examination on the sideline revealed a click upon palpation of the anterior neck near the thyroid cartilage. He had full ROM of his cervical spine with a normal neurological exam. He had no respiratory distress, subcutaneous crepitus, or voice changes. He did have some pain with swallowing. Hyoid bone and cricoid cartilage is non-tender. Cardiac and pulmonary exams were also unremarkable. Exam was stable when repeated in emergency department.

DIFFERENTIAL DIAGNOSIS: Fracture of Thyroid Cartilage Fracture of Hyoid Bone Contusion of Neck Carotid Artery Dissection

TEST AND RESULTS: CT Neck with Contrast Minimally displaced fracture involving the anterior right thyroid cartilage. The left thyroid cartilage has a concave appearance suggestive of a depressed nondisplaced cartilage fracture. The larynx is angulated to the right.

Nasolaryngeal scope True vocal cords were freely mobile. Airway is patent. Subglottis is normal without any hematoma or edema. Both true vocal cords are with some mild discoloration and edema, but no frank hemorrhage or hematoma within either vocal cord.

FINAL WORKING DIAGNOSIS: Fracture of Thyroid Cartilage

TREATMENT AND OUTCOMES:

1. Evaluated in emergency department where CT scan was performed that found a fracture of the thyroid cartilage 2. Nasolaryngeal scope done in ED by ENT 3. Admitted and stayed overnight in ICU because of risk for respiratory compromise 4. IV steroids given while in ICU to prevent any further edema 5. Evaluated at tertiary care facility day after discharge by ENT 6. Determined need for surgical repair 7. Athlete currently recovering with anticipated healing time of 4-6 weeks

3660 May 30 10:00 AM - 10:20 AM

Ovarian Torsion Presenting As Referred Cyclical Hip Pain In A Division I AthleteEmily D. Geyer¹, Christina L. Charles², Rachel Denison³, Bridget M. Geyer⁴, James A. Onate¹. ¹Ohio State University, Columbus, OH. ²Columbus Obstetricians-Gynecologists, Inc., Columbus, OH. ³University of Notre Dame, Notre Dame, IN. ⁴Duke University School of Medicine, Durham, NC.

Email: emily.geyer@osumc.edu

*(No relevant relationships reported)***HISTORY**

A 22-year-old female Division I rower presented to the emergency department (ED) due to severe right lower quadrant pain with nausea and vomiting. She had a three-year history of right hip pain diagnosed as femoroacetabular impingement (FAI) and infrequent flares of worsened hip pain treated with rest and intra-articular cortisone injections or oral steroid dose-pack. During ED visit, abdominal computerized tomography (CT) and transvaginal ultrasound (TVUS) revealed significantly enlarged right ovary diagnosed as ovarian cyst. She was discharged and was seen by OB/GYN that afternoon for follow up.

PHYSICAL EXAMINATION

Patient presented to the office in moderate distress due to unabated right lower quadrant (RLQ) pain. Abdomen was soft and tender throughout. Physical exam was otherwise unremarkable.

DIFFERENTIAL DIAGNOSIS

Prior to imaging:

1. Musculoskeletal: fracture, FAI, osteoarthritis, nerve compression, bursitis
2. Genitourinary: urinary tract infection, pyelonephritis, nephrolithiasis
3. Gastrointestinal: Irritable Bowel Syndrome, constipation, appendicitis
4. Gynecologic: ovarian cyst, ovarian torsion, pelvic inflammatory disease, tubo-ovarian abscess

TESTS AND RESULTS

TVUS revealed 7 cm edematous right ovary with 2 small follicles and no large cyst. There was very minimal to no Doppler flow. Blood work revealed elevated white blood cell (WBC) count.

FINAL/WORKING DIAGNOSIS

Suspected diagnosis of right ovarian torsion

TREATMENT AND OUTCOMES

1. Patient was admitted to the hospital for mini-laparotomy and right oophorectomy.
2. Right ovary torsed 5 times and appeared normal other than being significantly enlarged to 7-8 cm
3. Given that there was no cyst to be drained, the right ovary was removed.
4. The right fallopian tube, left ovary and fallopian tube, and uterus were all normal.
5. The patient tolerated the procedure well and has since experienced only mild hip pain consistent with FAI.
6. It is likely the patient's flares of pain over the previous 3 years were ovarian in etiology but disguised due to her irregular menstrual cycle and coincident chronic FAI. Ovarian etiology should be included in the differential for female athletes experiencing surges of lower quarter abdominal pain in a setting of hip pain.

3661 May 30 10:20 AM - 10:40 AM

Ehlers-Danlos Syndrome And CD5 Deficiency In A 22 Year-old MaleThomas Lowder, Courtney Holloway. *UNIVERSITY OF Central Arkansas, Conway, AR.*

Email: tlowder@uca.edu

(No relevant relationships reported)

HISTORY: A previously-active male presented with joint pain at age 15. He is positive for joint hypermobility and dislocation/subluxation, joint pain, food allergies, gastritis, gastroesophageal reflux, and CD5 immune deficiency (diagnosed at age 5, one of eight in the world at the time). He has a family history of aortic aneurysm.

PHYSICAL EXAMINATION: The patient exhibited joint pain and extreme hypermobility on examination. Genetic tests were performed on the patient, his mother, and his sister.

DIFFERENTIAL DIAGNOSIS: While there exists a family history of hypermobility, along with orthostatic hypotension in this patient (consistent with Ehlers-Danlos Syndrome, or EDS) the patient also exhibits CD5 immune deficiency, psychogenic seizures, a likely pathogenic variant in the AK2 gene (c.656delT), associated with reticular dysgenesis. His sister also carries this variant. He also carries the variant associated with cystic fibrosis, the congenital bilateral absence of the vas deferens, and chronic pancreatitis.

TEST AND RESULTS: We are presently working with this patient to determine if a moderate-intensity exercise program yields a decrease in joint pain, hypermobility, and downregulation of gene expression.

FINAL WORKING DIAGNOSIS: This is a work-in-progress of a patient with two rare diseases and a variety of genetic issues., which to our knowledge have never been exhibited in a single patient.

TREATMENT AND OUTCOMES: We will present working data and determine if an exercise intervention has a positive impact in this patient.

3662 May 30 10:40 AM - 11:00 AM

Left Flank Injury - SoccerJiao Xue. *Pomona Valley Hospital Medical Center, Pomona, CA.*

Email: jiao.xue.md@gmail.com

(No relevant relationships reported)

HISTORY: A 17-year-old senior high school soccer player sustained an elbow strike from opposing player to his left flank while practicing. Later that night, he experienced excruciating pain which led him coming to ED the following day. He was discharged despite elevated blood pressure (BP). 4 weeks later, he saw his primary care doctor who noted elevated BP in addition to flank pain, and patient was recommended to go to ED after concerning ultrasound findings. **PHYSICAL EXAMINATION:** On initial presentation to ED, patient's BP was 152/96. Examination revealed visible distension in the left abdomen. Palpable mass was appreciated in the same region while lying down. Tenderness to palpation to the left abdomen and left costovertebral angle were noted.

DIFFERENTIAL DIAGNOSIS: Left kidney hematoma v.s. muscular hematoma v.s. kidney contusion v.s. renal arteriovenous malformation v.s. ruptured spleen v.s. kidney mass

TEST AND RESULTS: CT Abdomen & Pelvis W/O Contrast revealed a 12 cm left perinephric hematoma with significant mass effect on the left kidney. Otherwise, CBC and BMP were unremarkable.

FINAL WORKING DIAGNOSIS: L subcapsular renal hematoma secondary to trauma

TREATMENT AND OUTCOMES: IR placed a pigtail drain with 1L output on the 1st day. BP was treated with amlodipine 2.5mg and Hydralazine 5mg PRN. Patient was discharged on the 4th day. On the day of discharge, patient's drain fell out accidentally during a school dance. An Trauma surgeon evaluated him in an outpatient setting. No additional imaging was done given he was asymptomatic. A few weeks later, he developed abdominal/back pain as well as headaches. He presented to Children's Hospital with hypertension to 170s/110s. Ultrasound showed 11cm left subcapsular hematoma with significant compression of left kidney. IR placed another drain which was eventually removed after 3.5 weeks. Prior to discharge, BP improved to 130s/70s

without medications. After discharge, patient was followed by a Pediatric Urologist with monthly imaging. 10 months later, he still had a small 0.5cm hematoma. Patient continues to have mildly elevated BP of unclear etiology. He was evaluated by a Pediatric Cardiologist, and echo did not show evidence of heart disease (LVH). He has not played soccer since the injury.

G-24 Clinical Case Slide - Thigh and Leg II

Saturday, May 30, 2020, 9:00 AM - 10:40 AM

Room: CC-2022

3663 Chair: Mary Lloyd Ireland, FACSM. *UK Healthcare Sports Medicine, Lexington, KY.*

(No relevant relationships reported)

3664 Discussant: Melody Hrubes. *Rothman Orthopaedics, New York, NY.*

(No relevant relationships reported)

3665 Discussant: Anastasia Noel Fischer, FACSM. *Nationwide Children's Hospital, Columbus, OH.*

(No relevant relationships reported)

3666 May 30 9:00 AM - 9:20 AM
Calf And Foot Injury- Crossfit

Jeff Nadwodny, Ahmad Al-Awadi, Michael Stiller, George Pujalte, FACSM. *Mayo Clinic School of Graduate Medical Education, Jacksonville, FL.* (Sponsor: George G.A Pujalte, FACSM)

Email: Jeffrey.Nadwodny@mayo.edu

(No relevant relationships reported)

HISTORY: A 51-year-old female presented with three-year worsening left lower leg and foot pain. No injury at time of onset but was active with CrossFit five times weekly. Pain began on bottom of forefoot with radiation through the sole of foot to posterior calf and popliteal fossa. Pain described as 7-8/10 in intensity, constant, sharp/stabbing in nature, with burning sensation on the bottom of foot. Associated with weakness of the left ankle, foot drop requiring patient to wear an ankle-foot orthotic, swelling, and color changes with her foot turning blue/red intermittently. Pain was unrelieved with oral NSAIDs, steroids, and only temporary relief with topical anti-inflammatory gel, heat/ice, deep tissue massage, and dry-needling with physical therapy.

PHYSICAL EXAMINATION: Examination revealed skin color changes with blue discoloration of left foot that was cool to touch. Tender to palpation maximally over left gastrocnemius muscle, Achilles tendon, sole and ball of foot; 0/5 strength with left ankle dorsiflexion/plantar flexion, ankle inversion/eversion or great toe extension. Sensation intact to light touch in L2-S2 dermatomes. Reflexes normal and symmetric bilaterally.

DIFFERENTIAL DIAGNOSIS:

1. Peripheral nerve damage secondary to entrapment/compression
2. Vascular insufficiency
3. Complex regional pain syndrome

TEST AND RESULTS:

MRI without IV contrast of left tibia/fibula, foot, ankle:

- Mild intramuscular edema within gastrocnemius and soleus, focal fatty atrophy adjacent to medial soleus muscle. Generalized subcutaneous edema throughout ankle. EMG:

- No evidence of left lumbosacral radiculopathy, left lower limb mononeuropathy, or large fiber peripheral neuropathy

US lower extremity Veins:

- No DVT in left lower extremity

Ankle brachial index:

- Normal arterial Doppler study on the left leg during rest with normal PVR waveforms.

NM bone scan:

- No abnormal blood flow or blood pool uptake involving the left foot or ankle. Mild radiotracer uptake in left midfoot.

FINAL/WORKING DIAGNOSIS: Complex regional pain syndrome

TREATMENT/OUTCOMES:

1. Physical Therapy focused on strengthening exercises and desensitization techniques
2. Diclofenac topical gel applied up to four times daily

3. Gabapentin 600mg BID

4. Referral to Pain Medicine for lumbar sympathetic nerve block

3667 May 30 9:20 AM - 9:40 AM

Acute Medial Calf Pain In Golfer

Kevin Baidoo¹, Luis J. Soliz¹, Jack Nickless². ¹*Rush University Medical Center, Chicago, IL.* ²*Midwest Orthopaedics at Rush, Chicago, IL.*

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(No relevant relationships reported)

History: 50-year-old male golfer presenting with 1-day history of acute onset right medial calf pain. He was playing golf and his pain started shortly after walking on flat ground when he felt a "snap" and "electric jolt" in the right medial calf. He subsequently had difficulty walking and has reported swelling in that area since that time. He denied any numbness, weakness, or tingling in his distal lower extremities. He has taken over-the-counter ibuprofen with some relief of his symptoms. His pain is constant and severe. He reported no prior injuries to his right calf before.

Physical Examination: Antalgic gait. Inspection of the right foot and ankle revealed minimal ecchymosis over the medial mid-gastrocnemius. There was moderate tenderness to palpation over the medial greater than lateral gastrocnemius muscle belly. Range of motion at the right ankle including dorsiflexion, plantarflexion, eversion, and inversion were normal. Strength was 4-/5 with right resisted plantarflexion but otherwise normal. Reflexes and sensation were grossly intact. Special tests including tib-fib squeeze, Thompson, anterior drawer, and talar tilt were negative. Distal pulses were intact.

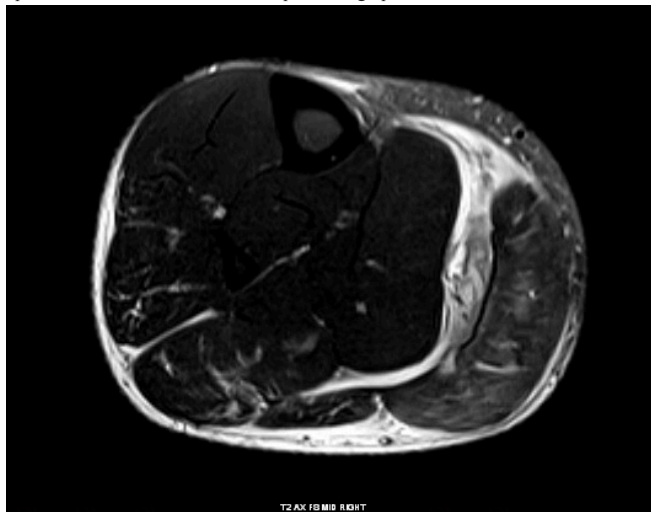
Differential Diagnosis: 1. Medial gastrocnemius strain 2. Tibia or fibular fracture 3. Acute peroneal nerve injury

Test and Results: Radiographs 4 views of the right tibia and fibula with soft tissue swelling and fullness in calf on lateral view. MRI right tibia and fibula with acute tear of the anterior gastrocnemius aponeurosis with a longitudinal component as well as a retracted transverse component.

Final Working Diagnosis: Acute L-Pattern tear of the aponeurosis of the medial calf

Treatment and Outcomes: 1. Offload right lower extremity with walking boot 2.

Course of physical therapy for 6 weeks 3. Indomethacin 50 mg BID for the next 10 days to help reduce risk of heterotopic ossification development in the calf 4. Follow up in 6 weeks for reevaluation and repeat radiographs



3668 May 30 9:40 AM - 10:00 AM

Lower Leg Injury - Basketball

Duke Yi-Fu Yeh. *Pomona Valley Hospital Medical Center, Pomona, CA.*

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(No relevant relationships reported)

HISTORY: 24 year-old male basketball player presented to clinic with left lower extremity pain after inverting left ankle during a game. Immediately after the injury he grabbed his proximal fibula. He experienced moderate lateral ankle pain that's sharp and throbbing. He could bear weight but was unable to play. He also had swelling near the proximal fibula. The pain was worse with movement and relieved with rest, ice and elevation.

PHYSICAL EXAMINATION:

He was limping favoring his left side.

Left ankle with moderate amount of joint effusion and mild-moderate amount of swelling over proximal peroneal muscle.
 AROM and PROM: limited to pain, especially in inversion and plantarflexion.
 Tenderness to palpation in proximal peroneal tendon/fibula and distal peroneal muscle.
 Strength: Ankle Dorsiflexion 5-/5, Long peroneal, Plantarflexion, Inversion, Eversion all 4+/5. Left Anterior Drawer Test ankle has increased laxity.
 Unable to perform single foot toe raise on left. Neurovascularly intact.
DIFFERENTIAL DIAGNOSIS:
 Peroneal Muscle Strain
 Peroneal Tendon Rupture/Compartment Syndrome/Fibular fracture/Lateral Ankle Sprain
TESTS AND RESULTS:
 3v Xray Left ankle and 6v Xray Left tib-fib: no acute bony abnormalities.
 MRI Left tib-fib: high-grade partial to full-thickness tear of the peroneal longus tendon at the level of proximal fibula with torn tendon fibers to the level of proximal Meta-diaphysis. Low-grade partial tear of the proximal peroneal brevis tendon with intramuscular edema. Tendinosis and tenosynovitis of distal peroneal brevis and longus without high-grade partial tearing.
FINAL/WORKING DIAGNOSIS:
 Tear of Left Proximal Peroneal Tendon.
TREATMENT AND OUTCOMES:
 The patient was shut down from sports and placed in a Cam walker boot. Treatment with rest, ice and PT. Pain control with acupuncture, muscle relaxant, and Tylenol or ibuprofen as needed.
 2 days prior to the 2-week follow-up, the patient received 1 PRP injection at the site of pain.
 At 2 week follow-up, the patient's pain improved. He was able to ambulate without limping but still had tenderness in the proximal peroneal muscle. He was able to have pain free AROM and PROM and regained 5/5 strength in left ankle motions, except 5-/5 in Long Peroneal.
 At 4 weeks follow-up, all symptoms resolved and he was cleared to return to 15 minutes of contact practice.

3669 May 30 10:00 AM - 10:20 AM
Hi-ya!: A Rare Quadriceps Lesion In A Rising Champion
 Jose F. Velasquez, James Pearson, Alex Casey, Hamed Shalika.
Emanate Health, West Covina, CA.
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(No relevant relationships reported)

HISTORY: A 10-year-old Female w/o past medical history was brought to the ED by her mother due to left leg pain and swelling. The mother states that the patient practices taekwondo. 3 days before during training, she sustained a direct kick over the left thigh. The patient states that since then she has been having pain. Mother has been doing supportive care at home including ice, Epsom salt compresses, and Amica. The mother states that despite the pain, the patient continued training. The mother states that the pain and swelling have markedly increased over the left thigh and knee, which started to impair ambulation with associated excruciating pain on palpation. The patient was taken to urgent care where X Rays ruled out a fracture. The patient was seen in the ED due to the worsening of swelling and pain. ROS was negative except for hpi. **PHYSICAL EXAMINATION:** Left lower extremity swelling from thigh to knee, tender to palpation in the lateral aspect over the quadriceps even with light touch. The patient was not able to bear weight or ambulate due to pain. peripheral pulses preserved. Skin is Normal color, warm, No bruise over the thigh. Neuro: grossly intact, motor/sensation. **DIFFERENTIAL DIAGNOSIS:** Quadriceps hematoma, Quadriceps strain, Quadriceps rupture, Compartment syndrome. **TEST AND RESULTS:** MRI LT femur w/o con: Severe sprain of the vastus intermedius muscle with partial tearing of the mid to distal aspect of the muscle lateral of midline associated with a large hematoma and intramuscular hemorrhage and edema. Mild straightening of the vastus medialis muscle proximally. **FINAL WORKING DIAGNOSIS:** Vastus intermedius rupture. **TREATMENT AND OUTCOMES:** RICE therapy, ACE wrap a few hours a day, Stretching exercises, Cryotherapy, Relative rest, cupping, acupuncture, and laser therapy. The Patient was pain-free and no longer needed crutches after a month. The patient started light level tournaments and after more than a month in recovery, she won a taekwondo National Championship.

3670 May 30 10:20 AM - 10:40 AM
Leg Injury - Football
 Austin A. Brown, Joseph E. Escobar, James P. Toldi. *University of South Alabama, Mobile, AL.*
(No relevant relationships reported)

HISTORY: A 12-year old male quarterback sustained a right leg injury while cutting back across the field. He was running across the field and made a lateral cut to change directions, as this happened he tripped over himself and fell without a twisting motion.

He landed on his right lateral leg with immediate pain to the fibular head. There was no numbness, tingling, weakness or radiation of pain however he had a noticeable limp. He presented to clinic 2 days later and denied any prior injuries or trauma to the area. **PHYSICAL EXAMINATION:** 2 days post injury (PCP office) — No deformity, normal knee and ankle exams, no bony tenderness, moderate postero-lateral edema of proximal right lower leg, painful/antalgic gait, TTP lateral gastrocnemius and soleus, negative Thompson's. 4 days post injury (Sports Medicine Clinic) — Consistent with prior exam, new findings: point TTP just distal to fibular head, decreased edema, negative squeeze test, negative ER test.
DIFFERENTIAL DIAGNOSIS: 1. R fibular contusion 2. R knee apophysitis 3. LCL sprain 4. Gastrocnemius contusion/strain 5. Distal Bicep Femoris strain
TEST AND RESULTS: XR: R Tib/Fib AP and Lateral radiographs 2 days after injury — Bones/joints/soft tissue appear unremarkable.
 Repeat XR 13 days post injury — subtle irregularity along the lateral aspect of the proximal fibula physis with associated periostitis. Final XR 20 days post injury — Noted irregularity along the lateral aspect of the proximal fibula physis with increased benign periostitis.
FINAL WORKING DIAGNOSIS: Salter-Harris II fracture of R proximal fibula physis
TREATMENT AND OUTCOMES: 1. Cam walker boot 3 weeks with weekly exams/ XRs. 2. 20 days out from injury completely normal RLE exam, no pain, full ROM, XRs suggestive for healing SH2 fracture; patient was able to return to football as tolerated.
DISCUSSION: In isolation this is a very rare injury. There was one reported case of a SH-3 fracture that presented with initial knee injury and ROM deficits that was treated non-operatively. Most injuries to the proximal physis of the fibula occur in combination with an interosseous membrane/syndesmotomic and distal tibiofibular injury - must rule out a Maisonneuve injury. The presenting complaint was pain and edema in the region of the soleus this may have been a soleus traction injury to the apophysis vs direct trauma from the fall.

G-31 Free Communication/Poster - Late-Breaking Abstracts
 Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3684 Board #1
Acute Effects Of Sauna Exposure Compared To Aerobic Exercise On Pulse Wave Velocity
 Noah John Erb, Andrew D. Nelson, Julia D. Jenkins, Cory L. Butts. *Weber State University, Ogden, UT.*
(No relevant relations reported)

Cardiovascular disease is the leading cause of death worldwide. Aerobic exercise is recommended to reduce the risk of cardiovascular disease, however it may not be feasible for all individuals. Heat therapy via sauna exposure may be an alternative modality to aerobic exercise to improve cardiovascular health and lower risk of all-cause mortality. **PURPOSE:** To compare the influence of a single bout of sauna induced heat therapy to aerobic exercise on pulse wave velocity (PWV). **METHODS:** Ten participants (9 males, 1 female, age 23 ± 2 y, ht 1.74 ± 0.08 m, wt 80.9 ± 19.7 kg, BMI 26.5 ± 5.5 kg/m²) completed this randomized crossover, counterbalanced control study. Trials consisted of a 20-minute supine baseline followed by 30 minutes of either infrared sauna exposure (HEAT; ~56°C), cycling exercise (EXER; 40-50% heart rate reserve), or upright sitting (control; CON). Following the intervention, participants completed a 60-minute supine recovery. Ultrasound measures were recorded at baseline and immediately, 30 minutes, and 60 minutes post-intervention to evaluate central and peripheral PWV. **RESULTS:** Rectal temperature at the end of treatment was greater in the EXER (37.5 ± 0.2°C) compared to HEAT (37.1 ± 0.2°C, P < 0.001) and CON (36.9 ± 0.1°C, P < 0.001). Heart rate at the end of treatment was also increased in EXER (121.8 ± 5.4 bpm, P < 0.001) and HEAT (84.0 ± 16.2 bpm, P < 0.001) compared to CON (58.3 ± 9.0 bpm). Central PWV decreased regardless of treatment from 30 to 60 minutes of recovery (-19.3 ± 12.4 cm/s, P = 0.02). Central PWV also exhibited medium effects for HEAT (-23.8 ± 27.2 cm/s, Hedge's g = 0.57) and EXER (-23.8 ± 27.2 cm/s, Hedge's g = 0.48) compared to CON. Lower peripheral PWV was not different between treatments (HEAT 914.6 ± 52.8, EXER 912.6 ± 83.1, CON 940.7 ± 97.0 cm/s, P = 0.46, η_p² = 0.08) or across time (P = 0.53, η_p² = 0.07). Upper peripheral PWV was also not different between treatments (P = 0.84, η_p² = 0.02) or across time (P = 0.14, η_p² = 0.18). **CONCLUSIONS:** The 30-minute sauna exposure and cycling exercise had minimal short-term impacts on PWV in our healthy population. These preliminary findings suggest that greater physiological strain may be required to elicit the acute changes shown in previous research.

3685 Board #2

Arm And Leg Vascular Responses To A Weekend Of Reduced Physical Activity

Garrett L. Heaney¹, Alexander H.K. Montoye, FACSM¹, Paul J. Fadel, FACSM², Jennifer R. Vranish¹. ¹Alma College, Alma, MI. ²University of Texas at Arlington, Arlington, TX.
(No relevant relations reported)

PURPOSE: Physical inactivity is associated with leg macrovascular impairment following 6 hours of uninterrupted sitting or 5 days of reduced physical activity, however vascular responses in the upper limb are less clear. Indeed, the impact of physical inactivity on both arm and leg microvascular and macrovascular function over a 72-hour period remains unknown. This may be important as it represents a real-world scenario of an active individual during the workweek, followed by sedentary behavior over the weekend. Further, previous studies have investigated the popliteal artery, which does not assess the entire lower limb. We tested the hypothesis that 72 hours of reduced activity (<5000 steps/day) would result in reduced brachial artery (BA) and superficial femoral artery (SFA) resting shear rate, microvascular function (reactive hyperemia-RH), and macrovascular function (flow-mediated dilation-FMD).

METHODS: Physical activity was monitored for the week prior to and during the 72 hours of inactivity in 5 healthy, young men who were currently physically active. BA and SFA resting shear rate, RH (shear AUC), and FMD were measured via duplex Doppler ultrasound before (Pre) and after (Post) a 72-hour inactivity period.

RESULTS: In the SFA, resting shear rate (Pre: 53.6±17.9 s⁻¹, Post: 32.1±14.7; P=0.03) and RH (Pre: 23376±6266 AU, Post: 16580±3304 AU; P=0.01) were significantly reduced after a 72-hour inactivity period. Similarly, BA resting shear rate and RH tended to be reduced (P=0.09 and P=0.07, respectively). Finally, FMD was unchanged in both the BA and SFA (P>0.05).

CONCLUSIONS: Herein, we demonstrate that resting hemodynamics and microvascular function are reduced over 72 hours of inactivity, while macrovascular function is preserved in the upper and lower limbs. These findings may highlight a distinction between the vascular impact of short-term sitting studies versus longer term inactivity studies, as the brachial artery appears to be more affected by the latter.

3686 Board #3

FIt-1 And Endothelial Function Soon After Delivery: Effect Of Physical Activity

Chloe W. Caudell, Samantha Bouknight, Katherine Kramps, Erin O'Connor, Paige Wilbanks, Abbi Lane-Cordova. *University of South Carolina: Arnold School of Public Health, Columbia, SC.*
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(No relevant relations reported)

Vascular adverse pregnancy outcomes (APOs) are characterized by elevated levels of antiangiogenic Fms-like tyrosine kinase (FIt-1), attributable to placental ischemia. FIt-1 directly impairs endothelial function during pregnancy and contributes to maternal features of APOs, but infusion of FIt-1 into non-pregnant animals did not cause endothelial dysfunction. **Purpose:** The purpose was to evaluate the relation of FIt-1 and endothelial function in women 6 months – 3 years after delivery. Given the angiogenic effects of exercise, we tested the hypothesis that FIt-1 would be lower in women who achieved adequate prenatal and current physical activity (PA). **Methods:** 40 nonsmoking women free from diabetes and use of protease inhibitors (mean age: 33±1 yrs, mean BMI: 26.3±1.0 kg/m², 58% with adequate pregnancy PA) completed a blood draw and vascular testing after an overnight fast. We used an ELISA assay to determine levels of circulating FIt-1. Reactive hyperemia (RH) was measured with venous occlusion plethysmography to quantify resistance vessel endothelial function. A validated physical activity questionnaire (Godin Leisure Time Exercise Questionnaire) was used to determine current and second trimester PA; APO history was determined using self-report. We tested for associations of RH with continuous levels FIt-1 using linear regression, adjusted for APO status. We used t-tests to evaluate differences in FIt-1 between women who did versus did not achieve adequate PA during pregnancy or at the time of vascular testing. **Results:** There was no association of FIt-1 and peak RH; $\beta = -0.01 \pm 0.01$, $p = 0.50$. There was no difference in FIt-1 levels between women who did versus did not achieve adequate PA at the time of testing (412±17 versus 443±31 pg/ml, $p = 0.22$) or during pregnancy (408±20 versus 430±20 pg/ml, $p = 0.23$). **Conclusions:** Although related to vascular dysfunction during pregnancy, FIt-1 was not related to vascular function after delivery and did differ by current or pregnancy PA level. FIt-1 might not be useful for identifying women at risk of vascular dysfunction after pregnancy ends.

3687 Board #4

Blood Pressure, Fitness, And Fatness In Children The Arkansas Active Kids Study

Eva C. Diaz, Judith L. Weber, Sean Adams, Young G. Catarina, Bai Shasha, Elisabet Børshheim. *University of Arkansas for Medical Sciences, Little Rock, AR.*
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(No relevant relations reported)

Purpose The role of cardiorespiratory fitness (CRF) in pediatric health is gaining recognition. However, the quality and quantity of the current evidence are insufficient to inform clinical pediatric guidelines. **Objective:** to evaluate the association between direct measures of CRF and blood pressure status as determined by the 2017 screening guidelines from the American Academy of Pediatrics in school-age children. **Methods** Children (n=218) 7 to 10 years old participated in a single-study visit. Children were deemed to have high blood pressure (HBP) if blood pressure status was: elevated, stage-1 or stage-2 hypertension. CRF (VO_{2peak}) was measured using an incremental cycle ergometer test. Body composition was measured with DXA, and physical activity with accelerometers (7±1 days). Blood was sampled in the fasting state and estimated glomerular filtration rate (eGFR) calculated using the updated Schwartz equation. Children were categorized as having excess weight (EW) or normal weight (NW) if their fat mass index was above or below 1 z-score, respectively. Children were further classified into EW/NW more-fit or EW/NW less-fit using the groups' median VO_{2peak}. Multiple logistic regression analyses were used to model the probability of high blood pressure against VO_{2peak}. **Results** Participants' average age was 9 years, with 70% of EW children having HBP vs. 24% in the NW group ($p < .0001$). The probability of HBP decreased with increasing VO_{2peak} in the EW group only ($\beta = -0.09$, $p = 0.0095$). There was no association between CRF and probability of HBP in NW children. eGFR was lower in the less-fit groups than in more-fit groups regardless of adiposity status, even after adjusting for age and blood pressure status (adjusted mean difference between more-fit and less-fit groups: EW=7.1 ml·min⁻¹·1.73 m⁻², $p = 0.0046$ and NW= 2.9 ml·min⁻¹·1.73 m⁻², $p = 0.0144$). **Conclusion** The probability of HBP dramatically decreases with increasing CRF in children with EW but not in children with NW. eGFR is lower in children with lower CRF, regardless of obesity status, but the effect of CRF on kidney function is greater in EW than in NW kids. Funding USDA-ARS Projects 59-6250-4-001 and 6026-51000-012-06S. ECD partially supported by ArCAPT-8UG1OD024945.

3688 Board #5

Impact Of An Ankle-foot Orthosis On Physical Activity In Patients With Peripheral Artery Disease

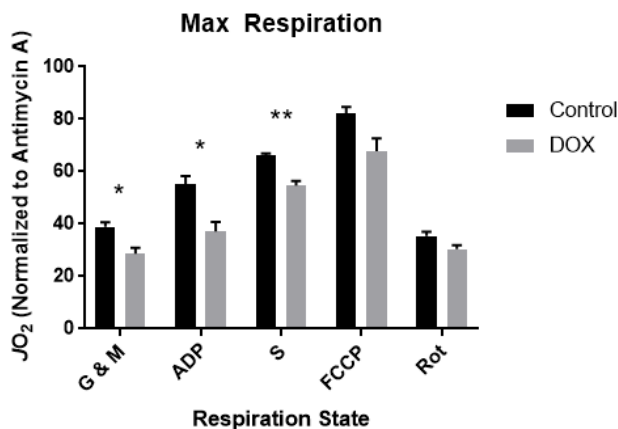
Mahdi Hassan¹, Danae M. Dinkel¹, Holly DeSpiegelae², Jason M. Johanning², Iraklis I. Pipinos², Sara A. Myers¹. ¹University of Nebraska at Omaha, Omaha, NE. ²Omaha Veterans' Affairs Medical Center, Omaha, NE.
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(No relevant relations reported)

Patients with peripheral artery disease (PAD) are sedentary due to claudication pain in the lower extremities. Our research has documented an inability of the ankle plantarflexors to generate normal push-off during walking. An ankle-foot orthosis (AFO) to offset push-off deficiency may improve physical activity levels and walking distances in patients with PAD. **PURPOSE:** To compare step count (SC), peak activity index (PAI), initial claudication distances (ICD), and absolute claudication distances (ACD) before and after an AFO intervention. **METHODS:** Six patients with PAD (Age: 71.7 ± 9.3 years; Body Mass Index: 27.5 ± 5.5 kg/m²) were enrolled in the study. They underwent measurements of SC and PAI over a week using an accelerometer. ICD and ACD were determined while subjects performed the Gardner treadmill protocol without wearing AFOs. All measures were assessed before and after the three month AFO intervention. Signed Rank tests were performed to determine differences following the intervention. **RESULTS:** ACD was significantly increased following the AFO intervention ($p = 0.046$). Mean ACD was 312 ± 169 meters at baseline and increased to 364 ± 194 meters after the three month AFO intervention. Measures before and after the AFO intervention of SC (2422 ± 1166 steps/day and 2349 ± 1112 steps/day), PAI (34 ± 13 steps/min and 30 ± 7 steps/min), and ICD (187 ± 111 meters and 173 ± 138 meters) were not significantly different. **CONCLUSION:** The preliminary results of this study indicated that the AFO intervention improves the ACD in patients with PAD while walking without AFO. Future work should increase the number of subjects and determine whether physical activity intensity levels (light, moderate, and vigorous) changed after AFO intervention. Supported by NIH Grant HD090333-01. We acknowledge Alex Dzewaltowski, Cody Anderson, and Kaeli Samson for supporting this study.

3689 Board #6

Doxorubicin Treatment Decreases Maximal Respiration In C2C12 MyotubesDavid Eastley, FACSM. *Brigham Young University, Provo, UT.*
Email: da.eastley@gmail.com*(No relevant relations reported)*

The chemotherapeutic drug doxorubicin (DOX) is commonly prescribed to treat patients diagnosed with cancer. However, patients on DOX cannot take it long term due to its cardio-toxic effects, as well as skeletal muscle wasting and dysfunction. The mechanism behind why skeletal muscle dysfunction occurs is not well known, so the effects of DOX on skeletal muscle mitochondria are currently being investigated. **PURPOSE:** To determine the maximal respiration levels in DOX treated C2C12 myotubes. **METHODS:** Immortalized C2C12 myotubes were cultured in vitro and allowed full differentiation. Fully differentiated cells were then treated with 0.5uM DOX for 16 hours. Maximal mitochondrial respiration was analyzed with high resolution respirometry. The following substrates were used: digitonin (permeabilize cells); glutamate (G), malate (M) (leak respiration), then ADP (complex I); cytochrome C (mitochondrial membrane integrity); succinate (S) (complex I & II); FCCP (uncoupled respiration); rotenone (Rot) (complex I inhibitor); antimycin A (complex III inhibitor). Results were analyzed using multiple t-tests. **RESULTS:** DOX caused an 18% reduction in complex I & II supported respiration compared to control (54.6 vs 66.2 JO₂, P <0.005; n=4), a 32% decline in complex I supported respiration (37.2 vs 55.2 JO₂, P <0.05), and a 26.6% decline in leak respiration (28.6 vs 38.99 JO₂, P <0.08), indicating an overall decrease in mitochondrial respiration. **CONCLUSION:** Treating C2C12 differentiated myotubes with DOX for 16 hours inhibits complex I & II supported maximal respiration. These findings enable future research to be conducted in order to better understand why these cells are decreasing in maximal respiration. We are currently investigating whether co-treatments can reduce or rescue reduction in respiration caused by DOX.



3690 Board #7

Effects Of Genetically Modified Probiotics And Exercise On Physical Function In Aged RatsYi Sun¹, Lisa Roberts¹, Anisha Banerjee¹, Youfeng Yang¹, Anthony Knighton¹, Sujitha Peramsetty¹, Amber Sanders¹, Amrisha Verma², Qiuhong Li², Christy Carter¹, Thomas W. Buford, FACSM¹. ¹University of Alabama at Birmingham, Birmingham, AL. ²University of Florida, Gainesville, FL.
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PURPOSE: Declining function in older individuals has enormous clinical and public health consequences, thus therapeutics for preserving function are needed. Advanced age is associated with changes in the gut microbiome, and these changes are associated with functional decline. Our prior work has demonstrated manipulating renin-angiotensin system (RAS) is a promising approach to mitigating age-related functional decline. Recently, genetically modified probiotics (GMP) have also been purported as a promising strategy to deliver drugs with precision and high site specificity. Physical exercise has also been suggested to promote gut health and has important interactions with the Ang(1-7) axis. Here we present preliminary data exploring the impact of oral delivery of genetically modified *Lactobacillus paracasei* secreting Ang(1-7) [LP-A] and exercise training on physical function in aged rats. **METHODS:** 24 month old, male F344/BN rats were randomized into 6 groups. They received oral gavage of LP-A, wild-type probiotics (*Lactobacillus paracasei*), or vehicle 3 times/week; combined

with or without exercise for 12 weeks. Exercised rats ran on a treadmill at 12 cm/sec, 10min/day, 5 days/week. Rats in sedentary group were placed on a non-moving treadmill for the same duration of time. After 12 week of intervention, an exercise tolerance test was performed, where all rats were running on a treadmill starting at 12cm/sec for 2 min, then increase by 2 cm/sec each minute until 16 cm/sec was achieved. Running time to exhaustion was recorded. Locomotor tests (open field assay) were also performed. **RESULTS:** Exercise (mean=1223s) significantly increased time to exhaustion in the exercise tolerance test compared with sedentary animals (mean=464s) in the aged rats. There was also preliminary, but not significant, evidence that LP-A (mean =1329s) group performed best compared to all other exercise groups (Range = 1115-1241s). LP-A increased overall physical activity, compared with all other groups, as measured by the total distance travelled and velocity in the open field test. **CONCLUSION:** Preliminary findings suggest exercise and LP-A increase physical function in aged male rats respectively, but not synergistically.

3691 Board #8

Undernutrition Promotes Oxidative Stress & Capillary Regression In Skeletal MuscleTakumi Hirabayashi¹, Badur un Nisa¹, Hiroyo Kondo², Hidemi Fujino¹. ¹Kobe University, Kobe, Japan. ²Nagoya Women's University, Nagoya, Japan.*(No relevant relations reported)*

PURPOSE: An undernutrition condition results in muscle atrophy and mitochondrial dysfunction. However, it is still not well-known that the characteristics of the skeletal muscle capillary network during undernutrition. The purpose of the present study was to verify the effects of undernutrition on the capillary network in skeletal muscle. **METHODS:** Male Wistar rats were assigned randomly to control and undernutrition groups. The rats in the undernutrition group fed low protein and limited 50% diets daily for 12 weeks. Plantaris and soleus muscle were analyzed. The three-dimensional capillary network of skeletal muscle was visualized using a confocal laser scanning technique. The capillary volume, mean luminal diameter and capillary-to-fiber ratio were measured in both skeletal muscles. In addition, the levels of VEGF and thrombospondin-1 proteins, lipid peroxidation and SOD-2 proteins were determined. **RESULTS:** The muscle mass decreased only plantaris muscle in the undernutrition group. The level of lipid peroxidation was increased, and the expression levels of SOD-2 in plantaris and soleus muscles were decreased. In addition, the capillary volume, mean luminal diameter and capillary-to-fiber ratio were decreased in both muscles of the undernutrition group. Furthermore, the level of VEGF protein was decreased, and thrombospondin-1 was increased in both muscles of undernutrition group. **CONCLUSIONS:** These results suggest that undernourished skeletal muscle induces capillary regression with increased oxidative stress, which also occurs in slow muscle without atrophy.

3692 Board #9

Long-chain Acyl-CoA Synthetases Relate To Fat Oxidation And Storage In Skeletal Muscle Of Lean HumansHarrison D. Stierwalt, Sarah E. Ehrlicher, Matthew M. Robinson, Sean A. Newsom. *Oregon State University, Corvallis, OR.*

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(No relevant relations reported)

Recent evidence from genetically altered cell and mouse models indicate long-chain acyl-CoA synthetases (ACSLs), namely ACSL1 and ACSL6, may be critical determinants of partitioning of fatty acids toward oxidation or storage, respectively, within skeletal muscle. However, the role ACSLs serve in skeletal muscle fat oxidation and storage remains to be determined in humans, and it is unknown if ACSLs are altered by acute exercise. **PURPOSE:** To identify 1) relationships between skeletal muscle ACSL1 and ACSL6 protein content and measures of fat oxidation at rest and during exercise, and fat storage, and 2) whether acute exercise induces changes in ACSL protein content in humans. **METHODS:** Sedentary lean adults (n=14 [4M/10F], BMI 22.2 ± 2.1 kg/m², VO_{2max} 32.2 ± 4.5 ml/kg/min) completed two metabolic study visits in a randomized crossover design. Trials were identical other than completing 1 h of moderate intensity cycling exercise (65% VO_{2max}) or remaining sedentary. Vastus lateralis muscle biopsies were obtained 15 min post-exercise or rest and 2 h post-exercise to determine ACSL protein and triacylglycerol (TAG) content. TAG content was determined by lipidomic analysis. Substrate oxidation was assessed at rest and during exercise using indirect calorimetry. **RESULTS:** Skeletal muscle ACSL1 protein content was not related to whole-body fat oxidation at rest (P=0.64, r=0.14); however, ACSL1 tended to be positively related with whole-body fat oxidation during exercise (P=0.07, r=0.53), when skeletal muscle accounts for the vast majority of energy expenditure. Skeletal muscle ACSL1 was not altered 15 min or 2 h post-exercise (both P > 0.05 vs. Rest). Skeletal muscle ACSL6 protein content was positively associated with resting muscle TAG content (P=0.05, r=0.57). ACSL6 protein content was not

altered 15 min or 2 h post-exercise (both $P > 0.05$ vs. Rest). **CONCLUSIONS:** Skeletal muscle ACSL1 and ACSL6 protein content were positively associated with measures of whole-body fat oxidation during exercise and skeletal muscle TAG content, respectively. We interpret our results to indicate ACSLs may be critical regulators of partitioning of fatty acids within skeletal muscle, but protein content was not altered in the hours after acute exercise in sedentary lean adults. Supported by ACSM Foundation Doctoral Student Research Grant

3693 Board #10

Adiposity And Cardiovascular Health And The Reallocation Of Waking Activities In Preschool Children With Overweight

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(No relevant relations reported)

Physical activity and sedentary behaviors differentially relate to health outcomes in children. Isotemporal substitution provides opportunities to evaluate the relation of hypothetical time replacement scenarios across intensity categories with health. Few isotemporal studies have been conducted among preschool-aged youth and ethnically diverse populations.

PURPOSE: To examine the relation of reallocation of waking activity behaviors on 1) adiposity and 2) cardiovascular health indicators among preschool-aged youth (ages 2-5 years) with overweight participating in Texas Childhood Obesity Research Demonstration (TX CORDD), a low-income, majority Hispanic cohort.

METHODS: Participants wore an ActiGraph wGT3X-BT monitor (waist) and attended health assessments. Valid wear time was defined as ≥ 10 hours between 06:00-22:59 hours on ≥ 3 days (≥ 1 weekend). Adiposity measures were percentage of the 95th percentile (%BMI₉₅), fat mass, fat mass index, waist circumference, and waist-to-hip ratio. Cardiovascular measures were resting systolic (SBP) and diastolic (DBP) blood pressure, and heart rate. Covariates included age, sex, ethnicity, and socioeconomic status. Isotemporal substitution modeling was employed to address the study purpose.

RESULTS: Complete data were available for 131 children (Mean age = 4.3 ± 1.1 , 53% female, 87% Hispanic, 31% $\leq 49\%$ income to poverty ratio). For boys, reallocating 15 minutes of sedentary, light, or moderate intensity activity to vigorous intensity activity was significantly associated with beneficial reductions in all adiposity indicators; for girls, these relations were statistically null. For boys and girls, reallocating 15 minutes of sedentary (-5.0 SBP, -3.7 DBP), light (-4.3 SBP, -3.2 DBP), or moderate intensity activity (-7.3 SBP, -5.5 DBP) to vigorous intensity activity was significantly associated with favorable cardiovascular indicators.

CONCLUSIONS: Substituting vigorous for lower intensity physical activity is associated with several favorable adiposity and cardiovascular health outcomes among preschool children with overweight and obesity. Teaching caregivers how to engage young children in vigorous intensity is needed, especially as overweight children spend more time sedentary and less time in higher intensity activities.

3694 Board #11

Operationalization Of The Youth Physical Activity Guidelines Using The International Children's Accelerometry Database (ICAD)

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PURPOSE: Use data from the International Children's Accelerometry Database to explore how different methods of operationalizing the youth physical activity (PA) guidelines influence: (i) the proportion of youth deemed compliant with the guidelines, and (ii) associations between guideline compliance and health indicators. **METHODS:** Accelerometer data for 21,612 youth (5-18y, 62.4% female) was used to explore PA guideline compliance defined by four operationalization methods: daily method (DM; ≥ 60 minutes moderate-vigorous PA [MVPA] on every day of the measurement period), average method (AM; average of ≥ 60 minutes MVPA per day over the measurement period), AM5 (compliance with AM and ≥ 5 minutes of vigorous PA [VPA] on ≥ 3 days), AM15 (compliance with AM and ≥ 15 minutes VPA on ≥ 3 days). Relationships between guideline compliance and health indicators (e.g., BMI z-score, cholesterol levels, blood pressure) were examined for all operationalization methods. Descriptive statistics and McNemar's tests were used to compare compliance estimates for the four methods. Multivariate regression models were used to test associations between compliance and health indicators. **RESULTS:** Operationalization method influenced estimates of compliance with the youth PA guidelines: 5.3% using DM, 29.9% using AM, 29.4% using AM5, 23.7% using AM15. Associations between guideline compliance and health indicators were similar for the AM, AM5 and AM15 methods, for example, BMI z-score: AM compliance (coefficient -0.28, 95% CI: -0.33,-0.23), AM5 compliance (coefficient -0.28, 95% CI: -0.33,-0.23), AM15 compliance (coefficient -0.30, 95% CI: -0.35,-0.25). Compliance with the DM method demonstrated similar or weaker associations with health indicators, potentially due to a small number of participants that complied with DM and also had health indicator data (n=250-1,127). **CONCLUSION:** Operationalization method influences estimates of the proportion of youth meeting the PA guidelines. This finding adds to the PA data processing decisions that researchers need to consider. While operationalization method appears to have a minor influence on associations between guideline compliance and health indicators, further research with a larger sample of DM-compliant participants with health data is needed to confirm this finding.

3695 Board #12

Addressing Motivational Barriers For Early Morning Outdoor Physical Activity Using Smartphones

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(No relevant relations reported)

Lack of physical activity is a global health concern. Determining an appropriate time to motivate individuals for consistent outdoor exercise is challenging. Early morning outdoor physical activity (PA) has proven health benefits. However, in spite of known wellness benefits, people report motivational barriers such as lack of time, lack of enjoyment to experience morning outdoor PA. Smartphones are increasingly used as a tool to assist in outdoor PA. We have leveraged the smartphone technology capabilities to address the motivational barriers in early morning outdoor physical activity.

PURPOSE: The main purpose of our work is to share findings of an exploratory study for improving motivation of outdoor physical activity. **METHODS:** We developed an intervention called "Rise and Smile" led by one healthy participant and followed by 280 online followers for 365 consecutive days. The participant performed daily

15 minutes of early morning PA of walking or running to reach an outdoor Sunrise viewing location. The participant then captured a photo of the beautiful view of nature during sunrise on their smartphone camera upon completion of their PA. The participant then instantly published the photo on a social media page. **RESULTS:** The individual participant self-reported increased energy, better sleep and increased productivity. The virtual participants ($n=281$) showed positive acceptance via social media with regular sunrise photo likes. The positive reaction to the Sunrise photo also motivated the individual to establish the daily wellness habit. The positive experience of watching sunrise and the picturesque photos of nature during sunrise were used as motivational tools. The participant's motivation was used as a primary outcome measure and was reportedly improved upon successful completion of this study. The study also showed the influence of unique sunrise photos for emotional benefits and positive behaviour change. **CONCLUSION:** Our smartphone-enabled study suggested that use of technology to record unique picturesque outdoors during the sunrise can provide meaningful motivation for outdoor physical activity.

3696 Board #13**Physical Activity Prescription For Patients With Chronic Diseases: A Questionnaire Survey In Shenzhen, China**

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PURPOSE: To investigate the prevalence of prescribing PA in clinical setting for patients with chronic diseases in Shenzhen, China. **METHODS:** A total of 104 patients recruited from three general hospitals in Shenzhen of China completed a face-to-face questionnaire. Patients were asked "have you ever been provided with PA prescription by physicians/healthcare providers". Those who answered yes were then further prompted about the PA frequency (number of times per week), intensity (low, moderate or high intensity), duration (number of minutes per session) and type of PA provided by physicians/healthcare providers.

RESULTS: Overall, 53.4% patients reported receiving PA prescription from physicians/healthcare providers. Of those PA being prescribed, 61.8% of patients reported the frequency were introduced, whereas 65.5% included intensity and 67.3% included duration, respectively. Fewer participants (43.6%) reported being provided the type of PA, and the most common type of PA being prescribed was walking (75%). Moreover, less than a third of patients (31%) received a complete prescription (including PA frequency, intensity, duration & type) from their physicians/healthcare providers.

CONCLUSIONS: This study revealed that about half of physicians/healthcare providers are incorporating PA promotion into clinical setting in Shenzhen. However, only a small percentage of physicians/healthcare providers could provide completed PA prescription for chronic disease patients. Furthermore, the type of exercise that prescribed by physicians/healthcare providers seems to be limited. The results may support that further education/training to physicians/healthcare providers in China are needed in order to foster PA prescription in clinical setting.

3697 Board #14**Hydrotherapy With Hydrogen-rich Water Versus R.I.C.E. Protocol For Acute Ankle Sprain In Professional Athletes**

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(No relevant relations reported)

Different therapeutic approaches with hydrogen (H_2) have been recently put forward in sports medicine, yet the effectiveness of specific experimental treatments with H_2 was rarely compared with standard clinical procedures. **PURPOSE:** To analyze the effects of intensive hydrotherapy with hydrogen-rich water (HRW) on injury recovery in athletic men who suffered an acute ankle sprain and compare it with RICE protocol (rest, ice, compression, elevation), a universally accepted as best practice immediately after acute ankle sprains.

METHODS: Eighteen healthy male professional athletes who incurred an acute ankle sprain during a sport-related activity were randomly assigned immediately after the injury to either hydrogen group ($n=9$) or the conventional RICE treatment group ($n=9$). Hydrogen group received six 30-min ankle baths with HRW throughout the first 24 h post-injury, with hydrotherapy administered every 4 hours during the intervention period. RICE group stood off the injured leg, with ice packs administered for 20 min every 3 hours (total of 8 sessions), with the injured ankle compressed with an elastic bandage for 24 hours and elevated at all possible times above the level of the heart. The trial was registered at *ClinicalTrials.gov* (NCT04167202).

RESULTS: Hydrotherapy with hydrogen-rich water was equivalent to RICE protocol to reduce ankle swelling ($2.1 \pm 0.9\%$ vs. $1.6 \pm 0.8\%$; $P=0.26$), range of motion (2.4 ± 1.3 cm vs. 2.7 ± 0.8 cm; $P=0.60$), and single-leg balance with eyes opened (18.4

± 8.2 sec vs. 10.7 ± 8.0 sec; $P=0.06$) and closed (5.6 ± 8.4 sec vs. 3.9 ± 4.2 sec; $P=0.59$). Neither intervention affected serum CRP, TNF- α and IL-1 β ($P>0.05$), although hydrogen treatment tended to reduce circulating IL-1 β levels at 24-h follow up (10.8% on average; 95% confidence interval from 6.0 to 27.6; $P=0.07$).

CONCLUSIONS: HRW appeared to be equally effective to RICE for improving recovery after an acute ankle sprain in professional athletes, therefore advancing this innovative approach as an effective alternative in the field of sports medicine. However, more studies are needed to corroborate these findings in other soft tissue injuries.

3698 Board #15**Clinical Benefit Of Cntx-4975 Intra-articular Injection For Moderate To Severe Osteoarthritis Knee Pain**

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Reported Relationships: R.M. Stevens: Salary; Centrexion Therapeutics Corp. Ownership/interest/stock; Centrexion Therapeutics Corp. Other (please describe); Funding for this abstract sponsored by Centrexion Therapeutics Corp.

Purpose: To evaluate the effect of CNTX-4975 intra-articular (IA) injection on pain, function, and quality of life (QoL) in subjects with knee osteoarthritis (OA). **Methods:** A phase 3, open-label, 8-wk study (NCT03661996) enrolled subjects aged 40–95 y with stable, moderate to severe OA knee pain in the index knee (average pain 24 h) after ≥ 2 failed therapies. Subjects were assigned to unilateral/bilateral CNTX-4975 1 mg IA injections as determined by OA pain/joint replacement status (Table) and randomized by site to 1 of 5 joint cooling/injection regimens to evaluate procedure experience. The circumferential joint cooling wrap used in the phase 2 pivotal trial was compared with 4 circumferential gel-pack wrap cooling groups with varying cooling schedules/injection techniques. Outcomes assessed through wk 8 included average daily index knee pain with walking (numeric pain rating scale [NPRS], 0 [no pain] to 10 [worst pain]) and Knee Injury OA Outcomes Score (KOOS) subscales (range, 0–100; higher is improvement; Table). Least squares (LS) mean, 95% CI, and P value were calculated for change from baseline in NPRS and KOOS scores using a mixed model for repeated measures. **Results:** The intent-to-treat population included 848 subjects; baseline NPRS index knee pain with walking scores (mean [SD]) by subject type: A, 6.5 (1.50); B, 7.4 (1.35); C, 6.2 (1.21). By day 3, NPRS scores were significantly ($P<0.0001$) improved; LS mean (SE [95% CI]): A, -3.98 (0.170 [-4.32, -3.64]); B, -4.21 (0.103 [-4.41, -4.01]); C, -3.71 (0.375 [-4.48, -2.94]). Improvement was maintained at wk 8; A, -3.48 (0.191 [-3.86, -3.10]); B, -4.02 (0.118 [-4.25, -3.79]); C, -3.52 (0.416 [-4.38, -2.67]); all $P<0.0001$. All KOOS subscale scores were significantly improved at wk 8 (Table). **Conclusions:** Subjects with moderate to severe knee OA pain showed significant clinical improvements as early as 3 days and through 8 wks post injection in knee pain, function, and QoL after a single CNTX-4975 1 mg IA injection.

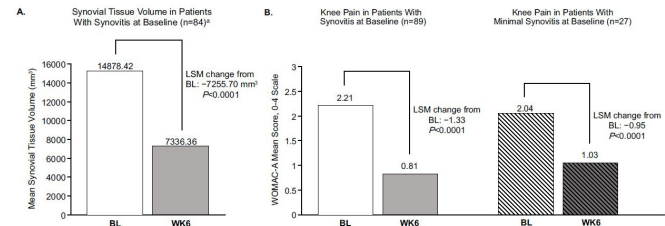
Table: KOOS Scores in the Index Knee After Single Intra-articular Injection of CN1X-4975 1 mg for Moderate to Severe Osteoarthritis Knee Pain

Outcome	Subject Type A: Unilateral Injection (no/mild pain, nonindex knee) n=273	Subject Type B: Bilateral Injection (moderate to severe pain in both knees*) n=523	Subject Type C: Unilateral Injection (prior nonindex knee replacement) n=52
KOOS Pain with walking			
Baseline mean (SD)	53.9 (20.12)	48.1 (19.35)	50.5 (19.03)
Week 8			
CFB (SD)	18.7 (24.43)	27.5 (28.21)	24.5 (26.96)
LS Mean (SE)	21.1 (1.74)	25.9 (1.04)	25.3 (6.06)
95% CI	17.7, 24.5	23.8, 27.9	12.8, 37.8
P value	<0.0001	<0.0001	0.0003
KOOS subscale Pain			
Baseline mean (SD)	47.9 (14.01)	43.3 (13.66)	46.8 (11.86)
Week 8			
CFB (SD)	19.0 (19.40)	27.9 (22.80)	23.4 (20.59)
LS Mean (SE)	22.5 (1.48)	25.6 (0.87)	23.9 (4.61)
95% CI	19.5, 25.4	23.9, 27.3	14.4, 33.4
P value	<0.0001	<0.0001	<0.0001
Other symptoms			
Baseline mean (SD)	52.6 (15.76)	48.7 (16.57)	53.9 (15.40)
Week 8			
CFB (SD)	13.9 (18.49)	23.4 (22.21)	16.6 (19.26)
LS Mean (SE)	17.2 (1.40)	20.9 (0.82)	20.4 (3.69)
95% CI	14.4, 19.9	19.3, 22.6	12.8, 28.0
P value	<0.0001	<0.0001	<0.0001
Function (Daily living)			
Baseline mean (SD)	52.2 (14.92)	46.6 (14.12)	49.0 (14.22)
Week 8			
CFB (SD)	18.2 (19.27)	27.4 (22.51)	23.6 (18.03)
LS Mean (SE)	20.9 (1.48)	25.6 (0.86)	25.7 (4.57)
95% CI	17.9, 23.8	23.9, 27.3	16.2, 35.1
P value	<0.0001	<0.0001	<0.0001
Function (Sports and Recreation)			
Baseline mean (SD)	28.0 (21.20)	26.7 (21.70)	27.8 (25.13)
Week 8			
CFB (SD)	20.2 (29.85)	31.2 (31.59)	26.2 (26.23)
LS Mean (SE)	25.2 (2.25)	27.8 (1.23)	33.1 (5.80)
95% CI	20.7, 29.6	25.4, 30.2	21.2, 45.1
P value	<0.0001	<0.0001	<0.0001
Quality of life			
Baseline mean (SD)	32.4 (16.35)	31.6 (17.96)	30.9 (15.78)
Week 8			
CFB (SD)	17.6 (23.42)	25.7 (26.21)	19.8 (26.07)
LS Mean (SE)	22.1 (1.90)	21.5 (1.06)	16.8 (6.26)
95% CI	18.4, 25.8	19.4, 23.6	3.8, 29.7
P value	<0.0001	<0.0001	0.0132

*In subjects receiving bilateral CN1X-4975 injections, the index knee was defined as knee with worse pain. Statistics were based on a mixed model of repeated measures. CFB, change from baseline; CI, confidence interval; LS, least squares; SD, standard deviation; SE, standard error; KOOS, Knee Injury and Osteoarthritis Outcomes Score (range, 0-100; higher scores indicate improvement).

Parameter	Statistics	Patients With Synovitis at BL* (n=89)	Patients With Minimal Synovitis at BL* (n=26)	All Patients (N=116)
Age, years	Mean (SD)	62.3 (7.9)	58.8 (8.3)	61.5 (8.1)
Female	%	64.0	63.0	63.0
BMI, kg/m ²	Mean (SD)	30.3 (4.4)	29.6 (5.3)	30.1 (4.6)
Years since diagnosis	Mean (SD)	9.0 (8.4)	9.6 (10.1)	9.1 (8.8)
Days with pain/mo	Mean (SD)	29.1 (2.8)	29.6 (2.7)	29.2 (2.8)
Bilateral OA	%	67.4	81.5	70.7
Prior index knee surgery	%	29.2	11.1	25.0
Prior IACS	%	43.8	29.6	40.5
Prior IAHA	%	13.5	7.4	12.1
KL grade 2	%	38.2	74.1	46.6
KL grade 3	%	61.8	25.9	53.4
Joint space width, mm	Mean (SD)	4.3 (1.3)	5.2 (0.8)	4.5 (1.3)
WOMAC-A (pain)	Mean (SD)	2.2 (0.6)	2.0 (0.5)	2.2 (0.6)
WOMAC-B (stiffness)	Mean (SD)	2.5 (0.7)	2.1 (0.8)	2.4 (0.7)
WOMAC-C (function)	Mean (SD)	2.3 (0.6)	2.0 (0.6)	2.2 (0.6)
KOOS-QOL	Mean (SD)	26.1 (16.6)	32.2 (13.6)	27.5 (16.1)
Baseline STV, mm ³	Mean (SD)	14,878.4 (10,349.3)	1405.0 (735.8)	11,693.8 (10,712.1)

*Patients with STV <3000 mm³ were defined post hoc as a population with minimal synovitis. BL, baseline; BMI, body mass index; IACS, intra-articular corticosteroid; IAHA, intra-articular hyaluronic acid; KL, Kellgren-Lawrence; KOOS-QOL, Knee Injury and Osteoarthritis Outcome Score-Quality of Life; OA, osteoarthritis; STV, synovial tissue volume; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.



*Imaging population: all pts from the safety population who had a diagnostic quality MRI pre-treatment and at least one post-BL. BL, baseline; LSM, least-squares mean; WK, week; WOMAC-A, Western Ontario and McMaster Universities Osteoarthritis Index (pain).

3699 Board #16

Effect Of Triamcinolone Acetonide Extended-release On Synovial Inflammation In Patients With Osteoarthritis Of The Knee

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Reported Relationships: S. Kelley: Salary; Flexion Therapeutics, Inc.. OOwnership/interest/stock; Flexion Therapeutics, Inc..

PURPOSE: Synovitis is common in osteoarthritis of the knee (OAK) and is associated with pain and disease severity. This open-label phase 3b study is evaluating the effect of an intra-articular (IA) injection of triamcinolone acetonide extended release (TA-ER) on synovial tissue volume (STV), pain, and function (NCT03529942). A prespecified analysis of the primary endpoint is reported.

METHODS: STV was determined using gadolinium MRI; synovitis was defined as pre-treatment STV ≥3000 mm³ (3 mL). All patients (pts) received TA-ER 32 mg at baseline (BL) and were assessed at Weeks 6, 12, 18, and 24. MRIs were repeated at Weeks 6 and 24. Interim analysis was performed for the primary efficacy endpoint, mean standardized change from BL in STV at 6 weeks. Planned enrollment was based on earlier studies.

RESULTS: We enrolled 116 OAK pts with typical OA characteristics (Table); 89 (77%) demonstrated synovitis at BL. STV was significantly reduced from BL at 6 weeks (P<0.001; Fig. 1A). The primary endpoint was met: standardized least squares mean change in STV was -1.13 (95% CI, -1.35 to -0.91; P<0.001). Western Ontario and McMaster Universities Osteoarthritis Index (pain) was significantly reduced at 6 weeks in all pts (Fig. 1B). 24 (20.7%) pts experienced ≥1 treatment-emergent adverse event (TEAE); 6 (5.2%) pts had ≥1 index-knee TEAE. All TEAEs were mild or moderate; none were treatment related.

CONCLUSIONS: At 6 weeks, a single TA-ER IA injection markedly reduced STV in pts with synovitis at BL. Marked symptomatic improvement was observed in all pts at 6 weeks following TA-ER.

3700 Board #17
Choosing Wisely Initiative: Analysis Of Twelve Years Of Therapeutic Ultrasound
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(No relevant relations reported)

In 2014, the Choosing Wisely Initiative partnered with the American Physical Therapy Association to produce a list of low-value physical therapy (PT) practices, titled “Five Things Physical Therapists and Patients Should Question.” This publication described the limited value of deep heat, or therapeutic ultrasound (TUS), to improve long term outcomes for a myriad of musculoskeletal conditions, yet TUS continues to be used. It is unclear how often TUS is used in contemporary PT practice, how its use has changed after this initiative and for what specific conditions it is most used.

PURPOSE: To assess the historical use of TUS by physical therapists before and after the Choosing Wisely Initiative across a regional health network. **METHODS:** A de-identified Clinical Research Data Warehouse was queried using i2B2 software to collect the history of TUS usage by PTs between 2008 and 2019. The specific CPT code 97035 was used to identify TUS episodes of care. In addition, the total number of unique patients in PT each year was collected. Indications for individual TUS treatment units were analyzed in 2018 and 2019 to yield the most frequent ICD-10 codes for which TUS was performed. **RESULTS:** Episodes of TUS were standardized by the total number of patients seen in PT each year to account for the growth of the health network. The percentage of patients who received TUS each year was reported. TUS usage rates between 2008 and 2019 were compared using Pearson’s two proportion Z-test. Utilization was significantly lower in 2019 (5.2%) than it was in 2008 (24.0%) (χ² = 2059.6, p-value < 2.2e-16). Between 2018 and 2019, 5,936 units of TUS were performed by 118 unique PT providers. TUS was commonly performed for shoulder pain (13.0%), ankle or foot pain (9.6%), neck pain (9.6%), knee pain (7.7%), hip pain (6.1%), low back pain (6.0%), unspecified chronic pain (4.3%), and Achilles tendinopathy (4.1%). **CONCLUSION:** Over the last 12 years, there has been a significant decrease in use of TUS by PTs. This decline coincides with the Choosing Wisely Initiative. However, TUS continues to be used, albeit at a significantly lower frequency, for treating musculoskeletal conditions despite having little evidence in improving long term clinical outcomes. Supported by NIH Grant UL1TR001436.

3701 Board #18
High-intensity Interval Training Improves Cardiorespiratory Fitness In Prior Non-responders To Traditional Aerobic Exercise
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PURPOSE: Although most people respond to traditional aerobic exercise and improve cardiorespiratory fitness (CRF), some do not respond, called non-responders, and they are often ignored. One theory of non-response is the lower intensity of

traditional exercise. This study was conducted to answer the important question, "Can high-intensity interval training (HIIT) improve CRF for prior non-responders?" **METHODS:** Participants were 8 (5 women, mean age 54) prior non-responders from the CardioRACE study who were at high-risk of cardiovascular disease including 35-70 years old with overweight/obesity and elevated/stage 1 hypertension. They previously participated in CardioRACE traditional continuous aerobic exercise for 3 times/week, 60 min/session, at 50-80% heart rate reserve [HRR]). They were identified as non-responders due to no or minimal increase in CRF (similar to <5% CRF increase) after 6 months of exercise, following the recommended non-responder definition that considers technical errors in CRF assessment and day-to-day variability. In this study, participants performed HIIT exercise 3 times/week, 30 min/session for 1 month, containing four 4-min high-intensity intervals at 85-95% HRR separated by three 3-min active recovery at 40-60% HRR with 5-min warm-up and cool-down. CRF was measured by maximal treadmill test using a Balke protocol. **RESULTS:** This short HIIT exercise significantly improved CRF with a mean increase of 8% from 26.7 to 28.8 ml/kg/min ($p < 0.01$ from paired t-test) in prior non-responders to traditional exercise (Figure 1). All participants improved CRF and 6 became responders. All high-risk participants safely completed HIIT with 100% attendance rate without adverse events. **CONCLUSION:** Even half the HIIT exercise time (30 min/session) over 1 month significantly improved CRF in prior non-responders. A long-term HIIT trial with a control group is necessary to confirm the findings. CardioRACE was supported by NIH Grant R01HL133069

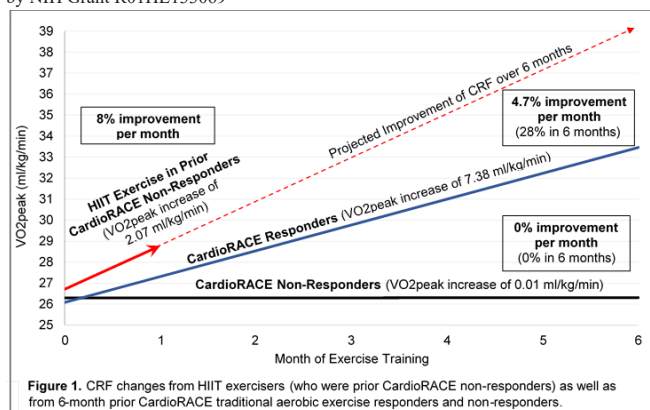


Figure 1. CRF changes from HIIT exercisers (who were prior CardioRACE non-responders) as well as from 6-month prior CardioRACE traditional aerobic exercise responders and non-responders.

3703 Board #20

Fitbit Analysis Shows Enhanced Mobility Of Knee Osteoarthritis Patients Treated With Triamcinolone Acetonide Extended Release

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(No relevant relations reported)

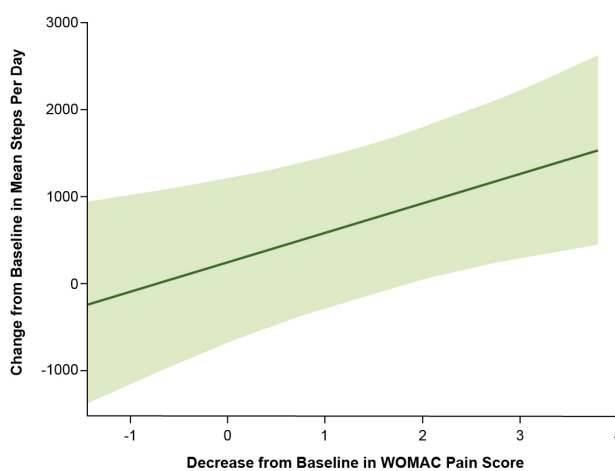
PURPOSE: In knee osteoarthritis (OAK), walking >6000 steps/day can prevent functional limitation (White DK. *Arthritis Care Res.* 2014;66:1328). Intra-articular triamcinolone acetonide extended-release (TA-ER) is approved for OAK pain. This Phase 3b study assessed safety and an exploratory endpoint of mobility (steps/day) in patients treated with TA-ER.

METHODS: OAK patients aged ≥40 years, symptomatic ≥6 months, with Western Ontario and McMaster Universities Osteoarthritis Index pain (WOMAC-A) score ≥6, and index-knee pain >15 days during the past month received TA-ER on Day 1. Movements were analyzed with a Fitbit® device (≥7 days prior to Day 1 to end of Week 12).

RESULTS: A total of 208 patients were treated with TA-ER; 67.8% had moderate-severe OAK, mean age of 60.8 years, and mean body mass index (BMI) of 31.4 kg/m². Baseline mean WOMAC pain score was 2.17. Mobility improved as seen by increases in weekly mean steps/day. 73 of 203 patients (36%) with sufficient step data at baseline had <6000 steps. Of these, 42 (57.5%) had ≥1 post-baseline week with average daily steps >6000; 19 (26.0%) had ≥50% of their follow-up with >6000 steps. Patients treated with TA-ER had mean changes from baseline in WOMAC pain scores of -1.4, -1.2, and -0.8 at Weeks 4, 8, and 12, respectively. A significantly greater change in steps from baseline was associated with decreases in WOMAC pain scores, male sex, lower BMI, lower baseline GPAQ average MET, and lower baseline steps/day. For every 1-unit decrease (from baseline) in mean WOMAC pain, mean steps/day increased by 339 (Figure 1).

CONCLUSIONS: OAK patients given TA-ER had increased mobility (≥6000 steps/day) as measured by fitness monitor which was associated with a decrease in pain. Limitations were incomplete adherence to monitor usage and a no comparator open-label design. Fitness monitors are a feasible tool to measure patient mobility and understand pain and function.

FIGURE 1. Effect of Change in WOMAC Pain Score from Baseline on Steps per Day



3702 Board #19

Strength Training Enhances Recovery After Surgery (STERAS)

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(No relevant relations reported)

Undergoing general anaesthetic and complex surgery is associated with significant risk. Compounding this, reduced muscle mass is proven to be linked to increased post-operative complications and increased length of stay. Exercise focused prehabilitation research is emergent and increasingly supportive of preventive strategies to improve post-surgical outcomes. **PURPOSE** To investigate the role of a multi-site strength focussed exercise intervention in improving patient condition prior to surgery to enhance recovery **METHODS** 43 (26 male, 17 females; 68.3 ± 9.3 years) patients scheduled for surgery were randomly assigned to one of 3 groups; 1) prehabilitation [pre-surgery exercise] 2) prehabilitation + rehabilitation [pre and post-surgery exercise] or 3) usual care. The exercise program consisted of an aerobic component and 6 resistance exercises targeting the major muscle groups. Primary outcomes were length of stay (days) and post-operative complications. Secondary measures included; whole body resistance, muscular strength, aerobic fitness, physical function and quality of life. **RESULTS** There was no difference in length of stay between groups (prehab: 11.2±10.3; pre+rehab: 13.2±6.2; control: 13.9±12.4). Post-operative complications were not different between groups. A significant time*group interaction was observed for isometric grip strength ($p=0.046$). Patients reported significantly greater quality of recovery in the prehab+rehab exercise group compared to control ($p=0.05$). No differences were observed between groups for whole body resistance, aerobic fitness, measures of physical function or self-reported quality of life. **CONCLUSION** The preliminary results of this study indicate resistance-based exercise training prior to and following surgery results in greater muscular strength and enhanced quality of recovery compared to current standard care practices. These findings provide promising support for the development of future strength focused prehabilitation programs to improve patient function prior to surgery and reduce the surgery stress response, promoting an accelerated recovery. Supported by WA Cancer and Palliative Care Network NMHS20193593; Spinnaker Medical Research Foundation

3704 Board #21

Sex Differences In Quadriceps Angiogenic Signaling And Muscle Capillary Supply After ACL Injury

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Following an Anterior Cruciate Ligament (ACL) reconstruction, females have worse functional outcomes; however, skeletal muscle biology has preferentially been studied in males. Muscle adaptation and recovery from injury are intimately tied to the muscle capillary network, which delivers oxygen, nutrients, and hormones to muscle fibers. **PURPOSE:** To examine differences in skeletal muscle angiogenic signaling and capillary supply in males and females after ACL injury. **METHODS:** Vastus lateralis (VL) biopsies were collected (24.6 ± 5.5 yr; 8M, 5F) from the ACL injured (INJ) and non-injured (NI) leg before reconstruction. Samples were assessed for vascular endothelial growth factor receptor 1 and 2 (VEGFR1 and VEGFR2) by western blot. Capillary to fiber ratio (C:F), capillary to fiber perimeter exchange index (CFPE), and capillary tortuosity (% fiber border directly contacting capillary wall) were assessed by immunohistochemistry. **RESULTS:** The percentage of phosphorylated relative to total VEGFR2 was not different between INJ and NI, but was lower in females ($76.9 \pm 4.1\%$) compared to males ($89.2 \pm 3.2\%$; $P = 0.043$). VEGFR2 abundance tended to be higher ($P = 0.098$) and C:F was lower (INJ: 2.3 ± 0.2 capillary•fiber⁻¹, NI: 2.6 ± 0.2 capillary•fiber⁻¹; $P = 0.018$) in INJ compared to NI, but neither parameter was different between sexes. VEGFR1 abundance displayed a sex by injury interaction ($P = 0.004$), with females having greater abundance of VEGFR1 in INJ (548 ± 54 A.U.) compared to NI (478 ± 53 A.U.; $P = 0.050$), while males showed the opposite (NI: 461 ± 42 A.U., INJ: 383 ± 42 A.U.). CFPE was lower in INJ compared to NI (INJ: 5.1 ± 0.3 capillary• $1000\mu\text{m}^{-1}$, NI: 5.8 ± 0.3 capillary• $1000\mu\text{m}^{-1}$; $P = 0.002$), and post-hoc analysis revealed that the difference was driven by females. Capillary tortuosity was lower in INJ ($13 \pm 2\%$) compared to NI ($17 \pm 2\%$) for females only ($P = 0.006$). **CONCLUSION:** Differences in angiogenic signaling between males and females in both INJ and NI limbs were evident, and ACL injury resulted in an exacerbated deficit in muscle capillary supply for females. These results support the idea that sex-specific differences in VL capillary network remodeling following ACL injury contribute to different functional outcomes following reconstruction and rehabilitation. Supported by NIH grants: R01 AR072061 and K23 AR062069.

3705 Board #22

Mechanistic Insights Into Using Aerobic Exercise To Remodel Tumor Vasculature And Increase Chemotherapy Efficacy

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Tumor blood vessels pose obstacles for drug delivery because they are hyper-permeable and non-functional. There is a critical need to identify safe methods to increase chemotherapy delivery to the tumor. **PURPOSE:** We demonstrated that aerobic exercise improves tumor vasculature function, in multiple disparate tumor models, causing increased chemotherapy delivery and efficacy in mice. Across models, exercise reduced tumor vessel permeability. Because aerobic exercise increases blood flow both in healthy and tumor vessels, we aimed to investigate shear stress responsive mechanisms by which exercise may reduce tumor vessel permeability. **METHODS:** *In vivo* approaches including pharmacologic agents, a forced treadmill model of moderate aerobic exercise, and transgenic mouse models were utilized in combination with *in vitro* modeling of exercise induced shear stress, using a cone and plate viscometer. **RESULTS:** In tumor endothelium, we found the flow responsive kinase and co-transcriptional activator extracellular signal-regulated kinase 5 (ERK5) regulates tumor vessel permeability, similar to exercise. ERK5 activation in response to exercise was investigated *in vivo*, using a Krüppel like factor 2 (KLF2) reporter mouse. KLF2 is a well-defined downstream target of ERK5. KLF2 was upregulated by exercise in the lung and aorta endothelium providing the first evidence for the involvement of ERK5 activation in response to aerobic exercise. Based on this and our previous data demonstrating that exercise induced shear stress upregulates spingosine-1 phosphate receptor 1 (S1PR1) on tumor vessels, we hypothesized that exercise activates ERK5, causing S1PR1 upregulation and decreasing permeability in tumor endothelium. To investigate this, we modeled basal tumor vasculature (low shear stress, 3 dynes/cm²) and exercise-induced flow (high shear stress, 15 dynes/cm²) with a cone and plate viscometer *in vitro*. We found the ERK5 axis has a similar flow responsive pattern as S1PR1. Further, ERK5 directly regulates S1PR1 in cultured endothelial cells revealing a novel EC pathway, the ERK5-S1PR1 axis. **CONCLUSION:** In summary, our data

identifies the ERK5-S1PR1 axis as a potential exercise responsive pathway in tumor and healthy vasculature. We are currently investigating activation of the ERK5 axis in tumor vasculature.

3706 Board #23

The Impact Of High Intensity Interval Training On Fitness, Stress And Immunity In Breast Cancer Survivors

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PURPOSE: The aim of this study was to explore the impact of exercise intensity on aerobic fitness and autonomic cardiac regulation (heart rate variability (HRV)) and salivary biomarkers of the stress systems (HPA-axis, cortisol; sympathetic nervous system, α -amylase) and mucosal immunity (secretory(s)-IgA), in breast cancer survivors.

METHODS: Seventeen participants (62 ± 8 years) were randomly assigned to: 1) high intensity interval training (HIIT; n = 6); 2) moderate-intensity, continuous aerobic training (CMIT; n = 5); or 3) a wait-list control (CON; n = 6) for a 12-week (36 session) stationary cycling intervention. Cardiorespiratory fitness ($\text{VO}_{2\text{peak}}$), resting HRV and salivary biomarkers were measured at baseline 2-4 d pre-intervention and 2-4 d post the last exercise session.

RESULTS: A significant improvement ($p \leq 0.05$) was observed for $\text{VO}_{2\text{peak}}$ in the HIIT group; 19.3% ($B = 3.98$, $95\%CI = [1.89; 46.02]$) and a non-significant increase in the CMIT group; 5.6% ($B = 1.96$, $95\%CI = [-0.11; 4.03]$), compared with a 2.6% ($B = -0.64$, $95\%CI = [-2.10; 0.82]$) decrease in the CON group. Post intervention improvements in HRV markers of vagal activity ($\log(\ln)LF/HF$, $\ln\text{RMSSD}$) and sympathetic nervous system (α -amylase waking response) occurred for individuals exhibiting outlying ($> 95\%$ CI) levels at baseline compared to general population.

CONCLUSIONS: HIIT (compared to CMIT and CON) improved cardiorespiratory fitness in breast cancer survivors. Non-invasive measures of the autonomic nervous system, stress systems and mucosal immunity should be explored further to understand the individualised responses to training adaptations within the breast cancer population.

3707 Board #24

A Longitudinal Study Of Combined Exercise Intervention With Internet And Social Media For Breast Cancer Patient

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PURPOSE: Breast cancer patients in treatment suffer from long-term side effects that seriously influence their physical and mental health. The aim of this study was to examine differences in health-related outcomes between a 12-week remotely-guided combined exercise (CE) intervention group and a usual care (UC) group after one year for breast cancer patients.

METHODS: In phases I-III, 60 patients (51.2 ± 7.9 years) with breast cancer (BC) who completed chemotherapy/ postoperative radiotherapy within the previous 4 months to 2 years participated in a randomized controlled trial intervention of combined exercise with remote guidance. Eligible participants were approached to assess cancer-related quality of life (QOL), muscle strength, cardiorespiratory endurance and physical activity (PA) barriers after one year.

RESULTS: The result demonstrated that after one year the CE group reported higher in vitality-related QOL (5.776, CI 0.987, 10.565, ES=0.360), mental health-related QOL (9.938, CI 4.146, 15.729, ES=0.512), leg strength and endurance (2.880, CI 1.337, 4.423, ES=0.557), strength and endurance of upper extremities (2.745, CI 1.076, 4.415, ES=0.491), and lower physical activity (PA) hindrance (5.120, CI 1.976, 8.264, ES=0.486) than the UC group.

CONCLUSIONS: The CE group had significant differences from the UC group in quality of life, muscle strength, cardiopulmonary endurance and physical activity participation. These findings showed that the combined exercise intervention with remote guidance produce a long-term benefits for breast cancer patients.

3708 Board #25

Associations Between Physical Activity, Quality Of Life And Emotional Well-being During Active Surveillance For Prostate Cancer

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PURPOSE: The purpose of this retrospective longitudinal study was to examine the association between post-diagnosis physical activity (PA), and the change in quality of life (QoL) and emotional well-being over time in men on active surveillance (AS) for low-risk prostate cancer. **METHODS:** Our analysis included 630 participants from AS initiation until AS discontinuation or loss to follow up. A modified Godin Leisure-Time Exercise Questionnaire was used to measure post-diagnosis PA in metabolic equivalent-minutes per week (MET-min/wk). Participants were categorized based on their PA levels: inactive (<210 MET-min/wk), insufficiently active (210-499 MET-min/wk), active (500-1000 MET-min/wk), and highly active (>1000 MET-min/wk). QoL and emotional well-being were assessed by the Patient-Oriented Prostate Utility Scale. The association between post-diagnosis PA (independent variable) and QoL (dependent variable) was assessed using generalized estimated equations (GEE). GEEs were also used to determine the association between PA (independent variable) and emotional well-being (dependent variable). All models adjusted for participant's age. **RESULTS:** Compared to inactive participants, active (β1.14; 95%CI= 0.11, 2.16, $p=0.029$) and highly active (β1.62; 95%CI= 0.58, 2.67; $p=0.002$) participants had higher QOL during AS. Highly active participants were more likely to experience high emotional well-being (OR =1.55 95%CI = 1.11, 2.16; $p=0.010$) over time compared to their inactive counterparts. In a subgroup analysis for men with low emotional well-being early on during AS, engaging in > 1000 MET-min/wk (highly active) was associated with greater odds of experiencing high emotional well-being over time (OR = 2.17; 95%CI = 1.06, 4.46, $p=0.034$) relative to lowest PA (<210 MET-min/wk). **CONCLUSIONS:** Our findings emphasize the importance of PA as a supportive care strategy during AS for low-risk prostate cancer.

3709 Board #26

Reliability Of The Athlete Diet Index: A Rapid Dietary Assessment Tool For Athletes

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Diet quality indices are a practical and inexpensive way to evaluate dietary patterns and adherence to nutrition guidelines. While the diet quality of athletes has been reported using population indices, there is currently no reliable athlete-specific diet index. **PURPOSE:** To assess the reliability of the recently developed Athlete Diet Index (ADI) in athletes. **METHODS:** Eighty-three athletes (55 female; 18.9±4.2 years) from a state-based Australian sports institute consented to complete the ADI deployed using FileMaker™ Pro 16 (FileMaker Inc., 2017, Santa Clara, USA) on a portable device (iPad mini™) on two occasions two weeks apart between June and December, 2019. Sixty-eight athletes completed the ADI on two occasions. Scoring (maximum=125) was based on population guidelines and international sports nutrition recommendations. Scored ADI items measured intake of core and discretionary foods, and markers of dietary habits relevant to athletes. Reliability was evaluated by comparing ADI scores of the first and second administrations using paired t-tests, intra-class correlation coefficients (ICC) and Bland-Altman plots (limits of agreement (LOA) set at mean±1.96SD, and bias determined via regression analysis) all conducted using SPSS Statistics version 26 (IBM Corp, Armonk, NY, USA). **RESULTS:** In preliminary analyses, the mean ADI score was 84.1±15.2 (range 42.5-114.0, median 85.0). There was no difference between ADI scores on the two occasions of administration, mean difference 1.94 (95% CI: -0.49, 4.38, $P=0.117$) (paired t-test). The ICC was very good (ICC=0.80, 95% CI: 0.69, 0.87, $P<0.0001$). Bland-Altman analysis showed a mean difference of 1.94 (LOA -17.79, 21.60) and the regression line demonstrated no indication of systematic bias ($y=4.57-0.03*x$) (95% CI: -0.19, 0.13, $P=0.701$). There were no differences in serves of fruit, vegetables and grains between

administrations; while differences were reported in serves of meat (1.69 vs 1.55, $P=0.01$) and discretionary foods (1.83 vs 1.86, $P<0.0001$). **CONCLUSIONS:** The ADI is a novel athlete-specific diet index which has demonstrated very good reliability in athletes, providing practitioners with a promising measure of usual dietary intake. Further evaluation of the ADI, including validation compared to established dietary methodology, is warranted.

3710 Board #27

Abstract Withdrawn

3711 Board #28

Effects Of Mitochondria-targeted Antioxidant Supplementation On The Transcriptional Response To Exercise And Cycling Performance

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Oral supplementation with general antioxidants has little impact on performance and, in some cases, interferes with training-induced adaptations that improve performance. This may be attributed to the non-specific nature of most antioxidant supplements. Mitochondria-targeted antioxidants are becoming popular amongst active individuals as they are specifically designed to accumulate within the mitochondria to provide more targeted protection against oxidative damage. The aim of this research was to investigate the effect of MitoQ on 1) the transcriptional response to high intensity interval exercise (HIIE) and HIIT training (HIIT) -induced changes in performance and 2) cycling performance in trained cyclists.

To understand how MitoQ supplementation during training affects the transcriptional response to HIIE and HIIT-induced changes in performance, twenty-three untrained middle-aged (age 44.6 ± 8 years) men were randomised to receive MitoQ (20 mg/d) or a placebo before completing HIIE (cycle ergometer, 10 x 60s at VO₂ peak workload with 75s rest) and HIIT (3 x wk for 3 wk). Mitochondrial and antioxidant gene expression were measured in muscle biopsies collected before, immediately and 3 hr after HIIE and VO₂ peak and 20 km time trial performance were measured before and after HIIT. To further elucidate where MitoQ could be an ergogenic aid, twenty trained (VO₂ peak 55.1 ± 13.2 ml.kg.min⁻¹), middle-aged (age 44 ± 3 years) male cyclists were randomly assigned to the order in which they received MitoQ (20 mg/d) and the placebo for 6 weeks before completing a performance test (cycling at 70% VO₂ peak for 45 min followed by an 8 km time trial). In untrained men, expression of peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC1-α) was increased 3 hr after HIIE and this effect was increased by MitoQ (Cohen's d = 0.89). While VO₂ peak and 20 km time trial performance improved similarly in the MitoQ and placebo group after HIIT, the improvement in peak power output (PPO) achieved during the VO₂ peak test was greater in the MitoQ group (by 5.8%, $p=0.03$). MitoQ also significantly improved 8 km time trial performance in trained cyclists. These results suggest that MitoQ may augment exercise-induced increases in PGC1α expression and improve cycling performance when taken during exercise training.

3712 Board #29

Fit And Fast Versus Slow And Steady: The Relationship Between Fitness And Cognitive Performance In Males And Females

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PURPOSE: Previous research shows aerobic fitness influences attentional inhibition. However, few studies have reported a differential relationship between aerobic fitness and inhibition between males and females. This study investigated the relationship between fitness and inhibitory performance in college-aged males and females.

METHODS: Seventy-nine young adults (M: 19.90 ± 1.1 yrs; 48 females) completed measurements of physical fitness (VO₂max test) and inhibitory control (modified flanker task). Moderation analyses were conducted to determine the influence of sex on the relationship between aerobic fitness and inhibitory control.

RESULTS: RT, response accuracy, and percentage of commission errors were regressed onto mean-centered fitness (VO₂max percentiles), sex, and the interaction between fitness and sex. Fitness was significantly correlated with congruent accuracy ($p < 0.05$), but not correlated with incongruent accuracy ($p = NS$) or RT ($p = NS$). Fitness was negatively correlated with total commission errors ($p = NS$). The interaction between fitness and sex revealed males who are more fit are faster in both congruent ($p < 0.05$) and incongruent responses ($p < 0.05$), whereas fitter females are slower in both congruent ($p < 0.05$) and incongruent responses ($p < 0.05$).

Interestingly, fitter males are significantly less accurate during incongruent trials ($p < 0.005$), whereas females did not differ in accuracy based on fitness ($p = \text{NS}$). Neither males nor females differed in accuracy based on fitness for congruent trials. Similarly, fitter males have a greater percentage of incongruent commission errors ($p < 0.005$) but no differences in congruent commission errors ($p = \text{NS}$), whereas in females, fitness did not influence percentage of congruent ($p = \text{NS}$) or incongruent commission errors ($p = \text{NS}$).

CONCLUSIONS: These results suggest that aerobic fitness may differentially influence flanker performance, particularly in the more challenging condition, in males and females. Furthermore, males and females may adopt different strategies in the difficult condition to maintain performance. These results suggest that while higher fit females may slow down in order to maintain accuracy, higher fit males may have faster responses at the expense of errors.

3713 Board #30

Alzheimer's Disease-related Gene Expression Is Reduced Following Six Months Of High-intensity Exercise

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Extensive research supports the use of exercise to protect against Alzheimer's disease (AD). Nevertheless, there is limited evidence from human studies regarding the mechanisms underlying the positive effects of exercise on the brain. Gene expression determines the extent to which a gene is "turned on or off" and can be used to understand mechanistic pathways. Animal research has demonstrated that exercise influences the expression of genes related to various AD biological pathways; however, the impact of exercise on AD-related gene expression has not yet been studied in humans. **PURPOSE:** To examine changes in AD-related gene expression following a six-month high-intensity exercise intervention.

METHODS: Cognitively normal men and women (60-80y) were randomised to either six-months of work-matched high-intensity exercise ($n=33$), moderate-intensity exercise ($n=34$) or an inactive control group ($n=32$). Blood samples were collected pre- and post-intervention and expression levels from a panel of genes implicated in AD were measured. Analysis of covariance (covaried for age and gender), with adjustment for multiple comparisons, was conducted to determine group differences. **RESULTS:** Decreases in AD-related gene expression following six months of exercise, compared with the control group. More specifically, gene expression associated with cholesterol metabolism (ABCA1; $p < 0.001$), amyloid precursor protein processing (ADAM17, BACE1; $p < 0.05$) and synaptic plasticity (UCHL1; $p < 0.001$) was favourably altered in the high-intensity exercise intervention, compared with the moderate-intensity intervention and control groups. **CONCLUSIONS:** Investigation of AD-related gene expression has the potential to play an important role in understanding the biological pathways by which exercise reduces AD risk and contributes to enhanced cognitive health. The current work indicates a dose-dependent effect of exercise intensity on the expression of genes associated with AD, revealing mechanistic pathways that require further investigation.

3714 Board #31

The Role Of Apolipoprotein ε4 Allele Carriage In Exercise-induced Cognitive Change

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Emerging evidence indicates that there may be substantial individual variability in exercise-induced cognitive enhancement, which likely contributes to the inconsistent findings regarding exercise and cognition across the literature. Previous research is inconclusive with respect to how genetic risk for Alzheimer's disease (defined by apolipoprotein, APOE, ε4 allele carriage) modulates the relationship between exercise and cognitive health. **PURPOSE:** To examine the moderating effect of apolipoprotein E (APOE) ε4 allele carriage on cognition following a six-month exercise intervention. **METHODS:** Ninety-nine cognitively normal men and women (aged 60-80 years) were randomised to either six-months of high-intensity exercise ($n=33$), moderate-intensity exercise ($n=34$) or an inactive control group ($n=32$). All participants underwent verbal

learning and memory assessment using the California Verbal Learning Test (CVLT) at pre- and post-intervention. A series of linear mixed-models were undertaken to examine the effects of a group*time, and group*time*APOE ε4 interaction term on repeated CVLT assessments. **RESULTS:** No effect of group*time was observed on any of the CVLT sub-scores. However, an effect of group*time*APOE ε4 was observed for CVLT learning ($d=0.87$, $p < 0.01$) and CVLT short delay recall ($d=0.67$, $p < 0.05$). Post-hoc analyses revealed only carriers of the APOE ε4 allele received benefit from the high-intensity intervention, compared with the moderate-intensity and control groups. **CONCLUSIONS:** No changes in verbal learning and memory were observed from pre- to post-exercise intervention in the whole cohort. However, we observed that APOE ε4 carriers received benefit from the high-intensity exercise intervention in terms of improvement on tasks assessing memory and thinking. Our results indicate that individuals at greater risk of AD, and thus more likely to be experiencing a degree of cognitive decline, may benefit most from exercise.

3715 Board #32

Sex Differences In The Clinical Sequelae Of Exertional Heat Stroke In Military Servicemembers

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Exertional heat stroke (EHS) represents a significant source of morbidity and mortality for the military and other occupational and athletic populations. EHS patients tend to present with elevated biomarkers of acute liver and kidney injury, rhabdomyolysis, and altered hematological parameters. However, little is known about how men and women may respond differently to EHS, in terms of clinical severity and/or biochemical responses. **PURPOSE:** The aim of this study was to characterize clinical and biochemical differences between male and female servicemembers immediately following an EHS episode. **METHODS:** We performed a retrospective analysis of EHS patient records in all US military personnel (41% between 20-24 years old) from 2008-2014 using the Military Health Systems Data Repository. We compared diagnoses of organ failure during the course of treatment and clinical laboratory markers of end organ damage. Sex differences in clinical outcomes are presented with odds ratios, and biomarker differences are presented as the median difference with 95% confidence intervals in brackets. **RESULTS:** A total of 2,529 EHS cases were recorded with 9.8% [8.7, 11.2] occurring in women. Per patient treatment cost was lower in women by \$1110 [620, 1647]. Men were 2.35 [1.6, 3.58] times more likely to experience renal failure ($p < .001$). Blood urea nitrogen, (difference = -121.05 mg/dL [41.9, 182.28]), myoglobin (difference = 3 ng/mL [2, 4]), aspartate transaminase (difference = 7 units/L [1, 14]), and alanine transaminase (difference = 13 units/L [8.5, 15.92]) were elevated in men (all $p < .01$). Platelet count was also lower in men compared to women (difference = -22.14×10^3 per uL [-39.25, -2.99], $p = 0.03$). **CONCLUSION:** Female servicemembers appear to have a slightly less severe response to EHS compared to their male counterparts. In particular, renal failure was more common, and numerous markers of end-organ damage (hepatic, renal, and cardiovascular) were more likely to be elevated immediately following EHS in men. Supported by USAMRDC; author views not official US Army or DoD policy.

3716 Board #33

Relationship Between Body Composition And Sport-specific Performance Metrics In Ncaa Di Female Volleyball Players

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PURPOSE: The present study examined the relationship between body composition and sport-specific performance markers in NCAA Division I female volleyball players. **METHODS:** Twelve NCAA DI female volleyball players were assessed for body composition [body mass (BM), fat mass (FM), fat-free mass (FFM), body fat % (BF%)] via air displacement plethysmography (BODPOD) and sport-specific performance metrics [standing vertical jump (SVJ), pull-ups (PU), power clean (PC), back squat (BS), bench press (BP), and 5-10-5 pro agility shuttle (PA)] pre-, mid-, and post-season. Pearson and partial correlations assessed the relationships between FM, FFM, and performance metrics. **RESULTS:** FM and FFM were highly correlated ($r=0.521$, $p<0.01$). FM and PC were correlated ($r=0.405$, $p=0.01$) when assessed via Pearson correlation but no longer correlated when controlling for FFM (partial correlation, $r=0.084$, $p<0.05$). FM and SVJ were correlated when controlling for FFM ($r=-0.477$, $p<0.05$). FFM was correlated (Pearson, $p<0.05$) with BP ($r=0.335$), PC ($r=0.748$), SVJ ($r=0.659$), and PA ($r=-0.373$). When controlling for FM, partial correlations ($p<0.03$) existed between FFM and PC ($r=0.653$), SVJ ($r=0.707$), and PA ($r=-0.407$). **CONCLUSION:** SVJ was the only performance variable that correlated

with FM when controlling for FFM. FFM was positively correlated with PC and SVJ, and negatively with PA when controlling for FM. This suggests greater amounts of FFM are more advantageous for performance in the PC (lift greater amounts of weight) and PA (perform in less time) than having low FM, while having low FM or greater FFM are both advantageous for SVJ (greater jump height).

3717 Board #34

Validity And Reliability Of A Portable Metabolic Analyzer For Assessing Oxygen Consumption And Ventilation

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(No relevant relations reported)

Metabolic analyzers are standard tools in research-based, exercise physiology laboratories in university settings. Portable, low-cost metabolic analyzers have the capacity to extend the value of metabolic gas analysis beyond the traditional laboratory setting. **PURPOSE:** This study's purpose was to assess validity and reliability of a portable, low-cost metabolic analyzer (VPRO) for assessment of oxygen consumption (VO₂) and minute ventilation (VE) during progressive cycling testing. **METHODS:** In Protocol 1, eight male participants (height: 171.9 ± 5.8 cm, weight: 79.6 ± 8.3 kg, age: 41.0 ± 12.3 years) with previous competitive cycling experience ranging from 2-40 years completed an hour-long stationary cycling protocol twice, progressing from 100-300 Watts every 10-12 minutes while wearing the VPRO and a criterion measure (PMED) for five minutes each, at each stage. In Protocol 2, 16 recreationally active male participants (height: 168.2 ± 8.4 cm, weight: 76.5 ± 13.3 kg, age: 23.0 ± 9.4 years) completed three incremental, maximal stationary cycling tests wearing one of three analyzers for each test (VPRO version 1.1.1, VPRO version 1.2.1, PMED). Mean absolute percent differences (MAPD) ≤10% were deemed acceptable validity/reliability. **RESULTS:** For Protocol 1 and convergent validity, the VPRO had mean absolute differences from the PMED of <0.3 L/min for absolute VO₂ and <5 L/min for VE overall and at each exercise stage. MAPD for VO₂ and VE were <9% overall and <12% at each exercise stage. Test-retest reliability of VO₂ and VE of the VPRO (MAPD: 8.9-11.0%) was lower than the PMED (MAPD: 4.7-7.6%). For Protocol 2, validity was similar for both VPRO versions (MAPD ~12% overall) compared to the PMED for VO₂ and VE. **CONCLUSIONS:** The VPRO had an acceptable validity and test-retest reliability for most variables and intensities tested and may be an appealing option for VO₂ and VE analysis.

3718 Board #35

The Effects Of Acute Resistance Exercise On Bioelectrical Impedance Analysis Measures Of Body Composition

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PURPOSE: The purpose of this study was to determine if acute, localized resistance exercise (RE) compromises the validity of BIA total body composition estimates. **METHODS:** In a crossover design, 16 healthy, resistance trained adults, including 7 females (age: 22.7 ± 1.9 y; height: 165.4 ± 8.4 cm; body mass: 62.1 ± 10.9 kg; body fat: 25.9 ± 7.3%) and 9 males (age: 24.3 ± 3.6 y; height: 179.1 ± 5.1 cm; body mass: 88.0 ± 7.6 kg; body fat: 18.4 ± 6.6%) completed three conditions in a randomized order: lower-body resistance exercise (RE_{LOWER}), upper-body resistance exercise (RE_{UPPER}), and no exercise (REST). A warm-up consisting of 2 sets of 12-15 repetitions of 3 upper- or lower-body exercises, followed by 5 sets of 10 repetitions per exercise, with 1-minute rest intervals. BIA (InBody 770) was completed immediately pre and post-exercise and at 15-, 30-, and 60-minutes post-exercise. BIA estimates of fat mass (FM) and fat-free mass (FFM) were analyzed using 3 x 5 (condition x time) ANOVA with repeated measures, follow-up pairwise comparisons, and evaluation of the partial eta-squared (η_p^2) effect sizes. **RESULTS:** Pre-exercise FM and FFM did not differ between conditions (0.1 to 0.4 kg; $p > 0.4$ for all). Condition x time interactions were present for both FM ($p < 0.0001$, $\eta_p^2 = 0.48$) and FFM ($p < 0.0001$, $\eta_p^2 = 0.45$). Pairwise comparisons indicated that FM was lower in the RE_{UPPER} condition as compared to both REST (1.5 kg; $p < 0.001$) and RE_{LOWER} (1.3 kg; $p < 0.001$) conditions immediately post-exercise. These differences remained at 15-, 30-, and 60-minutes post-exercise (0.6 to 1.6 kg; $p \leq 0.01$ for all). Pairwise comparisons also indicated that FFM was higher in the RE_{UPPER} condition as compared to both REST (1.3 kg; $p < 0.001$) and RE_{LOWER} (0.9 kg; $p < 0.01$) conditions immediately post-exercise. These differences remained at 15- and 30-minutes post-exercise (0.8 to 1.3 kg; $p \leq 0.02$ for all). At 60-minutes post-exercise, FFM remained higher in RE_{UPPER} as compared to REST (1.0 kg; $p = 0.005$) but no longer differed between RE_{UPPER} and RE_{LOWER} (0.4 kg; $p = 0.44$).

CONCLUSION: These data indicate that acute upper-body RE compromises the validity of BIA total body composition estimates compared to REST and lower-body RE and reinforces exercise abstinence as a pre-test consideration.

3719 Board #36

The Effects Of Acute Resistance Exercise On Dual-Energy X-Ray Absorptiometry Measures Of Body Composition

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PURPOSE: The purpose of this study was to determine if acute, localized resistance exercise disrupts the validity of DXA total body composition estimates. **METHODS:** In a crossover design, 18 healthy, resistance-trained, college-aged adults, including 7 females (age: 22.7 ± 1.9 y; height: 165.4 ± 8.4 cm; body mass: 62.1 ± 10.9 kg; body fat: 25.9 ± 7.3%) and 11 males (age: 24.2 ± 4.1 y; height: 180.0 ± 5.1 cm; body mass: 90.2 ± 9.5 kg; body fat: 18.7 ± 7.2%) completed three conditions in a randomized order: lower-body resistance exercise (RE_{LOWER}), upper-body resistance exercise (RE_{UPPER}), and rest (REST). The resistance exercise (RE) protocol consisted of a RE warm-up consisting of 2 sets of 12-15 repetitions of 3 upper-body exercises (upper), or 3 lower-body exercises (lower) or nothing (rest). The RE circuit consisted of 5 sets of 10 repetitions per exercise, with 1-minute rest intervals between circuits. A DXA scan was performed immediately before exercise and at 60 minutes post exercise. DXA estimates of fat mass (FM) and fat-free mass (FFM; calculated as lean soft tissue plus bone mineral content) were analyzed using 3 x 2 (condition x time) analysis of variance with repeated measures, follow-up pairwise comparisons, and evaluation of the partial eta-squared (η_p^2) effect sizes. **RESULTS:** Pre-exercise FM and FFM did not differ between conditions (0.2 to 0.4 kg; $p > 0.14$ for all). For FM, no statistically significant interaction or main effects were present (interaction: $p = 0.80$, $\eta_p^2 = 0.01$; time main effect: $p = 0.14$, $\eta_p^2 = 0.12$; condition main effect: $p = 0.92$, $\eta_p^2 = 0.01$). For FFM, no statistically significant interaction ($p = 0.13$, $\eta_p^2 = 0.12$) or condition main effect ($p = 0.56$, $\eta_p^2 = 0.03$) was present. However, a statistically significant time main effect was present ($p = 0.009$, $\eta_p^2 = 0.34$). Pairwise comparisons indicated that post-condition FFM estimates were 0.20 ± 0.07 kg lower than pre-condition values in all conditions combined. **CONCLUSIONS:** No differences were seen among conditions, indicating that DXA total body composition estimates may be relatively robust to the effects of acute, localized RE. However, investigation of segmental estimates is warranted due to RE-induced blood flow redistribution.

3720 Board #37

High School Basketball Coach And Player Perspectives About Warm Up Routines And Lower Extremity Injuries

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PURPOSE: To understand high school basketball coach and player routines, knowledge and attitudes relating to warm-ups and lower-extremity injuries (LEIs). **METHODS:** A prospective qualitative study using data from semi-structured interviews with high school basketball coaches and players conducted from May-October 2019, then thematically analyzed by multiple coders employing team coding. **RESULTS:** We interviewed n=12 coaches (9 male; 3 female) and n=30 players (11 male; 19 female). **Current warm-up.** Coaches and players report regular engagement in warm-up routines, but the types of exercises, time dedicated (range: 5-45 minutes) and exercise order varied. Coaches often rely on players to co-lead warm-up exercises. **Knowledge and beliefs re: LEI prevention research.** Most coaches and players believe that regularly engaging in a warm-up routine is effective at preventing injury ("...warming up is absolutely important. There's no disputing."), but lack thorough knowledge of the current evidence ("I have a general interest in sports and fitness...[but] I can't give you any specific...sources."). **Barriers.** Warm-up routines suffer at games due to limited time and space ("Game-[time] is the worst time."). Some players and coaches perceive youth as impervious to injury and minimize warm-up ("I remember being 16 and 17...[you get] out of bed and [you] just run two miles and you're fine."). Coaches face multiple demands during practice, which can impede their focus on a warm-up routine ("...as a coach, [warm-up] is hard...you don't have a lot of time...You want to get right to the point [of practice]."). Coaches also expressed concern that they lack adequate knowledge to select the best exercises and skills to teach their players how to perform them correctly ("...what stretches

are out there. I don't think I know all of them.”). **Enablers.** Players' past injury experience was a key motivator for warming-up (“I'd just put on my shoes and I'd start playing...[until I hurt]...My knee.”). Coach encouragement was also a motivator for players. **CONCLUSION:** Regular involvement in basketball warm-up routines was common among high school teams, but the methods and time dedicated to these practices varied. Players and coaches are eager for more information on warm-ups shown to reduce LEIs, as well as targeted strategies to effectively implement these routines.

3721 Board #38
Validity And Reliability Of A Lower Body Power Test In Older Adults

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Lower body power declines with age and is associated with decreased physical function in older adults. However, current tools to assess muscle power are expensive and non-portable which limits their widespread use. **PURPOSE:** The purpose of the study was to assess the validity and reliability of a functional sit-to-stand power test (STS) in older adults by comparing it with pneumatic leg press, which is widely used in clinical trials to measure lower body power. **METHODS:** A total of 51 community-dwelling adults, 65 years or older, were recruited. Lower body peak power was assessed using a portable linear transducer and a pneumatic leg press. The highest peak power across three attempts with 1 min of rest in between was used for the analysis. To assess construct validity of the STS test, the participants completed the 8-Foot Up and Go (8' UG) test, at both usual and fast pace, and the Short Physical Performance Battery (SPPB) that rates participants from 0 (worst performance) to 12 (best performance) based on balance, usual walk speed, and chair stand tests. A two-week test-retest was conducted to assess reliability in 36 participants. Pearson's correlation coefficient was used to assess construct validity while intra-class correlation (ICC) was used to assess reliability. **RESULTS:** The mean age of the sample was 71.3 yrs, with 62% females, and an average SPPB score of 10.6. Peak power assessed using STS showed a high correlation (0.88, $P < .01$) compared to the pneumatic leg press. As hypothesized in our pre-registered protocol, the STS test showed similar or greater correlation compared to pneumatic leg press for SPPB (0.30 vs. 0.40), chair stand test (-0.37 vs. -0.46), 8' UG test at usual pace (-0.28 vs. -0.37) and fast pace (-0.35 vs. -0.41) and balance (0.23 vs. 0.33). The test-retest assessment yielded an ICC of 0.99 and 0.95 for leg press and STS, respectively. All values were statistically significant ($P < .05$). **CONCLUSION:** The novel functional STS test is comparable to the pneumatic leg press in measuring lower body power. The STS test is relatively inexpensive, portable, takes less space, and should be considered for further validation and future implementation.

3722 Board #39
INFLUENCE OF GENETIC BACKGROUND ON HEART MITOCHONDRIAL DNA LESIONS AND COPY NUMBER IN INBRED MICE

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PURPOSE: The heart is a critical tissue responsible for facilitating a multitude of endurance training adaptations in aerobic capacity. Mechanisms of heart mitochondrial DNA (mtDNA) repair remain incompletely understood, and genetic susceptibility to exercise-induced mitochondrial-derived oxidative damage may be present. mtDNA damage presents as an indirect measure of mitochondrial-derived oxidative stress, while mtDNA copy number is a correlate of mitochondrial biogenesis. As two critical aspects for enhancing trainability in aerobic capacity, the purpose of this study was to characterize heart mtDNA lesions and copy number in a genetically diverse panel of male inbred mouse strains. **METHODS:** A genetically diverse panel of 34 inbred mouse strains were selected, and hearts of male mice ($n = 184$; 2 - 6 mice per strain) were removed and weighed. DNA was and a gene-specific quantitative PCR-based assay was used to measure mtDNA lesions and copy number.

RESULTS: Among the strains, we found significant interstrain variation in mtDNA lesions (range = -0.15 - 4.0 mtDNA lesions/10Kb) and copy number (range = 3682 - 111895 mtDNA copies). We observed that the wild-derived PWD/PhJ strain had the highest overall heart mtDNA lesions (PWD/PhJ = 4.31 ± 0.07 mtDNA lesions/10Kb vs all other strains = 0.25 ± 0.42 mtDNA lesions/10Kb; $p < 0.0001$), while having the lowest overall mean mtDNA copy number (PWD/PhJ = $6,538 \pm 898$ mtDNA copies vs all other strains = $54,943 \pm 27,085$ mtDNA copies; $p < 0.0001$). We did not find an association between mtDNA lesions or copy number with exercise capacity or heart

weight. **CONCLUSIONS:** Our results demonstrate that there are inherent differences in heart mtDNA damage and copy number. Interestingly, the wild-derived PWD/PhJ strain had higher overall mtDNA lesions, complemented by lower mtDNA copies, possibly suggesting the hearts of this strain undergo more significant mitochondrial-derived oxidative stress (e.g. higher fission vs fusion; mitophagy) compared to others. Thus, ongoing work aims to 1) characterize markers of mitochondrial-derived oxidative stress (i.e., fission/fusion; mitophagy), 2) sequence the complete mitochondrial genome and determine levels of heteroplasmy and indels that may associate with mtDNA damage and copy number.

3723 Board #40
Acculturation And 24-hour Behaviors In Asian American Women

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PURPOSE: Asian American (AA) women have elevated cardiovascular disease (CVD) risk but are an understudied minority group. Physical activity (PA), sedentary behavior (SB) and sleep duration are recognized as independent CVD risk factors, yet these behaviors have not been well described in this population. The study's purpose was to describe AA women's 24-hour behaviors and explore how these relate to acculturation. **METHODS:** Participants were middle-aged normotensive AA immigrant women living in New York City. They completed measures of acculturation along with 7 days of wrist and hip actigraphy to measure sleep duration, moderate-vigorous PA (MVPA), light intensity PA (LIPA) and SB. MVPA, LIPA, and SB were classified by Freedson(1998)'s cut-points and sleep duration was identified by using the Cole-Kripke algorithm and sleep diaries. Linear regression analysis was conducted to test the associations of ethnicity (East Asian vs. South Asian) and acculturation variables (age immigrated to the U.S., years of U.S. residency, English proficiency) on 24-hour behaviors, controlling for age, BMI, education, and employment.

RESULTS: Of the 94 AA women enrolled, 89% ($n=84$) completed hip and wrist actigraphy monitoring (age= 61.3 ± 7.9 , BMI= 25.4 ± 3.6 , 58.9% college or higher, 54.4% employed). Their average hours spent on 24-hour behaviors were: MVPA= 0.5 ± 0.4 , LIPA= 6.2 ± 1.6 , SB= 9.8 ± 1.7 , sleep = 5.3 ± 0.9 . More daily MVPA was related to East Asian ethnicity ($b=0.42$, $p < 0.01$), immigrating to the U.S. at an older age ($b=0.43$, $p < 0.01$), and greater English proficiency ($b=0.32$, $p=0.03$). More SB was related to South Asian ethnicity ($b=0.36$, $p=0.03$) and longer U.S. residency ($b=0.35$, $p=0.02$). Average sleep duration was below recommendations in both East and South Asian women (5.4 ± 0.8 vs. 5.1 ± 0.9), but sleep duration and LIPA were not related to any of the acculturation variables. **CONCLUSIONS:** AA women's 24-hour behaviors differed by ethnicity, and associations with some acculturation variables were observed in this study. Larger, prospective studies are needed to explore the heterogeneity in 24-hour behaviors within this growing minority group and explore both positive and negative effects of acculturation. Culturally tailored strategies may be needed to improve 24-hour behaviors and reduce CVD risk in AA women.

3724 Board #41
The Effect Of Using Electromyostimulation To Taekwondo Athletes' Brain Waves During PNF Stretching Methods

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PURPOSE: The purpose of this study was to analyze the activity of brain waves depending on the different type of stretching exercise as a warm-up for Taekwondo competitions in order to find out the feasibility of using EMS during PNF-stretching method. We would like to see the difference between the stretching techniques used by Taekwondo athletes and the stretching methods using EMS. **METHODS:** A total of three method of treatments were conducted to 8 elite Taekwondo athletes (Age: 25.87 ± 0.99 , Height: 185.75 ± 11.01 , Weight: 80.87 ± 21.56) repeatedly in random order: PNF Stretching with electric stimulation (EMS+PNF), warm-up exercise with electric stimulation, and PNF stretching without electric stimulation. The EMS+PNF group's electrical treatment was 60 Hz, with five seconds of stimulation and five

seconds of rest alternately. Exercise intensity is RPE 15-16 levels. The brain wave condition of all subjects were presented in comparison before and after(post-hoc) treatment procedures. We performed Two-way Repeated Anova test at the difference of the data between the before and after the program. **RESULTS:** First, EMS part ($M = 66.73$, $SD = 7.23$), PNF part ($M = 38.02$, $SD = 7.23$), EMS during PNF stretching part ($M = 59.33$, $SD = 7.23$) were confirmed in Alpha value. So significant differences were found between warm-up exercise with EMS during PNF-stretching($p < .01$); EMS during PNF-stretching and PNF-stretching($p < .05$) in Alpha value. In addition, it showed significant increases in alpha value corresponding to duration of treatments($F = 4.851$, $p = .009$). Second, significant differences between before and after were found in beta values($F = 5.024$, $p = .026$). Third, significant differences were found between EMS ($M = 151.99$, $SD = 14.93$) and PNF-stretching($M = 84.67$, $SD = 14.93$) in theta value($p < .01$). EMS showed higher value than PNF-stretching in theta wave. **CONCLUSIONS:** This study was showed changes of an alpha wave, which reflects positive emotions, depending on presence of EMS. Thus, it can be considered as more effective method when applying EMS to conventional stretching which leads athletes to feel more effectively treated. The result of the increase in the beta wave was predicted about the difference between EMS stimulation and general stretching by reflecting the characteristics of the beta wave that is activated as cognitive processing occurs. Theta wave is activated when the influence and anxiety of a quiet environment are felt. We are guessed Player thinks that the effect of stretching is low and that the result is reflected when the traditional stretching is performed. Throughout this study, athletes can be expected to show better performance by using EMS during stretching exercise.

experimental schematic diagram

pre-test EEG ↓
 EMS EMS+PNF Stretching PNF Stretching
 ↓
 10 min rest (Between measurements)
 ↓
 post-test EEG

3725 Board #42

The Effects Of Citrulline Malate Supplementation In Strength And Muscle Mass

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L-citrulline (CIT) is a non-essential amino acid, found abundantly in watermelon, which has the ability to indirectly increase nitric oxide production by increasing arginine levels. A combination and the acute use of CIT with malate (intermediate of the Krebs cycle) has shown interesting results in the sports science literature, but the chronic effect of citrulline malate (CM) in the scientific literature is still unclear. **PURPOSE:** Investigate the chronic effects of citrulline malate supplementation in increasing strength and muscle mass in trained healthy adults. **METHODS:** A randomized, double-blind, crossover, placebo clinical study. Twenty four (25.96 ± 4.7 years) healthy adult men were randomly divided into 2 groups: citrulline malate group (CM = 12; 82.4 ± 10.7kgs) or placebo group (PL = 12; 82.11 ± 10.9kgs). The CM group received a sachet containing 6g of citrulline malate + 15g of maltodextrin and the PL group 6g of non-essential amino acids (NAAE) + 15g of maltodextrin. Supplementation was performed for 28 days (4 weeks) and included a wash-out week. After this week, there was an exchange of supplements in both groups. Before and after each supplementation, body composition (body weight, fat mass and muscle mass) by plethysmography (BodPod), and repetition maximum test (1RM) in the bench press were performed. Statistical analysis was performed using the covariance analysis model for crossover experiments, considering a significance level $p < 0.05$.

RESULTS: CM supplementation promoted an increase in total lean mass (67.28 ± 8.11 kgs vs 67.77 ± 7.97 kgs, $p < 0.005$) in relation to placebo (67.83 ± 7.84 kgs vs 67.43 ± 8.57 kgs) (CM vs PL $p < 0.001$), a decrease in total weight (CM 82.39 ± 10.72 kgs vs 81.63 ± 9.98 kgs and PL 82.11 ± 10.9 kgs vs 82.08 ± 9.78 kgs, CM vs PL $p < 0.05$) and an increase in the final bench press (CM 37.95 ± 7.6 kgs vs 41.55 ± 8.31 kgs, $p < 0.05$) in relation to placebo supplementation (38.26 ± 8.69 kgs vs 40.08 ± 8.19 kgs, $p < 0.05$) (CM vs PL, $p < 0.01$), regardless of the sequence in which the supplement was ingested. **CONCLUSION:** Supplementation of CM for 4 weeks proved to be effective in improve body composition (decrease in total weight and increase lean mass) and increased strength, without showing adverse effects, indicating a viable strategy for practitioners of resistance exercise.

G-32 Free Communication/Poster - Interval Training

Saturday, May 30, 2020, 8:00 AM - 10:30 AM

Room: CC-Exhibit Hall

3736 Board #53 May 30 8:00 AM - 9:30 AM

Blood Flow Restriction Compared To High Intensity Interval Training On Body Composition And Tendon Width

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(No relevant relationships reported)

Blood flow restriction (BFR) is a low load exercise modality advocated to improve body composition. **PURPOSE:** To compare BFR against high intensity interval training (HIIT) body-weight squats (BWS), and 80% 1RM squats (CON) in body composition and quadriceps tendon cross section area (QXS). **METHODS:** Thirteen subjects participated in the study (27 ± 5.8 years, BMI: 23.3 ± 3.2 , F:8). Subjects were randomly assigned to a BFR ($n = 5$), HIIT ($n = 5$), or CON ($n = 3$). Body composition was measured via air plethysmography while QXS was measured via musculoskeletal ultrasound. Subjects were tested at baseline and 6-weeks after training. BFR bands were placed at the proximal thigh and inflated to 250mmHg while performing a 30/15/15/15 repetition (rep) protocol using a metronome (1 rep/2 secs). The HIIT group completed BWS during a 20 sec on and 10 sec off protocol for 8 sets. The control (CON) group completed 3 sets of 5 reps squats of their 80% 1RM. All three groups completed their workouts 3 times a week. Due to the small sample size Kruskal-Wallis (KW) was performed for the variables of fat mass (fm;kg), lean mass (lm;kg), and QXS (cm) during baseline. If no differences at baseline were found the same analysis was performed for the 6-week follow-up. In addition, a KW analysis between groups was performed for the difference between baseline and follow-up values between variables. **RESULTS:** Although BFR showed improvements (fm: -1.1 kg, lm: +0.3kg, QXS: +.01cm) for all variables over the other groups (HIIT: fm: +1.5kg, lm: -1.2kg, QXS: -.02cm; CON: fm: -.05kg, lm: +0.4, QXS: +0.1cm) none of the two KW analytical approaches showed a statistically significant difference for any of the variables of interest. **CONCLUSION:** Although BFR showed improvements in all variables, the magnitude of these changes was not significant enough to demonstrate it is a superior modality than HIIT or 80% 1 RM or 6-weeks of training is not sufficient time to elicit changes in these outcomes.

3737 Board #54 May 30 8:00 AM - 9:30 AM

Blood Flow Restriction Compared To High Intensity Interval Training On Power Output And Muscle Strength

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Many exercise modalities are used to increase muscle strength and power output with differing load capacities. Purpose: To compare the effects of 80% 1RM (CON) squats, High Intensity Interval Training (HIIT) body weight squats (BWS), and Blood Flow Restriction (BFR) BWS on quadriceps (quads) and hamstrings (hams) strength, and power output via isokinetic testing and standing vertical jump, respectively. Methods: 13 subjects were randomly assigned to: CON, HIIT, or BFR groups. Subjects were tested on an isokinetic dynamometer at 60, 180, and 300 degrees/sec while vertical jump was performed using a vertical jump tester. The training program for the control subjects (N=3) consisted of performing 3 sets of 5 repetitions (reps) at 80% of 1RM squats. The HIIT group (N=5) completed a protocol of 20 seconds of squats followed by 10 seconds of rest for 8 sets. The BFR group (N=5) completed a protocol of 30/15/15/15 reps with 30 seconds rest between sets with bands placed on the proximal thigh bilaterally and inflated to 250 mmHg. The squats for the BFR group were performed using a metronome set to 60 bpm with each rep for 2 seconds. Due to the small sample size, Kruskal-Wallis (KW) analyses were performed for each outcome for the baseline measures, post-training measures, and the difference between post and pre training measures. Results: Although all training modalities elicit improvements for all outcomes, 80% 1RM squats showed the greatest improvement in vertical jump (+8.59cm) while HIIT was the training program showing the greatest magnitude of improvement across all isokinetic variables (average: +0.84kg·m²/s²). However, none of the observed changes were statistically significant. Conclusion: It appears all

training modalities are viable for improvements in power and strength. Nevertheless, the small sample size of the study might be hiding if one modality is superior over the others.

- 3738** Board #55 May 30 8:00 AM - 9:30 AM
Short-Term Sprint Interval Training Increases Maximal Oxygen Uptake Without Changing Maximal Cardiac Output
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Traditional moderate intensity continuous training increases maximal oxygen uptake ($\dot{V}O_{2max}$). This effect is primarily attributed to an increased maximal cardiac output (Q_{max}), as predicted by the Fick principle. Sprint interval training (SIT) increases $\dot{V}O_{2max}$ similar to MICT, often despite a lower training volume, but the effect on Q_{max} is unclear. **PURPOSE:** To determine the effect of 6 sessions of SIT over 2 wk on $\dot{V}O_{2max}$, Q_{max} and exercise performance in healthy, untrained adults [$n=12$ (9 females); 21 ± 2 y; mean \pm SD]. **METHODS:** Training was performed on a cycle ergometer and involved a 2-min warm-up (50 W), 3 x 20-s 'all-out' bouts interspersed with 2-min of recovery (50 W), and a 3-min cool-down (50 W). $\dot{V}O_{2max}$ was determined using a ramp test to exhaustion. Q_{max} was subsequently determined using inert gas rebreathing (Innocor) over a 2-min period of exercise performed at 90% of the peak work rate attained during the $\dot{V}O_{2max}$ test. Pilot testing confirmed this protocol elicited $\dot{V}O_{2max}$ over the 2-min period of Q_{max} measurement. The performance test was a 2 kJ/kg body weight cycling time trial. All measurements were performed twice at baseline, and reproducibility determined as a coefficient of variation (CV). The CV for $\dot{V}O_{2max}$, Q_{max} and time trial performance was 5.8, 4.7 and 4.2%, respectively. Pre- and post-training measurements were compared using a paired t-test. **RESULTS:** $\dot{V}O_{2max}$ increased after SIT from 37.0 ± 7.3 to 40.7 ± 8.3 ml/kg/min ($p<0.001$), but Q_{max} was unchanged (17.2 ± 3.8 vs 17.7 ± 4.6 L/min; $p>0.05$). Exercise performance improved after SIT from 1040 ± 247 to 938 ± 238 s ($p<0.001$). Absolute $\dot{V}O_{2max}$ was positively correlated with Q_{max} ($r^2 = 0.86$, $p < 0.001$). **CONCLUSION:** Six sessions of SIT increased $\dot{V}O_{2max}$ without changing Q_{max} in previously untrained individuals. These data support previous suggestions that the early increase in $\dot{V}O_{2max}$ after SIT may be due mainly to peripheral responses (i.e., enhanced oxygen extraction by skeletal muscle), rather than a central change in blood oxygen delivery. Supported by NSERC

- 3739** Board #56 May 30 8:00 AM - 9:30 AM
High-intensity Interval Exercise While Wearing A Sauna Suit Increases Energy Expenditure
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PURPOSE: The use of sauna suits (SS) has increased and claims to enhance weight loss and body temperature during exercise. Whether high-intensity interval exercise (HIIE) with a SS enhances energy expenditure (EE) and excess post-exercise oxygen consumption (EPOC) is unknown. The purpose of this study was to examine changes in EE and EPOC in response to HIIE while wearing a SS.

METHODS: Seven recreationally active men and women (mean age, mass, and $\dot{V}O_{2max} = 29.7 \pm 6.9$ yr, 68.8 ± 17.3 kg, and 46.2 ± 8.10 mL/kg/min, respectively) initially completed assessment of resting metabolic rate (RMR) and maximal oxygen uptake ($\dot{V}O_{2max}$). During the $\dot{V}O_{2max}$ test, exercise began at 60 W for two minutes and work rate increased 25 - 30 W/min until volitional fatigue. Heart rate (HR) and breath-by-breath gas exchange were continuously measured. At least 48 hr later, subjects completed HIIE consisting of 10 x 1 min intervals at 85% peak power output, followed by 75 s of active recovery, with or without a SS. During exercise, HR, core temperature (T_{re}), and gas exchange data were continuously measured, and thermal sensation and rating of perceived exertion (RPE) were also recorded. For 1 hr post-exercise, subjects rested while changes in EPOC, T_{re} , and HR were determined. Blood lactate concentration was measured pre-exercise, 5 min post-exercise, and 1 hr post-exercise. Subjects returned 1 wk later and completed the other condition whose order was randomized

RESULTS: Compared to no SS (NSS), total $\dot{V}O_2$ (57.3 ± 13.8 L vs. 60.4 ± 13.5 L, $p = 0.028$) and EE (286.8 ± 69.2 kcal vs. 302.0 ± 67.3 kcal, $p = 0.048$) were significantly higher for SS. However, EPOC was not significantly different 1 hr post-exercise between NSS (5.1 L \pm 4.3 L) and SS (7.5 L \pm 5.1 , $p = 0.16$). End-exercise HR was not different between conditions ($p = 0.42$), but T_{re} was significantly higher ($p = 0.046$) for SS (38.6 ± 0.5 °C) compared to NSS (38.4 ± 0.4 °C). Post-exercise blood lactate concentration was not significantly different ($p = 0.20$) between conditions (9.6 ± 3.5 vs. 10.8 ± 3.4 in NSS vs. SS). End-exercise thermal sensation ($p = 0.60$) and RPE ($p = 0.17$) were not significantly different between conditions.

CONCLUSIONS: Wearing a SS during HIIE elicits greater EE and T_{re} versus not wearing a SS. Therefore, a SS may aid in weight loss by increasing the total amount of calories expended during HIIE.

- 3740** Board #57 May 30 8:00 AM - 9:30 AM
HIIT PROGRAM EFFECTS IN CAPILLARY BLOOD LACTATE LEVELS
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In the last decade, high intensity interval training (HIIT) has been shown to be an appropriate alternative to moderate-intensity, continuous exercise for improving cardiorespiratory fitness. HIIT protocols typically result in high blood lactate (La) levels. However, accumulated lactic acid is a potent metabolic stimulus, which plays a major role in the control of physiological adaptations. Therefore, it may be essential for improvements in endurance performance. The literature indicates that there is a strong positive relationship between maximum oxygen consumption ($\dot{V}O_{2max}$) and La production. Purpose: To investigate changes in La levels after 4 weeks of HIIT program. Methods: Blood samples were collected from five female and five male student-athletes ($n = 10$) ($M_{age} = 21$, $SD = 0.95$). A short-term (4 weeks) HIIT protocol used and $\dot{V}O_{2max}$ calculated through Course-Navette Test. The instruments used for this research were an Accutrend Plus-Roche lactometer and BM-Lactate test strips (Risch-Rotkreuz, Switzerland). The analysis consisted of t student tests for paired samples in IBM SPSS v.25 ($p < 0.001$). Results: $\dot{V}O_{2max}$ and blood La changed significantly in six participants (Pre-La $M = 11.65$ mmol/L; Post-La $M = 9.41$ mmol/L). The participants that achieved to increase their $\dot{V}O_{2max}$, produced lower amounts of capillary blood La. Conclusion: Using HIIT, our study results confirm the positive relationship of $\dot{V}O_{2max}$ and La. The inferences of these preliminary results could be used in future, larger-scale interventions concerning ways to affect La production through the increase of $\dot{V}O_{2max}$ using a HIIT program. Future studies should further investigate anaerobic threshold modification processes through different training programs, such as Repeated Sprint Training (RST), Sprint Interval Training (SIT) and Moderate Intensity Continuous Training (MICT). Limitations of this study include small sample size and indirect $\dot{V}O_{2max}$ estimation.

Keywords
 High-Intensity Interval Training, maximal oxygen consumption, lactate

- 3741** Board #58 May 30 8:00 AM - 9:30 AM
Effects Of High Intensity Physical Exercise On Short-term Memory In University Students
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Studies have determined that physical training provides benefits in people's physical health. Physical exercise is one of the most powerful lifestyle to positively affect the adult brain and emerging evidence points to high intensity interval training (HIIT) as an effective way to improve various aspects of brain function among them the improvement of cognition and short-term memory. Purpose: To analyze the effects of (HIIT) in university students on short-term memory. Methods: 22 university athletes ($M_{age} = 21.6$, $SD = 1.5$), ($n = 11$ experimental group), ($n = 11$ control group). A HIIT program of 12 sessions of short-term (3 weeks) and 6 sessions of short-term memorization was applied. Maximum oxygen consumption ($\dot{V}O_{2max}$) was estimated through the Course Navette Test and memory evaluation through a Rey Auditory Verbal Learning Test (RAVLT). The instruments used for the investigation was a Polar H10® band. A t student test for paired samples was applied by IBM SPSS v.22 ($p < 0.001$). Results: The maximum heart rate (HRmax) of the control group obtained a value of $M = 199.9$, $SD = 15$ ppm and the experimental group $M = 195$, $SD = 6.7$ ppm. In the third week of intervention results were found statistically significant. Conclusion: After twelve training sessions of high intensity physical exercise (HIIT), statistically significant results were obtained, in relation to high intensity physical effort with short-term memory. For future research it is recommended to implement a greater number of training and memory sessions. Limitations of this study include indirect $\dot{V}O_{2max}$ estimation and a small sample size.

Keywords: short-term memory, university students, high intensity interval training.

3742 Board #59 May 30 8:00 AM - 9:30 AM
Physiological Responses During High Intensity Functional Training Exercise Are Affected By Skill Level

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 (No relevant relationships reported)

Although high-intensity functional training (HIIT) is an increasingly popular exercise strategy, research describing the acute physiological responses are few and predominantly limited to novice or untrained. **PURPOSE:** To compare the cardiorespiratory responses of a bout of HIIT among individuals with varying degrees of skill. **METHODS:** Eighty-two participants (31.0 ± 7.4 years; 172.6 ± 9.6 cm; 77.9 ± 13.8 kg) with at least six-months of HIIT experience and varying skill levels were tested. Skill level was categorized by self-reported times of the benchmark workout "Fran" [Novice (NOV), n = 32; Intermediate (INT), n = 24; Advance (ADV), n = 26; (times reported = 5.3 ± 2.7 mins)]. All participants performed aerobic capacity testing to examine peak levels of oxygen consumption (VO₂), heart rate (HR), respiratory exchange ratio (RER), and lactate (LT). A week later, similar variables were measured with averages obtained for VO₂, HR, RER, and LT during a 15-minute HIIT based workout. Univariate analysis of variance (ANOVA) with Bonferroni adjustments were used to examine differences between skill category and outcome variables. **RESULTS:** During the Treadmill test, significant differences were only observed for VO₂ (ADV = 49.53 ± 5.12 ml/kg/min; NOV = 43.83 ± 6.49 ml/kg/min; p = 0.001; η² = 0.924) and LT (ADV = 12.31 ± 2.48 mmol/dL; NOV = 9.93 ± 3.33 mmol/dL; p = 0.004; η² = 0.874), with ADV athletes having greater values than NOV (p < 0.05). No significant differences were observed between ADV & INT (p > 0.05). Similarly, during the HIIT workout, differences were also observed between ADV and NOV categories, but only for VO₂ (ADV = 38.71 ± 3.47 ml/kg/min; NOV = 34.42 ± 5.20 ml/kg/min; p = 0.002; η² = 0.897) and LT (ADV = 9.04 ± 1.68 mmol/dL; NOV = 9.61 ± 2.40 mmol/dL; p < 0.001; η² = 0.946). **CONCLUSION:** These findings provide evidence regarding the impact skill level has on physiological outcomes. During a maximal effort bout of HIIT, the more advanced athletes tend to exhibit more efficient cardiorespiratory markers. Further research is necessary to elucidate how these differences impact overall performance of HIIT exercise.

3743 Board #60 May 30 8:00 AM - 9:30 AM
Energetic System Contribution According Sprint Number In Tabata High Intensity Interval Training Protocol

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PURPOSE: To analyze the contribution of energetic systems in Tabata's high intensity-interval training (HIIT) protocol according sprint number
METHODS: Sixteen physically active males attended to two experimental sessions. In the first one was performed an incremental test to identify the maximum oxygen uptake (VO_{2max}) and power output (pVO_{2max}). At the second visit, participants performed HIIT session composed by sprints lasting 20s at 170% of pVO_{2max} followed by 10s rest until volitional fatigue. For the aerobic system estimative, difference between relative rest VO₂ and its values during the activity was used. For the lactic system, the peak of blood lactate ([La-]) after the session was considered. The rapid phase of excess of post-exercise oxygen consumption (EPOC_{fast}) was used for alactic system contribution. Participants were allocated in three groups, considering the number of sprints performed (G23 = 2 to 3, G45 = 4 to 5 or G67 = 6 to 7 sprints). Relative (%) energetic contribution were analyzed using two-way ANOVA (group x energetic system)
RESULTS: Participants exhibited 24.9±6 years old, 1.67±2.7 cm, 55.6±8.7 kg and a VO_{2max} = 55.6±8.7 mL/kg/min, with [La-] = 13.2±1.7 mmol/L and maximum heart rate = 184±9.3 bpm. For relative energetic contribution (% of aerobic, lactic and alactic respectively), G23 showed 32.3±11.9% (CI95% = 25.5 - 39.2), 24.2±3.9% (CI95% = 17.3 - 31.0) and 43.5±15.4% (CI95% = 36.6 - 50.3); G45 showed 46.3±7.9% (CI95% = 39.4 - 53.1), 22.7±3.9% (CI95% = 15.8 - 29.5) and 31.0±7.2% (CI95% = 24.2 - 37.9), and; G67 showed 60.2±2.3% (CI95% = 51.8 - 68.6); 19.2±2.1% (CI95% = 10.8 - 27.6) and 20.6±3.4% (CI95% = 12.2 - 28.9), with no differences between groups (F=0.0; p=1), differences between systems (F=33.30; p<.001) and statistical significant interactions (F=11.77; p<.001)
CONCLUSIONS: Performing 2 to 3 sprints was found higher anaerobic contribution and performing 6 to 7 sprints, higher aerobic contribution in Tabata's protocol. No participant performed eight sprints.

3744 Board #61 May 30 8:00 AM - 9:30 AM
Effect Of High Intensity Interval Training On Body Composition In Overweight And Obese Sedentary Adults

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 (No relevant relationships reported)

Only ~20% of adults adhere to physical activity guidelines. Thus, exercise programs that require less time, such as high intensity interval training (HIIT), need to be investigated. Recent studies suggest HIIT incorporating body weight exercises result in increased exercise capacity (VO_{2peak}) and leg muscle endurance in healthy adults. **PURPOSE:** It is unclear if HIIT incorporating body weight exercises influences body composition and exercise capacity in overweight/obese, sedentary adults. We hypothesized that HIIT will 1) increase lean mass and decrease body fat and 2) increase VO_{2peak} to a greater extent than moderate intensity continuous training (MICT) in sedentary, overweight/obese adults.
METHODS: Eleven participants (10 women) were randomized and have completed all study components (6 HIIT vs. 5 MICT; Age: HIIT 39±7 vs. MICT 42±12 yrs; BMI: HIIT: 30±1 vs. 32±3 kg/m² (both, p>0.05). Exercise capacity (VO_{2peak} -cardiopulmonary exercise testing) and body composition (via dual energy X-ray absorptiometry) were measured at baseline and after 12 weeks of training. The HIIT group performed 5 body weight exercises (squats, pushups, lunges, mountain climbers, and plank) 3 days/week for 12 weeks at an intensity equal to a rating of perceived exertion (RPE) >17. The MICT group performed 150 min of MICT/week for 12 weeks at a RPE between 12-14.
RESULTS: Percent (%) lean mass increased from baseline following HIIT (p<0.05), but not MICT (HIIT: 54.4±3.4 vs. 55.5±4.0 %; MICT: 52.5±3.9 vs. 51.7±4.3 %). Body fat % significantly decreased from baseline following HIIT (p<0.05), but not MICT (HIIT: 43.9±3.5 vs. 42.7±4.1 %; MICT: 45.9±4.1 vs. 46.7±4.7 %). BMI was not different from baseline following HIIT or MICT (HIIT: 32 ±3 vs. 31±3 kg/m²; MICT: 30±1 vs. 30±3 kg/m²; both, p>0.05). VO_{2peak} significantly increased from baseline following HIIT (p<0.05), but not MICT (HIIT: 23.7 ±0.9 vs. 25.0±0.9 mL/kg/min; MICT: 22.2±6.1 vs. 23.1±6.1 mL/kg/min). **CONCLUSIONS:** These preliminary data support the hypotheses that non-traditional aerobic HIIT (e.g., HIIT incorporating body weight exercises) leads to more advantageous changes in body composition and exercise capacity compared to MICT alone.

3745 Board #62 May 30 8:00 AM - 9:30 AM
COMPARISON OF MODERATE INTENSITY CONTINUOUS TRAINING VERSUS HIIT ON AEROBIC PERFORMANCE USING STATIONARY AIR BIKE

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Stationary bikes are known as effective tools to improve physical fitness. Unlike most types of exercise bikes, a stationary air bike handles that move synchronously with the pedaling action, creating wind resistance via a large fan. Although several studies have been conducted on benefit of exercise bikes, there has been a relative absence of studies using stationary air bikes in order to compare the effects of high intensity interval training (HIIT) and moderate intensity continuous training (MICT) protocols. **PURPOSE:** The purpose of this study was to compare the effects of stationary air biking, utilizing MICT, ultrashort-HIIT (UH), and short-HIIT (SH) protocols on aerobic performance. **METHODS:** Thirty-two recreationally active participants were randomly assigned to MICT (n = 11), UH (n = 11), and SH (n = 10) groups. The intervention consisted of 3 d/wk for 4 wks. MICT sessions included 30 min of cycling at 75% of maximal heart rate reserve, while the HIIT protocols (i.e., UH, SH) consisted of 3 sets of 8 intervals at all-out intensity. SH and US protocols were performed with 20s:10s and 10s:5s work-to-rest ratios, and provided with 5- and 2.5-min recovery periods between sets, respectively. Maximal oxygen uptake was assessed via a cycle ergometer using a ramp protocol before and after the intervention. Absolute VO_{2max} (A-VO_{2max}) and time to exhaustion (TTE) were measured and analyzed with 2-way mixed factorial ANOVAs. Additionally, total work (TW) during 12 sessions was recorded and analyzed with one-way ANOVA. **RESULTS:** There were significant (p < 0.05) differences in TW (MICT: 2263.0 ± 897.0 cal., UH: 907.3 ± 332.0 cal., SH: 1230.0 ± 188.1 cal.) between groups. While, all groups significantly (p < 0.05) improved A-VO_{2max} (MICT: 2663.6 ± 764.6 to 3017.5 ± 833.4 ml/min, UH: 2652.6 ± 502.3 to 3017.5 ± 606.4 ml/min, SH: 2259.3 ± 281.3 to 2530.1 ± 406.8 ml/min), as well as TTE (MICT: 13:35 ± 02:39 to 14:41 ± 02:46 min, UH: 14:06 ± 02:02 to 15:09 ± 2:20 min, SH: 12:30 ± 01:29 to 13:33 ± 01:27 min). **CONCLUSION:** Despite the significant group differences in TW, all groups similarly improved aerobic performance

(i.e., A-VO₂max, TTE) following training. These findings suggest that performing HIIT on a stationary air bike at a 10s:5s work-to-rest ratio can improve aerobic fitness with a shorter time commitment compared to SH and MICT groups.

3746 Board #63 May 30 8:00 AM - 9:30 AM
Metabolic And Hemodynamic Responses To High Intensity Interval Training With Various Recovery Intervals

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For more than twenty years, the Tabata protocol has provided the basis for high intensity interval training (HIIT). Although the improvements associated with the protocol are laudable, an intensity of 170% of max VO₂, is difficult for even highly motivated athletes to achieve. A repeated bout HIIT protocol at 100% of Max VO₂ may be a more tolerable option, if it achieves a similar metabolic stress. **Purpose:** The purpose was to determine the metabolic cost of 8 repetitions of HIIT at a workload equivalent to 100% Max VO₂ (HIIT) for 20 sec with recovery intervals of 10, 20, 30 and 40 sec at 20% of Max VO₂. **Methods:** 14 recreationally active college-age students (age: 21.6±1.1 yrs., height: 171.41±0.5 cm, body mass: 75.0±10.6 kg, max VO₂ 2.89±.67, 8 ♂) volunteered to participate in a randomized, single-blind crossover design study with a minimum of 4 days between trials. A max VO₂ ramp protocol on a Lode Cycle ergometer preceded the HIIT trials and established the max workload. VO₂ was obtained by continuous open circuit spirometry and blood lactate by finger puncture. Excess Post Exercise O₂ Consumption (EPOC) was obtained for 20 min. **Results:** Statistical analysis by ANOVA with repeated measures (P<.05) was applied to the following data.

HIIT Trial	10	20	30	40
VO ₂ % max	90.2±4.5	87.9±6.4	86.9±6.8	81.6±7.2*
VO ₂ max L/min	2.59±0.6	2.52±0.5	2.49±0.6	2.33±0.5
HR b/min	181.1±7.0	179.8±8.2	176.0±7.8	173.4±6.5
LA mmol	15.0±2.9	14.7±3.3	15.2±3.6	14.2±2.6
20 min EPOC (L)	2.66±1.0	2.52±0.7	2.82±0.7	2.47±0.9

(*P<.05: 10, 20, 30 vs 40)

Conclusion: The prescribed HIIT work intervals provide ample metabolic stimulus, however recovery intervals in excess of 30 seconds substantially attenuate the oxygen uptake, while still requiring a strong anaerobic contribution. The use of eight repeat bouts of HIIT at a workload equivalent to 100% of max VO₂ may be a viable alternative to the traditional Tabata protocol.

3747 Board #64 May 30 8:00 AM - 9:30 AM
A COMPARISON OF INTERNAL TRAINING LOADS BETWEEN OBJECTIVELY VERSUS SUBJECTIVELY-DETERMINED HIGH-INTENSITY INTERVAL TRAINING

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High-intensity interval training (HIIT) is an effective and time-efficient method of aerobic training. Most HIIT programming relies on objectively determined work rate, velocity, or heart rate targets. There is very little evidence comparing HIIT that is programmed using objective measures and HIIT that is programmed using subjective ratings to determine the work and recovery intensities, even though subjectively-determined HIIT may have more real-world applicability. **PURPOSE:** To evaluate the internal training load generated by single treadmill sessions of objectively-determined HIIT (HIIT-Obj) and subjectively-determined HIIT (HIIT-Sub). **METHODS:** Thirteen (female n=7, male n=6) young (age 19.8 ± 2.0 years), healthy participants completed a baseline testing session to determine peak VO₂ and HR, followed by two HIIT sessions on a treadmill in a randomized order. Both HIIT sessions consisted of 10x1-min work intervals, interspersed with 1-min recovery intervals, with the work rate obscured from participants' view. HIIT-Obj session work intervals used the work rate associated with 90% of VO₂max, with recovery intervals completed at 4 km/hr. For HIIT-Sub sessions, participants were instructed to reach an RPE of 8-9 on the Borg CR-10 scale during work intervals and drop to an RPE of 3-4 during the recovery intervals. Internal training load calculations included Training Impulse (TRIMP) and HR zone methods. **RESULTS:** There were no significant differences in internal training load between HIIT-Obj and HIIT-Sub as determined via TRIMP (45.8 ± 12.3 vs. 47.8 ± 15.9 a.u., ES=0.03, p=0.59) and HR zones (57.9 ± 14.7 vs. 66.8 ± 22.6 a.u., ES=0.28, p=0.06) methods, though participants spent significantly less time in

the lowest intensity HR zone (zone 1) while completing HIIT-Sub (HIIT-Obj = 3.57 ± 0.93 min; HIIT-Sub = 2.43 ± 1.13 min, ES=0.48, p=0.01). Peak HR reached during the sessions was also not statistically different (186 ± 12 vs. 188 ± 16 bpm, ES=0.07, p=0.38). **CONCLUSION:** Participants are able to generate similar internal training loads using real-time subjective measures of intensity during HIIT compared to objectively-regulated HIIT. This indicates that this simpler, more applicable method of HIIT programming may generate the desired training stress for a client or athlete without rigid work rate or HR targets.

3748 Board #65 May 30 8:00 AM - 9:30 AM
The Oxidative Contribution Of Eight Repeat Bouts Of High Intensity Interval Training

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The oxidative contribution to eight repeat bouts of high intensity interval training

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 Interval training requires bouts of work followed by recovery intervals. The intensity of the work interval impacts the metabolic response of the recovery interval. **Purpose:** The purpose was to determine the oxidative cost of both the work (W) interval and the recovery (R) interval during 8 continuous repetitions of high intensity interval training (HIIT) at a workload equivalent to 100% Max VO₂. **Methods:** All 20 second work intervals were followed by recovery intervals of 10, 20, 30 and 40 sec at 20% of Max VO₂. 14 recreationally active college-age students (age: 21.6±1.1 yrs., height: 171.41±0.5 cm, body mass: 75.0±10.6 kg, max VO₂ 2.89±.67, 8 ♂) volunteered to participate in a randomized, single-blind crossover design study with a minimum of 4 days between trials. A max VO₂ ramp protocol on a Lode Cycle ergometer preceded the HIIT trials and established the max workload. VO₂ was obtained by continuous open circuit spirometry. **Results:** Statistical analysis by ANOVA with repeated measures (*P<.05) was applied to these data.

% max VO ₂	10 W	10 R	20 W	20 R	30 W	30 R	40 W*	40 R*
Interval 1	78.3	74.0	73.3	72.6	72.8	73.2	67.9	73.4
Interval 2	96.6	87.2	96.8	85.1	93.9	83.5	83.6	77.1
Interval 3	98.5	88.7	95.9	84.1	92.6	83.3	85.9	80.0
Interval 4	96.0	88.0	94.7	82.5	92.6	83.7	86.5	80.2
Interval 5	95.1	88.8	92.3	85.6	91.1	85.4	85.5	81.7
Interval 6	96.7	89.4	93.2	87.0	92.0	87.6	87.8	80.8
Interval 7	98.5	89.1	95.9	86.2	93.8	85.8	86.9	82.1
Interval 8	99.1	84.7	97.0	83.4	95.2	83.7	89.3	77.6

With the exception of interval one, recovery protocols of 10, 20 and 30 sec sustained significantly greater oxygen requirements during W & R vs the 40 sec trial. W was in excess of 90% of max VO₂ for 10, 20 & 30 trials, while the 40 sec recovery bout HIIT protocol provided significantly less oxidative requirements and never achieved 90%. **Conclusion:** Short recovery intervals of 30 seconds or less provide the greatest oxidative stress during interval training, which may be attributed to insufficient phosphagen resynthesis during recovery.

3749 Board #66 May 30 8:00 AM - 9:30 AM
Effects Of Elevation Training Mask In Conjunction With High Intensity Interval Training On Lung Function

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 (No relevant relationships reported)

A recent training tool, the elevation training mask (ETM) is a commercially available simulated altitude training device with claims to increase lung function and aerobic capacity by incorporating valves to create respiration resistance. Previous studies have resulted in conflicting conclusion regarding the effectiveness of the ETM with respect to lung function. **PURPOSE:** To compare the effects of the ETM in conjunction with high intensity interval training (HIIT) and HIIT alone (i.e., using mask with no resistance) on lung function. **METHODS:** Sixteen healthy adults (control group, n=8 & experimental group, n=8) participated in this study. Pre- and post-test consisted of lung function (FEV₁ & FVC) using spirometry, time to exhaustion (TTE) using the

Bruce protocol on treadmill, and body mass index (BMI). Training was completed on a cycle ergometer on 3 nonconsecutive days per week (MWF), for 4 wks. Participants exercised at 85% of $\dot{V}O_{2max}$ using heart rate monitor, with a pedal rate of 100-120 rpm at individually set resistance levels. Each training session consisted of 10 bouts of 30s exercise followed by 30s of active recovery for a total time of 10 min. The respiratory resistance on the ETM for the experimental group was progressively increased from 915.4 m-2,743.2 m (3,000 ft-9,000 ft.) during wks of training, while the control group used ETM with no resistance. **RESULTS:** Following training, a significant difference in FVC between the groups was found ($F(1, 4) = 7.486, p = 0.016$). In addition, no significant ($p > 0.05$) differences between the groups in FEV_1 (experimental: 3.78 ± 0.94 L; control: 3.83 ± 0.59 L), TTE (experimental: $11:30 \pm 1.92$ min; control: $12:23 \pm 1.60$ min) and BMI (experimental: 23.01 ± 3.24 kg/m²; control: 24.25 ± 2.97 kg/m²) was noted. However, the experimental group yielded a greater increase in FEV_1 compared to the control group (experimental: 3.40%; control: 2.42%). **CONCLUSION:** In the present study, the ETM resulted in a small increase in FEV_1 and significantly improved FVC more than HIIT alone. Using the ETM in conjunction with HIIT may significantly improve lung function compared to HIIT only. When used in conjunction with HIIT, the ETM appears to create sufficient resistance to strengthen the muscles in respiratory ventilation and improve respiratory efficiency.

3750 Board #67 May 30 8:00 AM - 9:30 AM
Effects Of Deep Slow Breath Training On Performance And Recovery During High Intensity Interval Cycling
 Andrew Brown. *Western Washington University, Bellingham, WA.* (Sponsor: Dr. Lorrie Brilla, FACSM)
 (No relevant relationships reported)

Andrew Brown, Lorrie R. Brilla FACSM, Harsh H. Buddhadev, David N. SuprakHealth and Human Development Department, Western Washington University, Bellingham WA 98225
 Voluntary alterations in components of the respiratory cycle have been utilized for centuries in yogic, qigong, and other meditative practices, and represent a fertile area of research within the context of sport performance. Changes to acid-base balance, vagal tone, and subsequent exercise performance following breath training have been demonstrated acutely and chronically. The efficacy of breath training in improving repeated glycolytic sprints has yet to be fully elucidated. **PURPOSE:** To delineate the effects of a six-week deep slow breathing (DSB) program on measures of cycling performance (mean power), recovery (heart rate recovery: HRR), and expired carbon dioxide: VCO_2 , and pulmonary capacities (maximum voluntary ventilation and forced expiratory volume). **METHODS:** Twenty male cyclists were divided into training ($n=10$) and control ($n=10$) groups, where the training group completed a six-week DSB program. Inclusion criteria included a minimum of 180-minutes of cycling volume per week for the previous 6 months. DSB was an app-driven program to extend expirations and post-expiratory breath holds to enhance vagal tone and endogenous buffering capacity. Participants completed two testing sessions, one before and one after the six-week period. Testing sessions involved three repeated 30-second Wingate Anaerobic Tests (WAnT) with three minutes of passive recovery between each interval. MP was recorded for each WAnT while measures of VCO_2 and HRR were taken immediately following each WAnT. **RESULTS:** No significant differences ($p > 0.05$) were found between groups for any of the variables measured, while both groups exhibited increased MP in the second WAnT following the six-week training period (Treatment: pre: 516.30 ± 20.82 W versus post: 536.38 ± 20.62 W; $p = 0.010$; $\eta_p^2 = 0.382$; Control: pre: 549.93 ± 18.66 W versus post: 567.83 ± 18.44 W; $p = 0.010$; $\eta_p^2 = 0.382$). **CONCLUSIONS:** The results presented here suggest DSB provides no performance relevant to recovery or pulmonary capabilities during high intensity interval cycling, beyond those which are incurred via endurance training.

3751 Board #68 May 30 8:00 AM - 9:30 AM
The Effects Of Rich Hydrogen And Oxygen Mixed Gas Inhalation After High Intensity Exercise Influence On Exercise Performance
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 (No relevant relationships reported)

PURPOSE: Both hydrogen-rich and normobaric hyperoxic gas exposure during exercise recovery is thought to promote ergogenic and therapeutic effects on the whole body physiological function and exercise performances. However, the synergistic intervention of high concentrations of hydrogen and oxygen mixture gas (HO gas) inhalation on these indexes have been poorly investigated. Therefore, we examined acute HO gas inhalation during exercise recovery on subsequent oxidative stress, inflammation, and exercise performance. **METHOD:** According to a two-trial, double-blind, crossover, repeated measures design, eight physically males inhaled HO gas (67 % of hydrogen and 32 % of oxygen) or Placebo gas (ambient air) during 60-min recovery after completion of oxidative stress-inducing exercise protocol consisting of 30-min treadmill running at 75 % of

participant's maximal oxygen uptake ($\dot{V}O_{2max}$) and 5 × 10 repetitions of squat jump exercise. Before oxidative stress-inducing exercise and 10-min after post exercise gas inhalation, blood and urine samples were obtained and exercise performance (jumping ability, pedaling power output, muscle strength) were evaluated.

RESULTS: A post-exercise HO gas inhalation attenuated the increase 8-OHdG excretion rate ($p < 0.05$), known as one of DNA oxidation markers, and the reduction in the jumping ability evaluated by the height of countermovement jump ($p < 0.05$) compared with Placebo gas inhalation. Moreover, the increase in urinary 8-OHdG excretion rate was significantly associated with the reduction in countermovement jump performance ($r = -0.78, p < 0.01$).

Discussion: These suggested that HO gas inhalation during post exercise recovery might, at least in part, improve exercise performance via reducing systemic oxidative damage.

3752 Board #69 May 30 8:00 AM - 9:30 AM
Comparison Of Interval Exercise And Continuous Exercise On Excess Post-exercise Oxygen Consumption: Matched For Duration

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 (No relevant relationships reported)

PURPOSE: Compare the excess post-exercise oxygen consumption (EPOC) after duration-matched bouts of high-intensity (HIIT) and sprint interval (SIT) exercise to moderate-intensity continuous (MCT) exercise. **METHODS:** Recreationally active men ($n=7$; 22 ± 3 yrs; 180.4 ± 4.7 cm; 77.8 ± 9.3 ; 13.4 ± 3.4 %BF; 44.7 ± 2.6 ml·kg⁻¹·min⁻¹) completed a maximal graded exercise test ($\dot{V}O_{2max}$) and three exercise trials (HIIT, SIT, and MCT) in a randomized, counterbalanced fashion on a cycle ergometer. HIIT consisted of 15 × 90-sec bouts at 85% $\dot{V}O_{2max}$ and 90-sec active recovery periods. SIT consisted of 15 × 20-sec bouts at 130% maximum wattage and 160-sec active recovery periods. MCT was continuous bout at 65% $\dot{V}O_{2max}$. Each trial lasted 53 min, including a 5-min warm-up and a 3-min cool-down. Oxygen consumption ($\dot{V}O_2$; ml·kg⁻¹·min⁻¹) was measured after bouts 1 (B1), 5 (B5), 10 (B10), 15 (B15), and cool-down (CD) which corresponded with min 0-3, 12-15, 27-30, and 42-45 of MCT, respectively. $\dot{V}O_2$ was also measured for 30 min prior to exercise (PRE) and during 1 h of recovery. EPOC (L of O₂) was measured by the area under the curve with respect to increase (AUCi) from PRE $\dot{V}O_2$ during the first 20 min of recovery. Trial effects were assessed via one-way analyses of variance. **RESULTS:** $\dot{V}O_2$ was lower in SIT compared to MCT after B1 ($p = 0.002$; 17.6 ± 4.6 ml·kg⁻¹·min⁻¹; 24.2 ± 1.8 ml·kg⁻¹·min⁻¹, respectively), B5 ($p = 0.007$; 21.8 ± 4.8 ml·kg⁻¹·min⁻¹, 29.1 ± 3.4 ml·kg⁻¹·min⁻¹, respectively), B10 ($p < 0.001$; 21.8 ± 2.6 ml·kg⁻¹·min⁻¹, 30.0 ± 2.5 ml·kg⁻¹·min⁻¹, respectively) and B15 ($p < 0.001$; 21.8 ± 2.6 ml·kg⁻¹·min⁻¹, 29.3 ± 3.3 ml·kg⁻¹·min⁻¹, respectively). SIT was also lower than HIIT at B5 (27.5 ± 3.4 ml·kg⁻¹·min⁻¹; $p = 0.021$), B10 (28.2 ± 2.9 ml·kg⁻¹·min⁻¹; $p < 0.001$) and B15 (28.8 ± 3.7 ml·kg⁻¹·min⁻¹; $p = 0.001$), while MCT was higher than HIIT at B10. After CD, $\dot{V}O_2$ was higher in MCT (19.0 ± 2.9 ml·kg⁻¹·min⁻¹) compared to SIT (16.4 ± 2.6 ml·kg⁻¹·min⁻¹; $p = 0.015$) and HIIT (15.5 ± 2.0 ml·kg⁻¹·min⁻¹; $p = 0.007$). EPOC was lower following SIT (5.5 ± 1.1 L) compared to MCT (7.4 ± 1.6 L; $p = 0.005$) and HIIT (6.7 ± 0.8 L; $p = 0.006$). **CONCLUSION:** EPOC was similar following both HIIT and MCT, but not SIT, when matched for duration. Of note, despite identical duration, the MCT protocol involved more total work when compared to both HIIT and SIT.

G-33 Free Communication/Poster - Monitoring

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3753 Board #70 May 30 8:00 AM - 9:30 AM
Global Positioning System Analysis Of Positional Locomotive Training Demands In Women's Varsity Rugby Union

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 (No relevant relationships reported)

Rugby union is a full contact, intermittent-intensity sport that requires a combination of power, agility, speed and endurance. In positional gameplay, forwards compete in high force-plays (scrums, rucks, mauls), while backs typically execute sprint and agility focused activities. **PURPOSE:** To determine the locomotive demands of female varsity rugby union athletes in regular season training, and to assess positional dissimilarities in these demands, using global positioning system (GPS) technology. **METHODS:** Wearable GPS technology was used to collect spatial and temporal data of female varsity rugby athletes (20.2 ± 2.4 yr) during three regular season

training sessions, each ~2 hr in length. Sessions were categorized as endurance training (ET), skill training (ST) or game-based training (GBT). Movements were catalogued into 5 speed zones. Player positions were classified as forward (n=14) or back (n=15). **RESULTS:** Backs traveled greater total distances on all practice days than forwards, and in ET backs traveled greater distances per minute than forwards (50.07 ± 6.67 m; 47.95 ± 16.64 m, $p < 0.01$). Positional work-to-rest ratio was higher in forwards vs. backs in ET only (0.244 ± 0.158 ; 0.230 ± 0.051 , $p < 0.05$). Backs traveled greater total distances in high-intensity zones than forwards (7.23 ± 4.34 %; 4.32 ± 2.50 %, $p < 0.05$) during GBT. In all practice sessions, significant differences between positions were observed in time spent and distance traveled within the 5 speed zones. **CONCLUSION:** Locomotive training demands for back positions are of higher intensity in GBT, and greater volume on all practice days, compared to forward positions. ET was the only session that exhibited a significantly higher work-to-rest ratio for forwards. Though GPS technology is effective for quantifying linear movements, it is not capable of quantifying athlete exertion in low-speed, high-power movements, performed by forwards in rugby union. Research funded by a grant from NSERC, Canada.

3754 Board #71 May 30 8:00 AM - 9:30 AM
Associations Between Two Athlete Monitoring Systems Used To Quantify External Training Loads In Basketball Players

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 (No relevant relationships reported)

Quantifying external training load (eTL), referred to as the biomechanical load during training, is becoming increasingly popular for team sport in an effort to manage fatigue, optimize performance, and guide return-to-play protocols following injury. During indoor team sport play, eTL can be measured via Inertial Measurement Units (IMUs) which incorporate accelerometers, gyroscopes, and a magnetometer to characterize an athlete's movement signature, while Indoor Positioning Systems (IPS) are also common, which use Ultra-wideband (UWB) to detect player positioning and their subsequent movements. **PURPOSE:** The purpose of this study was to assess the association between a commercially available IMU and IPS used to monitor eTL in team sport. **METHODS:** A retrospective analysis was performed on 13 elite male NCAA Division I basketball players from three practices during the off-season training phase. A Pearson's correlation was used to examine the association between the Distance traveled during practice captured by IPS system compared to PlayerLoad (PL), PlayerLoad per Minute (PL/Min), 2-Dimensional PlayerLoad (PL^{2D}), 1-Dimensional PlayerLoad Forward (PL^{1D-FWD}), Side (PL^{1D-SIDE}), and Up (PL^{1D-UP}) captured from the Catapult Sport IMU. **RESULTS:** There were significant ($p \leq 0.001$) positive correlations between Distance and PL ($r=0.891$), PL/Min ($r=0.891$), PL^{2D} ($r=0.863$), PL^{1D-FWD} ($r=0.799$), PL^{1D-SIDE} ($r=0.879$), and PL^{1D-UP} ($r=0.887$) during Practice 1. Practice 2 revealed significant ($p \leq 0.001$) positive correlations between Distance and PL ($r=0.947$), PL/Min ($r=0.947$), PL^{2D} ($r=0.901$), PL^{1D-FWD} ($r=0.819$), PL^{1D-SIDE} ($r=0.944$), and PL^{1D-UP} ($r=0.972$), while Practice 3 also displayed significant ($p \leq 0.001$) positive correlations between Distance and PL ($r=0.858$), PL/Min ($r=0.872$), PL^{2D} ($r=0.809$), PL^{1D-FWD} ($r=0.810$), PL^{1D-SIDE} ($r=0.761$), and PL^{1D-UP} ($r=0.891$). **CONCLUSION:** These data suggest a strong association between parameters captured by the two systems used to monitor eTL, however coaches and performance practitioners should be aware that each system may potentially provide unique information used to monitor and track eTL of athletes during basketball play.

3755 Board #72 May 30 8:00 AM - 9:30 AM
Using A 3d-accelerometer To Enhance Task Assessment

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 (No relevant relationships reported)

PURPOSE: Traditional fitness assessments use a standard test battery to gather outcome values that quantify movement capacity in terms of a generalized rating. While valuable, such assessments overlook the process-oriented aspects of a task performance. Triaxial accelerometers (TA) may help provide more process-oriented tracking of human movements by recording acceleration values. The purpose of this comparative analysis was to establish how TA's may provide more robust measures of task performance. **METHODS:** Male subjects (N=10) wore TAs while performing 2 tasks (squat (SQ) & pushup (PU)) at a moderate task workload. Using acceleration data, variables of amplitude (AMP) and frequency (FQ) per repetition were determined for each task. For each, mean (m), STDV, ANOVAs, and post hoc tests for significant differences were compiled. **RESULTS: AVG Subject Parameters: AGE:** 41.7y.o., **BW:** 84kg, **HT:** 185.0cm. **Means & STDV:**

	SQ				PU			
	AMP		FQ		AMP		FQ	
	μ (g)	STDV (+/-)	μ (s)	STDV (+/-)	μ (g)	STDV (+/-)	μ (s)	STDV (+/-)
S1	1.02	.05	1.94s	.06	1.13	.06	1.14	.03
S2	1.04	.05	1.89s	.12	1.18	.09	1.08	.04
S3	0.88	.08	2.69	.12	0.84	.07	2.19	.12
S4	0.64	.07	3.03	.17	1.03	.11	1.90	.07
S5	0.32	.70	2.89	.33	0.97	.05	2.04	.08
S6	0.60	.08	2.21	.09	0.74	.07	1.63	.28
S7	0.59	.04	3.10	.34	0.81	.09	2.02	.18
S8	0.49	.04	2.30	.16	1.32	.99	0.81	.03
S9	0.56	.05	3.39	.36	0.99	.07	2.10	.10
S10	1.40	.09	1.59	.05	0.99	.07	1.11	.04

ANOVA: SQ: AMP (F-critical 2.0): **F-value** 251.4 **Tukey** (7 out of 46 mean differences), **FQ: F-value** 79.8, **Tukey** (12 out of 46 mean differences). **PU: AMP** (F-critical 1.98) : **F-value** 30.1 **Tukey** (23 out of 46 mean differences) **FQ: F-value** 50.3, **Tukey** (18 out of 46 mean differences). **CONCLUSION:** Task measures of acceleration (AMP and FQ) revealed that subject results varied significantly. These findings suggest individuals rely on varying solutions to movement, and performance outcomes may be partially attributable to these differences. Assessments relying on both measurement types may provide more robust performance information.

3756 Board #73 May 30 8:00 AM - 9:30 AM
The Effects Of Home Versus Away Travel On Urine Specific Gravity In NCAA DII Volleyball Athletes

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 (No relevant relationships reported)

Urine specific gravity (USG) has historically been utilized to classify an individual's hydration status. Road trips, with decreased willingness to drink and increased "road food" selection, may affect athletes' hydration status. Athletic performance has been shown to be affected by hydration status.

PURPOSE: To compare urine specific gravity of home versus away weekends for DII volleyball athletes.

METHODS: Fourteen NCAA Division II female collegiate volleyball athletes (Red-shirt = 2, Freshmen = 1, Sophomore = 7, Junior = 1, Senior = 1) participated in this study. Urine was collected in sterile cups in the hours preceding games. Collections were conducted over two weekends of play with a total of five samples being collected. All samples were collected prior to the competitions. Home competitions (HM) were Friday and Saturday. Collections for away competitions (AW) were pre-trip Friday, post-trip/pre-game Friday, and post-trip/pre-game Saturday. Participants competed against the same two teams for home and away weekends. Urinalysis was conducted via reagent strips, according to manufacturer's instructions. Data were analyzed via repeated measures ANOVA with an a priori level of 0.05.

RESULTS: USG during HM Friday and HM Saturday were 1.015 ± 0.008 and 1.013 ± 0.006 , respectively. USG from AW pre-trip Friday, AW post-trip Friday, and AW post-trip Saturday were 1.011 ± 0.007 , 1.012 ± 0.005 , and 1.014 ± 0.003 , respectively. Post hoc analysis revealed no significant findings (range in p-values were 0.144-0.845). While no statistical significance was shown from the data analysis, there were some interesting trends. Overall, USG decreased during the HM weekend and gradually increased over the AW weekend. Only 17% of the athletes increased USG during HM weekend. However, 75% of the athletes showed an increase in USG from the time they showed up to travel Friday until pre-game on Saturday.

CONCLUSION: Following a two-hour road trip, USG did not differ significantly between home and away games. However, some athletes showed varying changes in USG across collection time points. Further analysis has yet to be done to determine the effect on game statistics and performance.

3757 Board #74 May 30 8:00 AM - 9:30 AM
Accuracy Of 5k Race Time Using A Gps Sports Watch
 Andrew James Brink, Andrea D. Workman, Rebecca W. Moore.
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 (No relevant relationships reported)

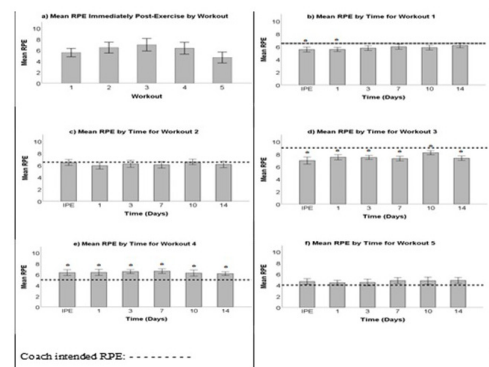
GPS sports watches are a convenient tool used to monitor improvement and predict race performance. Ensuring these watches are accurate allows runners to specifically plan out training to reach a desired race time. However, if predicted race time is inaccurate, an athlete may become frustrated during training or not reach their goals. **PURPOSE:** The purpose of this study was to determine if a GPS sports watch accurately predicts 5k race time. **METHODS:** Nineteen participants (26.8 ± 7.9 years) were recruited for this study. Eligibility included participants running at least 30 minutes a day, three times a week. Participants were required to visit the EMU Running Science Laboratory on two separate occasions. During the initial visit, participants completed a VO_{2max} test on a treadmill. Participants ran at a self-selected speed while grade increased 2% every two minutes until volitional exhaustion. Following the VO_{2max} test, participants were shown how to use a GPS sports watch and instructed to run three days a week for at least 30 minutes for two weeks. After two weeks, participants returned for their second visit and predicted 5k time was recorded from the GPS sports watch. Participants then completed a 5k race time trial on a 200m indoor track (measured 5k). A paired samples t-tests was used to compare predicted 5k to measured 5k ($p < 0.05$). **RESULTS:** Three participants were excluded due to failure to return for the second visit. The remaining 16 participants (5 female, 11 male) had an average VO_{2max} of 54.0 ± 9.1 ml/kg/min, height of 172.9 ± 7.0 cm, and weight of 69.5 ± 9.0 kg. There was a significant difference between measured 5k race time (25.3 ± 4.7 min) and predicted 5k race time (21.1 ± 2.5 min) indicating that the GPS watch underpredicted 5k time. **CONCLUSION:** The GPS sports watch underpredicted 5k time by approximately four minutes. The prediction from the GPS sports watch was based on factors such as speed, heart rate, and distance measured while participants wore the watch for two weeks. Failure to accurately measure heart rate at the radial pulse, inaccuracy associated with GPS, and varied training intensity while wearing the watch could explain some of the error.

3758 Board #75 May 30 8:00 AM - 9:30 AM
The Application Of Statistical Process Control In Athlete Monitoring: Case Study Series
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 (No relevant relationships reported)

To optimize sport performance, it is important for practitioners to assess training loads (TLs) and subsequent responses within individual athletes. Published research pertaining to athletes often report group or aggregate data. Investigations that present data from individual athletes are rare, particularly in a team setting. However, statistical process control (SPC) is often used in case studies of individual athletes where SPC is used to identify variances outside of normal ranges. **PURPOSE:** To determine the efficacy of using SPC to assess subjective measures of perceived wellness (PW) scores coupled with session rating of perceived exertion (sRPE) and global positioning system (GPS) derived TLs among soccer players. **METHODS:** Five NCAA Division I female soccer players (21.0 ± 1.3 yr, 165.7 ± 4.3 cm, 60.4 ± 5.2 kg) participated in this study. Each athlete played as a starter on the university team and on their respective senior or under-aged national teams. All PW and TLs were collected across 14 weeks of the competitive season. A customized questionnaire was used for players to report PW consisting of six subscales ranging from 1 (poor) to 5 (excellent). The athletes completed the questionnaire by noon seven days per week. PW subscales were summed and used for assessment. TLs including sRPE and total distance (TD) measured via GPS were collected for each practice and match. SPC was used to identify meaningful changes of the summed PW scores relative to individual mean. Means (M) and standard deviations (SD) of the PW scores were calculated for each player. SPC limits were set at $M \pm 1.0$, ± 1.5 , and ± 2.0 SD. **RESULTS:** There were 3.4 ± 1.9 scores of PW below -2.0 SD out of 91.4 ± 2.5 data. Additionally, 6.4 ± 2.8 data of PW were placed between -1.5 and -2.0 SD. SPC also identified 0.4 ± 0.5 PW data between 1.5 and 2.0 SD. However, no scores above 2.0 SD were observed. After matches, abnormal scores (PW scores $< M-2SD$) appeared from accumulated spikes of TD and increased sRPE. **CONCLUSIONS:** Based on the current analysis, each athlete appeared to respond differently to TLs despite having similar playing status. Thus, sport performance practitioners may consider incorporating SPC into an on-going athlete monitoring program to accurately access each athlete's recovery rate so that sport performance can be optimized across a given season.

3759 Board #76 May 30 8:00 AM - 9:30 AM
Temporal Robustness Of The Srpe Method Of Monitoring Training
 Carl Foster, FACSM, Bo Orton, Richard Pein, Richard P. Mikat, John P. Porcari, FACSM. *University of Wisconsin-La Crosse, La Crosse, WI.*
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 (No relevant relationships reported)

Introduction: Session Rating of Perceived Exertion (sRPE) has been used to monitor training as an alternative to traditional measures such as heart rate, blood lactate and VO_{2} . sRPE has traditionally been measured ~30 min post exercise, although recent data suggest that it is temporally robust in the 5-min to 24 hr post exercise window. The goal of this study was to analyze the post-exercise on temporal robustness of sRPE as well as the difference between coach-intended RPE and athlete-reported sRPE. **Methods:** Collegiate swimmers ($n=15$) (NCAA Division III) completed 5 training sessions at different coach intended levels of sRPE. The subjects reported sRPE ~30 min post-exercise and then 5 more times in the subsequent two weeks following each training session. **Results:** Athletes reported similar sRPE over all times post-exercise for all workouts, suggesting that sRPE is a viable method of monitoring training up to 14 days post-exercise. The sRPE reported by the athletes were significantly lower than coach intended when the intended RPE was high (sRPE~9.0), and significantly higher than coach's when intended sRPE was lower (~4.0-5.0). **Conclusions:** The findings suggest that sRPE is very temporally robust, but that there is a mismatch between coach and athlete related to training intensity.



3760 Board #77 May 30 8:00 AM - 9:30 AM
Field-based Validation Of An Epifluidic Colorimetric Patch For On-skin Analysis Of Regional Sweat Chloride Concentration
 Khalil A. Lee¹, Timothy J. Roberts¹, Justina L. Bonsignore¹, Melissa L. Anderson¹, Corey T. Ungaro², Alexander J. Aranyosi³, Stephen P. Lee³, Jeffrey B. Model³, John A. Rogers³, Roozbeh Ghaffari³, Lindsay B. Baker, FACSM². ¹*Gatorade Sports Science Institute, PepsiCo, Inc., Bradenton, FL.* ²*Gatorade Sports Science Institute, PepsiCo, Inc., Barrington, IL.* ³*Epicore Biosystems Inc., Cambridge, MA.* (Sponsor: Lindsay B. Baker, FACSM)

Reported Relationships: **K.A. Lee:** Salary; *Gatorade Sports Science Institute, PepsiCo Inc.* The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc.

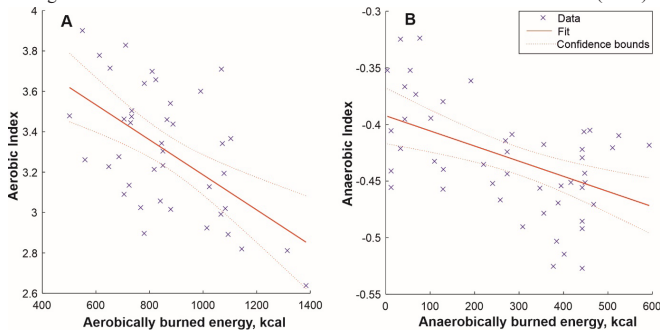
Sweat analysis via epidermal microfluidic (Epifluidic) patches may be a more practical alternative to standard sweat analysis techniques, offering users real-time feedback of sweat electrolyte concentrations. These patches have previously been validated in controlled, lab-based conditions for measuring regional sweat [Cl⁻]. However, research in the field is needed to determine Epifluidic patch validity in real-world, sport-specific conditions. **Purpose:** To determine the accuracy of an Epifluidic patch with built-in colorimetric assay to measure regional sweat [Cl⁻] during exercise in sport-specific conditions. **Methods:** Forty-six subjects (17 male, 29 female; 17.1 ± 0.8 y; 64.2 ± 10.2 kg) from five sports (tennis, soccer, lacrosse, basketball, and track & field) participated in coach-led training sessions ($22-34^{\circ}C$, $50-82\%$ RH; 39-127 min patch duration) while sweat was collected from the right and left ventral forearms with an Absorbent patch (3M Tegaderm+Pad) and Epifluidic patch (Epicore Biosystems, Inc.), respectively. Immediately after removal of the Absorbent patch, an image was taken of the Epifluidic patch on-skin with a 12MP smartphone camera (iPhone 8, Apple Inc.) for analysis of [Cl⁻] via colorimetry. Sweat from the Absorbent patch was extracted via

centrifuge and subsequently analyzed for [Cl⁻] by ion chromatography. Data are shown as mean±SD. **Results:** There was no difference in sweat [Cl⁻] between Absorbent and Epifluidic patches (21.1±13.8 vs. 19.9±12.2 mmol/L, $p=0.14$). Bland-Altman Limits of Agreement between methods was -9.3 to 11.6 mmol/L with a mean bias of 1.2 mmol/L. There was a significant correlation between patches ($r=0.92$, $p<0.0001$) and the coefficient of determination (r^2) for predicting Absorbent from Epifluidic patch [Cl⁻] was 0.85. Based on Deming regression analysis, the slope and intercept of the regression line describing Absorbent vs. Epifluidic patch sweat [Cl⁻] were not different than 1 and 0, respectively. **Conclusions:** The Epifluidic patch provides accurate data for forearm sweat [Cl⁻] estimation during exercise in sport-specific conditions during live indoor and outdoor training. Future research is needed to evaluate the Epifluidic Patch in other sports (beyond those investigated) as well as for on-skin analysis of sweat [Cl⁻] at other regional sites.

3761 Board #78 May 30 8:00 AM - 9:30 AM
ECG-derived Aerobic And Anaerobic Indices For Training Efficiency Tracking

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 (No relevant relationships reported)

There is a continuous search for indirect methods and simple criteria to evaluate physiological effects of training. ECG analysis provides a relevant option for routine monitoring as it can be supported in real-time mobile or wearable device applications. Determination of the optimal ECG features is essential for monitoring and assessing systems. **PURPOSE:** To introduce ECG-derived aerobic index (AI) and anaerobic index (ANI) which could determine training effects and indicate subject's metabolic state. **METHODS:** A healthy, physically active subject performed endurance and strength trainings 3 times a week. He fulfilled 55 ECG measurements using single-lead wrist-wearable device before and after 28 trainings. ECG signals were processed with detection of QRS-complex. AI and ANI were calculated as R-peak normalized to S-R complex slope and as S-T complex slope normalized to R-S slope. Correlations of AI and ANI with training load were calculated using Pearson correlation coefficient (r) with p value. **RESULTS:** Correlations between AI and aerobic load as well as ANI and anaerobic load were identified. The more energy was burned during training, the lower indices were registered. As shown in Figure, maximum of negative correlation between AI with aerobic load was in 60 min after training ($r=-0.57$, $p<0.01$). ANI showed negative correlation with anaerobic load ($r=-0.35$, $p<0.01$) in 30 min after training. **CONCLUSION:** Proposed ECG-derived aerobic and anaerobic indices showed statistically significant correlations with training load and could be used as assessed individual parameters of the degree of training in fitness and sport medicine. Figure. Dependences of ECG-derived aerobic (A) and anaerobic (B) indices on energy, burned during aerobic and anaerobic load. Correlation curves with confidence bounds (95 %).



3762 Board #79 May 30 8:00 AM - 9:30 AM
VALIDATION OF HEART RATE MONITORING OF FENIX 5 DURING MOUNTAIN BIKING

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 (No relevant relationships reported)

The availability of fitness trackers have increased in recent years. These trackers claim to accurately depict Heart Rate - among other factors. Little if any studies have looked into the accuracy of the HR sensor within these systems. **Purpose:** The Garmin Fenix 5 watch boasts about its performance tracking capabilities, claiming that it will accurately track heart rate, this study aims to assess its accuracy using the Polar H7. **Methods:** Sixteen participants (males = 8, females = 8, 24.69±4.44yrs, 171.45±8.9cm, 74.23±21.07kg) rode a mountain bike a total of 3.22km along the McCullough hills trail (Henderson, NV) while simultaneously wearing both the Garmin Fenix 5 and the Polar H7. Participants rode the same trail twice, each ride was 1.61km (round trip), with a 10-minute break in between rides. Validity was determined using the Mean Absolute

Percent Error (MAPE), Bland-Altman analysis with accompanying bias and Limits of Agreement (LoA), and single measures Intraclass Correlations (ICC). Prior to testing, the benchmark for validity was established as $mAPE < 10\%$ and $anICC > 0.7$ ($p < 0.05$), with the lower limit of the ICC 95% confidence interval (CI) set at > 0.7 . **Results:** During mountain biking the MAPE was 13.30%. The single measures ICC was 0.16 with a 95% confidence interval of .068 to .243 ($F(17142, 17142) = 1.495$, $p < 0.000$). **Conclusion:** This data shows that the Fenix 5 does not produce a valid measure of heart rate while mountain biking due to the MAPE being above 10% and the ICC being well below .7.

3763 Board #80 May 30 8:00 AM - 9:30 AM
Confounding Variables Influence Utility Of Heart Rate Measures In Collegiate Athletes.

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 (No relevant relationships reported)

Heart rate is easy to measure and a useful variable for determining training intensity, training status and fitness levels. The downward rate of the heart following a standardized stressor (heart rate recovery; HRR) and resting heart rate (RHR) are autonomic-mediated and can be used to detect training distress. However, confounding variables can limit the usefulness of heart rate when criteria for rate changes are not individualized, especially when applied to entire sporting teams. **PURPOSE:** To determine influences of sex, training status, player position and season duration have on the RHR and the HRR response following a standardized physical stressor. **METHODS:** Subjects were male ($n=17$) and female ($n=26$) collegiate soccer players aged 17 to 22 years. RHR (taken in the morning just after waking) and the HRR following a 300-yard shuttle run and maximal treadmill test were collected four times during one entire season: Beginning of August (pre-season), September (mid-season), October (mid-season), and end of November (post-season). Polar monitors were used to record heart rate. **RESULTS:** A comparison between shuttle run times showed men had faster times ($p<0.001$) and higher VO_{2max} ($p<0.05$) than women. Shuttle run performance and athlete's class standing were not found to be significantly different but trended towards significance ($p=0.052$). HRR examined by sex found that men had a faster HRR time than women ($p=0.010$). A multivariate analysis examining RHR and player position found that there was a statistically significant difference ($p=0.015$): The forward players had higher RHR compared to defenders ($p=0.051$) and midfielders ($p=0.049$). **CONCLUSION:** Player fitness, sex, position and year in school should be considered when establishing guidelines for using heart rate information.

3764 Board #81 May 30 8:00 AM - 9:30 AM
The Accuracy Of Heart Rate Monitors And Determination Of Heart Rate Percentages At Anaerobic Threshold

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 (No relevant relationships reported)

PURPOSE: To examine the heart rate percentage (HR%) at the Anaerobic Threshold (AT) in order to determine the appropriate exercise intensity below or above the AT. A second goal was to assess the accuracy of different types of wearable heart rate monitors (HRMs) during a graded exercise test. **METHODS:** Thirty healthy individuals ($n=21$ male & $n=9$ female; aged 24.5 ± 3.5 years) participated in a single incremental exercise protocol on a cycle ergometer (CE). AT was detected through a metabolic cart by using V-slope method, which determined the point of a nonlinear increase in carbon dioxide output (VCO_2) against oxygen uptake (VO_2). HR was measured each minute of exercise test via two optical-based monitors (Cellular Watch [IW] & Fitness tracker [FB]) and two electrical-based monitors (traditional monitor [ECG] & heart rate monitor [PL]). Electrocardiography (ECG) was used as a "Gold Standard" for comparison in this study. **RESULTS:** AT was reached at the mean and standard deviation (SD) of 130 ± 16 bpm. HR% at AT was observed $67 \pm 8\%$ of HRpeak, Heart Rate Reserve Percentages (HRR%) at AT were observed at $42 \pm 15\%$ of HRpeak. Across all exercise testing stages (Stage 1 [S1], Stage 2 [S2], Stage 3 [S3], etc.), no significant differences were found in HR values between ECG and PL. The most statistical differences were found in HR between ECG and IW, $S6=[p=0.018]$, $S6=[p=0.041]$ and $S7=[p=0.005]$, respectively. As intensity increased, FB and IW underestimated the HR values throughout all stages when compared with the ECG. **CONCLUSIONS:** Analysis of HR% at AT was estimated at approximately 67% of participant maximum effort as well as HRR% at AT was estimated at 42%. At the light-intensity, accurate outcomes of HR values were observed from all wearable HRMs. However, with increased intensity, the accuracy of wearable devices was varied at moderate and high-intensity exercise testing. The PL had the greatest agreement with

ECG when compared to other devices. This might be due to the fact that both HRMs utilize a similar mechanism of measurement. The electrical-based HRM was found to be more accurate in comparison to the optical-based HRMs.

3765 Board #82 May 30 8:00 AM - 9:30 AM
Effect Of Practice And Game-Related Impacts On Common Indicators Of Concussion: A Pilot Study

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Previous studies have suggested that football players not clinically diagnosed with concussion may still demonstrate differences in balance and neurocognitive performance by end of season. Clinically this is important as it indicates the athlete with sub-clinical injuries that may contribute to long-term deficits.

Purpose: A pilot study to determine if non-concussive impacts sustained during normal play at NCAA Division I football practices and spring season scrimmage are sufficient to elicit detectable changes in oculomotor (OM) and balance performance.

Methods: 23 NCAA Division I football players were recruited to this pilot study during the 2019 spring football season. Questionnaires were used to collect demographic information. Portable virtual reality equipment was utilized to measure OM performance of smooth pursuit, saccade, and vestibular ocular reflex (VOR). BESS was utilized to measure balance performance. Assessments were administered at baseline, 24-48 hours after 3 practices, and the spring season scrimmage. Shapiro-Wilkes analysis was used to assess changes in balance and OM skills in subjects across the pilot project.

Results: Of the 23 recruited subjects, 7 (30%) completed all assessments; however, there were missing data observations for the 7 subjects who completed all 5 assessment points. There was no significant change in balance performance ($p = 0.375$); one variable of smooth pursuit testing (mean phase error of left eye) demonstrated near significant changes ($p = 0.0625$). There was no significant change in any variables for horizontal or vertical VOR, while, one variable of horizontal and vertical saccade testing (accuracy x of left eye) demonstrated near significant changes ($p = 0.0625$).

Conclusion: We found no significant detectable changes in balance and OM performance in this pilot study.

G-34 Free Communication/Poster - Performance

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
Room: CC-Exhibit Hall

3766 Board #83 May 30 8:00 AM - 9:30 AM
Internal Load In Football Players: Can The Mind See What The Heart Says?

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Rating of perceived exertion (RPE) is a simple, validated, measure of physical effort, largely reflecting heart rate (HR). However, RPE is being replaced by continuous HR monitoring to quantify internal loads which maximize performance and enhance recovery. **Purpose:** Primary aim: assess relationships between RPE (athlete and coach) versus HR during football practice. Secondary aims: quantify internal load via HR assessments of training impulse (TRIMP) and recovery. **Methods:** Data represents pre-season testing, in an ongoing study. Twenty-nine collegiate male football players (age=20±2years; body mass index= 34±6kg/m²; weight=118±20kg) and 3 coaches volunteered to participate. Each athlete was pre-assigned a HR monitor for the first 7 days of football camp. All participants underwent a 3-minute quick recovery test (QRT). HR monitors were then worn during practice. Athlete HR, TRIMP, %heart rate reserve (%HRR), %heart rate max (%HRmax) were recorded and visible only to researchers. Immediately following practice, all athletes and coaches were asked to assess RPE for the entire training session (sRPE) using the Borg CR-10 scale. %HRmax and %HRR were transformed to scale from 1-10, to match the Borg CR-10. Significance set at $p < 0.05$. **Results:** Training sessions over this 7-day period, lasted 145.8±33.7 minutes. When weekly data were combined, significant overall correlations (pairwise; N=187) were noted between %HRR versus: %HRmax ($r = 0.84; p < 0.0001$), athlete sRPE ($r = 0.30; p < 0.0001$) and

head coach RPE ($r = 0.30; p < 0.0001$). Athlete sRPE was correlated with one coach sRPE ($r = 0.30; p < 0.0001$). Athletes were then subdivided into Big, Combo, and Skill position groups. Two-way ANOVA for sRPE between athletes, coaches and %HRR demonstrated a significant interaction effect ($F = 15.2; p < 0.0001; 22.8%$), time effect ($F = 36.4; p < 0.0001; 13.6%$), and position effect between groups ($F = 26.1; p < 0.0001; 6.5%$). TRIMP decreased over time, with a significant time effect ($F = 23.7; p < 0.0001; 33%$) and position effect ($F = 5.4; p = 0.005; 2.5%$). Trend for QRT to dip on Day 2, then increase over time. **Conclusions:** Athletes and one coach significantly predicted training effort (HR) during practice. However, the variance was small (9%) and sRPE remained steady despite decreased training load and increased QRT scores (trend) over time.

3767 Board #84 May 30 8:00 AM - 9:30 AM
Abstract Withdrawn

3768 Board #85 May 30 8:00 AM - 9:30 AM
Isometric Mid-thigh Pull Correlates With Power, Sprint, Agility And Smash Performance In Junior Female Badminton Players

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Purpose: Badminton is a racket sport characterized by high-intensity, intermittent actions. Some of the most important aspects of fitness required for badminton highlighted in the literature include speed, agility, strength, and power. Traditional strength testing such as one repetition maximum (1RM) squat can be time-consuming and inaccurate. As an alternative choice, the isometric mid-thigh pull (IMTP) has been shown to be related to performance variables such as vertical jump, strength, sprint, and agility in various sports. There are two primary variables for IMTP, the first is to quantify the athlete's maximal force-generating capacity, known as peak force, and the second is to assess the rate at which force can be applied during a maximal effort muscle contraction, called as the rate of force development. This study aimed to examine the relationship among IMTP, vertical jump, sprint, agility and smash performance in elite junior female badminton players.

Methods: Twenty-three national level junior female badminton players (Age: 15.21 ± 0.89 y; Height: 1.71 ± 0.06 m; Body mass: 58.54 ± 6.90 kg; Training age: 7.32 ± 1.95 y) participated in this investigation. The participants performed IMTP, vertical jump, 10-m sprint, badminton-specific change-of-direction testing, and forehand smash velocity testing. Bivariate correlation analysis (Pearson product-moment correlations) was used to examine the relationship between IMTP kinetic variables and sprint, agility and smash performance.

Results: Peak force had a significant negative correlation with 10-m sprint time ($r = -.582, p = .004$), left ($r = -.662, p = .001$) and right ($r = -.664, p = .001$) pro-agility time. Peak force also had a significant positive correlation with smash velocity ($r = .418, p = .047$) and vertical jump power ($r = .514, p = .012$). Rate of force development had a significant negative correlation with 10-m sprint time ($r = -.636, p = .001$), left ($r = -.575, p = .004$) and right ($r = -.546, p = .007$) pro-agility time, as well as a significant positive correlation with vertical jump power ($r = .534, p = .009$).

Conclusions: Results from this investigation demonstrate that IMTP variables such as peak force and rate of force development are associated with jump, sprint, agility and sport-specific performance in elite junior female badminton players.

3769 Board #86 May 30 8:00 AM - 9:30 AM
Ankle Proprioception And Sport-specific Performance In Professional Youth Table Tennis Players

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(No relevant relationships reported)

Purpose The current study aimed to investigate the relationship between ankle proprioception and sport-specific performance in professional youth table tennis players. **Methods** 14 players competed nationally and internationally (Level 1, age=14.29±1.75 yrs, training years=7.36±1.84yrs) and the other 14 players competed regionally (Level 2, age=11.14±1.46 yrs, training year=4.11±0.97yrs) were recruited. All players had no lower limb injuries in the past 3 months. The dominant ankle proprioception was tested by using the active movement discrimination extent apparatus (AMEDA) under three randomized conditions: 1) single AMEDA (Single-A); 2) dual task AMEDA tested while performing forehand attack (Dual-FA), and 3) performing forehand loop (Dual-FL) to hit the topspin into a designated corner on the table, with their hitting rates (HR) recorded. The mean Area Under the ROC

Curve (AUC) was calculated for ankle proprioceptive discrimination sensitivity score. 2-way repeated measures ANOVA was performed to determine the differences among the 3 AMEDA tests for players between 2 levels, and Pearson's correlation evaluated among the measures. **Results** Repeated measures ANOVA showed significant main effects for task load AMEDA tests ($F=46.30, p<0.01$) and competition levels ($F=19.95, p<0.01$), with no significant interaction ($p>0.05$). A significant linear effect was found across the 3 task load conditions ($F=64.97, p<0.01$). Pearson's correlation showed that the HR for both Dual-FA and Dual-FL were significantly correlated with all 3 AMEDA scores (r ranged from 0.38 to 0.66, all $p<0.05$). In addition, years of training was significantly correlated with both HR for Dual-FA ($r=0.46, p=0.02$) and Dual-FL ($r=0.61, p<0.01$), as well as the proprioceptive AUC scores of both Single-A ($r=0.45, p=0.02$) and Dual-FA ($r=0.64, p<0.01$), but was not significantly correlated with the AUC scores of Dual-FL ($p>0.05$). **Conclusion** Ankle proprioception may be an essential ability underpinning sport-specific performance and was significantly impaired under the dual tasks in youth table tennis players. Testing ankle proprioceptive ability during Dual-FL may place demand on central resources not developed by training. These findings have implications for ankle injury prevention, table tennis training and talent identification.

3770 Board #87 May 30 8:00 AM - 9:30 AM

Predictors Of Obstacle Course Racing (OCR) Performance

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Reported Relationships: W. Titus: Other (please describe): I was an employee of the gym where participants were recruited from and where data were collected at the time of this study (Fall 2018). I am no longer an employee at this facility.

Purpose: Obstacle course racing (OCR) has become a popular recreational activity in the last ~10 years, with more than 8.5 million participants. Despite the popularity, little is known about predictors of performance in OCR; research to date has focused on injury prevalence. The purpose of this study was to conduct laboratory and field tests of athletic performance in OCR athletes and examine their relationships to performance in a simulated OCR. **Methods:** Thirty-two men and women (mean \pm standard deviation (SD) age: 42 ± 10 years; OCR experience: 2.8 ± 2.3 years) completed laboratory testing for $\dot{V}O_{2\max}$, anaerobic power (Wingate), vertical jump, flexibility, and body composition. Additional field tests were completed for 400 meter and 1 mile running time, muscle strength (back squats and deadlifts) and endurance (bucket carry for distance), grip strength, and burpees. Participants also completed a 3-mile simulated OCR. Independent t-tests examined differences between sex and bivariate regressions were conducted between testing variables and OCR performance. **Results:** For the combined sample, the best individual predictors were mean relative power from the Wingate tests ($\beta \pm$ standard error (SE): -6.47 ± 1.12 minutes) and mile run time ($\beta \pm$ SE: 6.43 ± 0.71 minutes). Multivariable analysis controlling for age, sex, and mile run time found an independent association between bucket carry for distance and race time ($\beta \pm$ SE: -0.04 ± 0.01 minutes), but mile run time was still the best predictor ($\beta \pm$ SE: 6.33 ± 0.97 minutes). **Conclusions:** Data from the present study suggest that aerobic and anaerobic fitness have important contributions to OCR success.

3771 Board #88 May 30 8:00 AM - 9:30 AM

Relationship Between Seated Single Arm Shot Put And Isokinetic Shoulder Flexion And Elbow Extension Strength

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PURPOSE: Previous studies have demonstrated a strong correlation between isokinetic pushing force and seated single-arm shot-put (SSASP) test performance. However, there is limited research on the contribution of shoulder flexion and elbow extension strength on SSASP test outcomes. Therefore, the purpose of this study was to examine the relationship between isokinetic shoulder flexion and elbow extension strength and SSASP test performance and compare limb symmetry indexes (LSI) between the two tests. **METHODS:** Healthy, physically active men ($n=16$, ages=21-34 yrs) and women ($n=15$, age=18-29 yrs) performed dominant (DOM) and nondominant (NDOM) shoulder flexion and elbow extension isokinetic tests (System 4, Biodex, Shirley, NY) at $60^\circ/s$ (5 repetitions) and $180^\circ/s$ (10 repetitions) to determine peak torque production. The average horizontal range from three SSASP (2.0kg ball) trials were computed separately for each limb. In addition to conducting correlational analyses between the

peak torques and SSASP distances, the differences in LSI computed between each of the peak torques and SSASP distances were statistically compared at each velocity by joint analysis of variance.

RESULTS: Significant ($P<0.001$) relationships were revealed between DOM and NDOM SSASP performance and shoulder ($r=.819$ to $.853$) and elbow ($r=.803$ to $.820$) peak torques at both velocities. LSI for the SSASP ($104.4 \pm 7.1\%$) were similar to the isokinetic LSI at both $60^\circ/s$ (Elbow: $101.3 \pm 10.2\%$, Shoulder: $102.2 \pm 13.8\%$) and $180^\circ/s$ (Elbow: $100.4 \pm 9.7\%$, Shoulder: $103.5 \pm 12.8\%$), with no statistically significant differences ($P=.364$ to $.844$, $\eta_p^2=.001$ to $.028$).

CONCLUSIONS: Results demonstrate shoulder and elbow isokinetic torques are strongly associated with SSASP distances. Moreover, LSI for both tests were not significantly different from each other, thereby supporting the utilization of the SSASP for making bilateral comparisons in healthy individuals.

3772 Board #89 May 30 8:00 AM - 9:30 AM

Evaluating The Impact Of Competition On Vertical Jump Performance

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PURPOSE: The vertical jump (VJ) test is used in athletic populations to assess lower body power and this value can be utilized as a predictor for sports performance. Incidentally, athletes have often elevated their level of performance in competitive environments. However, competition during assessment tests has not been widely examined. It is logical to assume that conducting the VJ test where subjects compete against each other may contribute to higher jumps. The purpose of this study was to determine if a competitive environment would have an impact on VJ performance in females.

METHODS: Twenty-six no less than averagely fit college females (age = 21 ± 1.86 years, Ht. = 166.53 ± 7.30 cm, Wt. = 64.47 ± 11.84 kg, BF% = $23.55 \pm 6.22\%$) completed a dynamic warm up followed by four minutes of passive recovery (PR). After the completion of familiarization jumps and a four-minute PR period, subjects completed two jump series (in a counterbalanced order, solo and competitive) consisting of six jumps per series. The competitive series consisted of two subjects jumping side by side against one another simultaneously. The highest jump, second highest jump, and average jump heights of the solo (SFHJ, SSHJ, SAJ) and competitive (CFHJ, CSHJ, CAJ) jumps were compared and analyzed using a paired-samples T-test ($p \leq 0.05$).

RESULTS: Significant differences occurred between: CFHJ (54.61 ± 1.31 cm) and SFHJ (53.34 ± 1.27 cm) ($p=0.001$); CSHJ (53.68 ± 1.32 cm) and SSHJ (52.27 ± 1.34 cm) ($p<0.001$); and CAJ (52.97 ± 1.31 cm) and SAJ (51.45 ± 1.33 cm) ($p<0.001$).

CONCLUSIONS: The results of this study suggest that a competitive environment for the VJ test does have an impact on VJ performance. Future research may need to assess the impact of a competitive environment on the VJ test utilizing athletes from sports where jumping actions are of extreme importance. Furthermore, an evaluation of the competitive environment on other power tests, such as the broad jump, should occur.

3773 Board #90 May 30 8:00 AM - 9:30 AM

Audience Presence Prolongs Maintenance Of Peak Power In Maximal Anaerobic Activity

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Sport participation commonly occurs in front of an audience. It is important to know if the presence of that audience influences the force profile of the performer. **PURPOSE:** To examine the influence of spectator presence on power output in a short-duration, high-intensity activity. **METHODS:** We tested 15 men and 28 women, ages 18-25, on a 30-second Wingate cycle ergometer test. All subjects were tested twice, separated by 72 hours. During one trial, performance took place in front of the test administrator; during the other trial, the administrator was accompanied by an audience. Spectators observed but did not interact with the subjects. Testing conditions (e.g., time of day, instructions provided, and verbal encouragement) were identical in the two trials. The order of tests was assigned in a counter-balanced design. Mixed ANOVA with repeated measures was used to compare peak power (PP), duration of peak power (DPP), and mean power (MP) between the two trials overall and by sex. **RESULTS:** Subjects were 20.4 ± 1.4 years of age; across all testing, PP 1.7 ± 1.3 w/kg, DPP was 2.6 ± 3.5 seconds, and mean power was 1.2 ± 0.3 w/kg. There was no effect of test order on performance ($p=0.199$). Similarly, there was no effect of audience presence on PP ($p=0.348$) or an interaction effect with sex ($p=0.406$). There was an increase

in MP in the audience trial; subjects were 0.1 w/kg higher, corresponding to a 6.5% increase ($p=0.003$; 95% CI: 0.03 to 0.13 w/kg). There was no interaction effect with sex ($p=0.416$). The increase in MP was the result of an increase in DPP, which was 1.6 seconds longer in the audience trial, corresponding to a 91.6% increase ($p=0.002$; 95% CI: 0.61 to 2.49 seconds). There was no interaction effect with sex ($p=0.418$). **CONCLUSIONS:** The presence of an audience influenced power output on the Wingate test. Although peak power was unaffected, the duration peak power was maintained nearly doubled, indicating endurance at peak performance may be sensitive to arousal.

3774 Board #91 May 30 8:00 AM - 9:30 AM
Combined Driving: Task-specific Position Impacts Grip Strength Of Equestrian Athletes

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Equivalent to a human triathlon, combined driving is an equestrian sport designed to test ability to navigate horses and carriage during three phases. Drivers control up to four horses at a time relying heavily on hand strength. **PURPOSE:** to 1) establish baseline data on grip strength and endurance of combined drivers in standing and task-specific positions; and 2) compare grip values to normative data by driver age. **METHODS:** Drivers were included if medically cleared to actively compete, and free from current injury. Fifty-one combined drivers (9 males, 42 females) ages 21-78 participated during two nationally recognized events. All drivers were right hand dominant. 63% of drivers were over 50 y/o. 22% of drivers reported having arthritis in their hands/wrists. Drivers completed a demographics and sport-specific survey, and three grip tests in two positions: standing and task-specific (sitting). Measures included peak values and endurance. Peak grip was recorded into four categories based on normative values.

RESULTS: Females with more than 30 yrs of driving experience had higher strength in the non-dominant hand ($p=0.0345$). There was a significant difference between strength based on position for both sexes (Table 1). Over 45% of females were stronger than normative data for both dominant and non-dominant hand, while only 22% of males fell in the stronger category. Female drivers average hand grip strength was 1.25 times greater than the normative population. The endurance for all subjects was significantly higher for the right hand ($p=0.002$). **CONCLUSIONS:** This study is the first to establish standing and task-specific grip strength in combined drivers. Female drivers over 50 y/o demonstrated greater hand strength in their non-dominant hand, suggesting continuous use of hands for driving promotes strengthening muscle and maintaining hand function regardless of reported arthritis. Results demonstrated equestrian driving is beneficial to hand grip strength.

Table 1. Average peak grip strength while standing and sitting by sex.

	Average Standing Peak - Right (kg)	Average Standing Peak - Left (kg)	Average Sitting Peak - Right (kg)	Average Sitting Peak - Left (kg)
Males	43 ± 5.1	44 ± 6.9	38 ± 7.5 ^b	36 ± 9.3 ^b
Females	32 ± 6.5 ^a	30 ± 6.2 ^a	25 ± 8.3 ^{a,b}	23 ± 8.1 ^{a,b}

Note: Values are displayed as mean ± SD.

^adenotes significant difference ($p<.05$) between right and left

^bdenotes significant difference ($p<.05$) between sitting and standing

3775 Board #92 May 30 8:00 AM - 9:30 AM
Differences In Player Metrics Between Lacrosse Games And Practices

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Lacrosse participation in the United States has rapidly increased in recent years, however there is minimal research related to the sport. Existing research has mainly utilized laboratory-based testing procedures. There is a need to understand the physiological demands of players during live play to assist coaches with the training and conditioning necessary for improved player performance. **PURPOSE:** To compare player metrics of high school male lacrosse players during games and practices.

METHODS: A team heart rate monitoring system with an internal global positioning system and gyroscope was used to record internal player metrics (heart rate [HR], calories) and external player metrics (duration, distance, speed, sprints). Participants in the study consisted of 13 male high school club lacrosse players (16.2 ± 1.5 yr; 175.3 ± 7.7 cm; 69.9 ± 13.6 kg). Subjects were monitored during two practices (130.9 ± 5.2 minutes) and one game (39.58 min). Differences in player metrics were compared by session, as well as by position: attack, midfield, defense, and face-off-get-off (FOGO). Game and practice data were compared utilizing paired samples *t*-tests, while individual position metrics were analyzed by independent sample *t*-tests. A standard

$p \leq .05$ was used to determine significance for the analyses. Effect sizes (*r*) were also calculated for each comparison. **RESULTS:** Significant differences and large effect sizes were found for average HR, total calories, and caloric expenditure ($t \geq 4.2$, $p \leq .003$, $r \geq .590$). Significant differences and large effect sizes were also found for duration, total distance covered, and number of sprints between game and practice sessions ($t \geq 2.32$, $p \leq .049$, $r \geq .253$). Positional comparisons identified significant differences and large effect sizes between midfield and FOGO positions for maximum HR ($t = 2.411$, $p = .028$, $r = .525$) and number of sprints ($t = 3.242$, $p = .005$, $r = .745$). **CONCLUSION:** The results of the study suggest that both internal and external metric requirements differ between high school lacrosse practice and game sessions, as well as across varying positions. This data could be used to alter practice sessions to better mimic the higher intensities of games and provide coaches the ability to train athletes at game-like and position-specific intensities.

3776 Board #93 May 30 8:00 AM - 9:30 AM
Performance Profile Of International Male Lacrosse Players

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PURPOSE: Even with its rising participation numbers worldwide, there has been little quantitative analysis on the activity profile of Lacrosse players. Therefore, this study aimed to determine (a) the overall activity profile and differences over the course of play, and (b) differences between players position.

METHODS: Data involved eight World Championships games of the male Austrian lacrosse national team using micro technological devices. Assessed parameters included total distance covered (m), mean heart rate (%HR_{mean}), time spent in four different HR-zones (HRz) (<75; 75-84.9; 85-89.9; ≥90%), distance covered (m) in five different Speed-zones (Sz) (0.0-0.2; >0.2-1.8; >1.8-3.3; >3.3-5.7; >5.7m/s), and mean respiratory frequency (RF). Additionally to total game values differences between quarters and players position were analyzed. Statistical significance was set at $p \leq 0.05$ and for an estimate of effects Cohen's ES was calculated.

RESULTS: Overall activity results show a total distance covered of 4,511.6 ± 1,151.3m, a RF of 25.4 ± 1.7bpm, and a HR_{mean} of 72.3 ± 5.1%. Greatest distance was covered in Sz 2 (1,578.4 ± 627.2m), and most of the time spent in HRz 1 (3,028.4 ± 714.2s). Comparison between quarters showed lower HR_{mean} values ($p=0.00$; $n^2p=0.08$), more time spent in HRz 1 ($p=0.00$; $n^2p=0.12$) and less in HRz 3 ($p=0.03$; $n^2p=0.03$) and HRz 4 ($p=0.00$; $n^2p=0.09$), and a lower RF ($p=0.00$; $n^2p=0.09$) over the course of play. Regarding players position, attackers showed more time spent in HRz 2 compared to other positions (1,482.3 ± 51.2s; $p=0.00$; $n^2p=0.69$), and covered greater distance in Sz 2 (2,275.8 ± 149.4m; $p=0.01$; $d=3.10 \pm 1.55$) compared to midfielders. On the other hand, midfielders showed greater distance covered in Sz 4 (1,334.0 ± 320.9m; $p=0.05$; $d=1.32 \pm 1.15$) compared to defenders.

CONCLUSIONS: Players' profile data are in agreement with recent research. Furthermore, results indicate a reduction of activity along with an increase of physical stress over the course of play. Regarding players position our findings support the hypotheses that midfielder are exposed to higher intensity bouts with longer rest periods compared to other positions. Overall, findings will be of interest for coaches and practitioners for a deeper understanding of demands players are exposed to in lacrosse match-play.

3777 Board #94 May 30 8:00 AM - 9:30 AM
An Evaluation Of Internal And External Load Metrics In Games In Women'S Collegiate Lacrosse

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PURPOSE: There is little published data to guide coaches and sport scientists about important variables for measuring game and training load in sports outside of soccer and rugby. The purpose of this study was to statistically evaluate the relationship of internal and external load metrics in women's collegiate lacrosse games.

METHODS: Twelve Division I collegiate female lacrosse players wore a heart rate (HR) monitor and global positioning system (GPS) during 17 intercollegiate games. Seven measures determined training load: two internal measures [mean HR and training impulse (TRIMP)] and five external measures [total distance, high-intensity distance (HID), distance rate, accelerations, and decelerations]. The training load measures were analyzed for the whole game and by first and second halves. Principal component analysis (PCA) was used to determine which internal and external load variables were most associated with each portion of the game. A paired samples *t*-test was used to compare differences in first and second half metrics.

RESULTS: The whole game and each half extracted only one principal component. For the whole game, HID, decelerations, accelerations, TRIMP, and total distance

explained 58% of the variance ($p < .001$). The same metrics explained 55% of the variance for the first half ($p < .001$). For the second half, the same metrics with the addition of distance rate explained 57% of the variance ($p < .001$). Interestingly, the distance rate measure was only significant in the second half, although total distance contributed the most to the component, as it did in the first half and whole game data. The paired samples t-test showed differences between first and second halves for HID ($p < .001$), accelerations ($p < .001$), decelerations ($p < .001$). In all cases, there was greater distance and more intense efforts in the first half than the second.

CONCLUSIONS: These results show that a combination of internal and external load measures should be used to determine load during games. The loaded metrics should be compared to a complimentary analysis for drills to ensure that training load metrics are similar. These data also support the concept of reduced high-intensity performance in the second half. This information should be used to bolster appropriate training methods to improve second half fitness.

3778 Board #95 May 30 8:00 AM - 9:30 AM
Cut-Off Values In The Prediction Of Success In Olympic Distance Triathlon

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PURPOSE: To determine cut-off values to reach a Top-3 position in an Olympic distance triathlon by investigating which discipline has the most influence in overall race performance, and whether or not this has changed over the decades.

METHODS: Data from 1989 to 2018 of 33,099 men and 18,928 women ($n=52,027$) who competed in the Triathlon World Cup, World Triathlon Series, and Olympics race events were included. In addition to exploratory data analyses, linear regressions were applied for performance trends in overall and top-3 of each race. A t-test for independent samples was applied for sex comparison. Multivariate analysis was performed to assess which discipline may have the greater influence. The cut-off value to achieve a top-3 position was calculated.

RESULTS: The cut-off values for Men were: swimming=19.5min; cycling=60.7min; running=34.1min. Women's cut-off values were: swimming=20.7min; cycling=71.6min; running=38.1min. Based on this analysis, it was shown that running is the discipline with the most influence on overall race time for men, while swimming is the discipline with most influence for women. Cycling is the discipline with least influence on overall race performance for both men and women.

CONCLUSIONS: In conclusion, the established cut-off values were set in order to increase the chances of achieving a successful rank in an Olympic distance triathlon. In summary, swimming split seems to be the better predictor of overall race performance in women, while running time is a better predictor for men. Our analyses showed that this influence pattern has not changed in the last three decades.

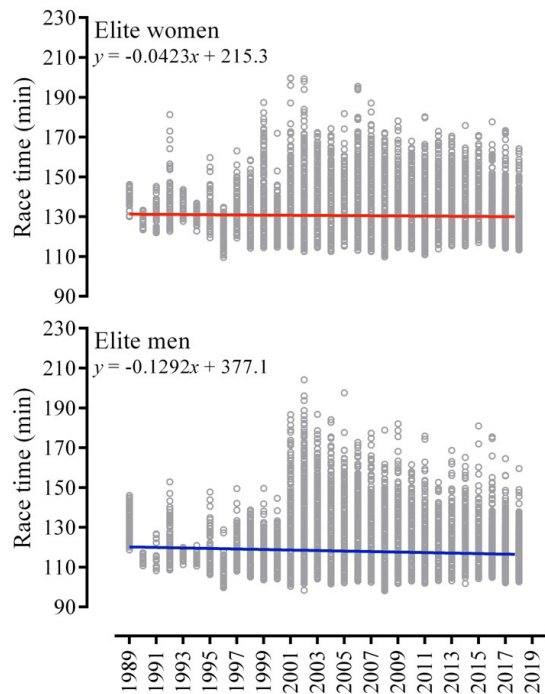


Figure 1. Performance trend of overall race time in Olympic distance triathlon from 1989 to 2018 in men and women.

3779 Board #96 May 30 8:00 AM - 9:30 AM
Abstract Withdrawn

3780 Board #97 May 30 8:00 AM - 9:30 AM
Differences In Mechanics Between First And Second Drop Vertical Jump Landings
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PURPOSE: A drop jump and landing, followed by another maximal jump and landing, has been used when assessing injury risk using the Landing Error Scoring System (LESS). The LESS provides a way to measure frontal and sagittal plane alignment during landing and has traditionally used the first, but not the second, landing for assessment. Additionally, vertical ground reaction force (vGRF) and knee excursion are commonly analyzed during a drop vertical jump. The purpose of this study was to investigate whether there was a difference in LESS scores, vGRF, and knee excursion between the first and second landings of the drop vertical jump.
METHODS: Forty healthy subjects performed a drop vertical jump from a 30 cm box with an initial landing (L1) immediately followed by a second maximal jump and landing (L2). Three trials were scored using the LESS. Subjects were dichotomized as "high risk" on the LESS if they had a score greater than 5 (including moderate and poor scores) and "low risk" (including good and excellent scores) if they scored 5 or under. Jump height, peak vGRF, and knee excursion were recorded using an in-ground force plate and a 3-D motion analysis system. To further analyze the data, subjects were separated into "high" and "low" jumpers by dichotomizing the average jump height. Statistical analysis was performed with SPSS (version 25.0) to identify whether there were significant differences in LESS scores, peak vGRF, and knee excursion between landings for all subjects and "high" and "low" jumpers.

RESULTS:

Table 1. Comparisons of Average Total LESS Score, Peak vGRF and Knee Excursion Between L1 and L2 for "All Subjects" and "Low" and "High Jumpers."

	All Subjects				Low Jumpers				High Jumpers			
	L1	L2	p-value (alpha=.05)	n	L1	L2	p-value (alpha=.05)	n	L1	L2	p-value (alpha=.05)	n
LESS score	4.46 ± 2.12	6.25 ± 3.04	0.001	40	5.03 ± 2.31	7.49 ± 2.73	0.001	21	3.82 ± 1.73	4.88 ± 2.83	0.071	19
Peak vGRF (N/kg)	1.98 ± 0.59	2.57 ± 0.74	0.001	39	2.08 ± 0.63	2.50 ± 0.74	0.003	21	1.86 ± 0.54	2.66 ± 0.76	0.001	18
Knee excursion (degrees)	66.13 ± 17.07	72.39 ± 26.21	0.051	39	60.41 ± 17.08	63.63 ± 27.55	0.41	21	72.8 ± 14.86	82.6 ± 20.93	0.067	18

CONCLUSIONS: The significant increase in LESS scores and peak vGRF between landings suggests that the second landing may be more indicative of injury risk when using the LESS. Low height jumpers had greater injury risk due to significantly higher LESS scores and minimal changes in knee excursion from landing one to landing two.

3781 Board #98 May 30 8:00 AM - 9:30 AM
"Critical Oxygenation Model": A Novel Approach To A Classical Fatigue Threshold

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Reported Relationships: A. Feldmann: Industry contracted research; Idiaq AG. Ownership/interest/stock; Moxy Monitor.

PURPOSE: The critical power (CP) model identifies a performance-based fatigue threshold which can be effectively used to predict time to task failure (TTF). The model's hyperbolic form identifies a clear asymptote (CP) which determines an over-under threshold with which an athlete can perform a task. Tasks over CP result in a depletion of work potential (W') which ultimately results in failure when W' is depleted. CP and W' are performance characteristics and the physiological mechanism behind this phenomenon remain difficult to pinpoint. Nonetheless, performance above CP is characterised by unsustainable metabolic process which are a potential explanation for failure. A physiological measure that could represent CP and W' would enhance the model's effectiveness for athletics. Muscle oxygenation (SmO2) as measured by Near-infrared spectroscopy (NIRS) offers itself as a potential physiological surrogate for CP and W', through a time-SmO2 integral (O') identifying unsustainable metabolic process.

METHODS: Eighteen participants (age: 21±1.7; weight: 68±11.1 kg) performed three trials of single-leg knee extensions, at 5%, 10% and 20% 1-RM, to exhaustion in order to evaluate individual power-duration curves. In order to eliminate the effect of blood flow knee extension trials were performed in occluded conditions (pressure cuff >300mmHg). NIRS and EMG sensors were placed on the vastus lateralis, vastus medialis and rectus femoris. O' of the NIRS curve was calculated for each trial.

RESULTS: The CP model predicts that W' is constant across tasks to failure. The same prediction was made for O'. The results suggest that this assumption is correct and O' remains constant for TTF; 5% 1-RM: M = -43.85, SD = 17.93, [95% CI: -35.3, -52.5]; 10% 1-RM: M = -44.75, SD 17.76, [95% CI: -36.2, -53.3]; 20% 1-RM M = -44.79, SD 16.16 [95% CI: -37.0, -52.5]. **CONCLUSIONS:** SmO2 represents a dynamic balance between O2 supply and O2 demand in real-time. An imbalance between O2 supply and O2 demand effects local muscle metabolism resulting in accumulating fatigue which if not restored results in specific TTF. The consistency between O' and TTF over the power-duration curve suggest potential for a physiological approach to a classical performance threshold. This knowledge could be invaluable to TTF prediction at an individual physiological level.

3782 Board #99 May 30 8:00 AM - 9:30 AM
Effects Of Different Intensity And Duration Of Warm-up On Hemodynamics, Jump Power, And Flexibility.

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PURPOSE: Tabata protocol (TP), usually consisting of eight to nine bouts of 20-sec of maximal exercise with 10-sec rest, is time-efficient intervention with both aerobic and anaerobic benefits. This study investigated the effectiveness of different variations of TP as a warm-up procedure.

METHODS: Twenty-five healthy subjects (13 females and 12 males) participated in this study. Participants performed 6 randomized exercise sessions separated by at least 48 hours. The exercise sessions involved 3-min (TP3-20:10; TP3-30:10), 5-min (TP5-20:10; TP5-30:10) or 8-min (TP8-20:10; TP8-30:10) consecutive bodyweight squats

of either 20-sec workout with 10-sec rest (20:10) or 30-sec workout with 10-sec rest (30:10). Heart rate (HR), blood pressure (BP), thigh skin surface temperature (TT), vertical jump performance (VJ), and flexibility (F) were measured before and after execution of the protocols. Countermovement jump was used to measure VJ and sit-and-reach test was used for measuring F.

RESULTS: Two-way ANOVA demonstrated significant condition*time interaction (p<0.01) and time main effect (p<0.01) for F. Significant condition*time interaction (p<0.01) and condition (p<0.01) and time main effects (p<0.01) were observed for HR. There were significant main effects for time with the post-test demonstrating higher values than the pre-test values for both SBP and DBP (p<0.01). Significant time main effect (p<0.01) was also noted for TT indicating reduction in TT following exercise bouts.

CONCLUSIONS: The findings are suggestive of a decrease in F following a higher duration of exercise (TP8-20:10 and TP8-30:10). This may be ascribed to greater accumulation of metabolites (lactic acid, ammonia, and hydrogen ion) in the working muscles, which may alter Type III and IV afferent neural activity to increase pain perception. Local tissue acidosis also stimulates bradykinin release, which may contribute to the transmission of nociceptive signals from skeletal muscle. Additionally, higher duration of exercise may increase cortisol level that decreases the pain threshold level. Therefore, the decreases in flexibility may be explained by one or a combination of metabolic, hormonal, and neurobiological changes stimulating the brain to inhibit the muscular response.

3783 Board #100 May 30 8:00 AM - 9:30 AM
Is Better Freestyle Swimming Technique Associated With Better Performance?

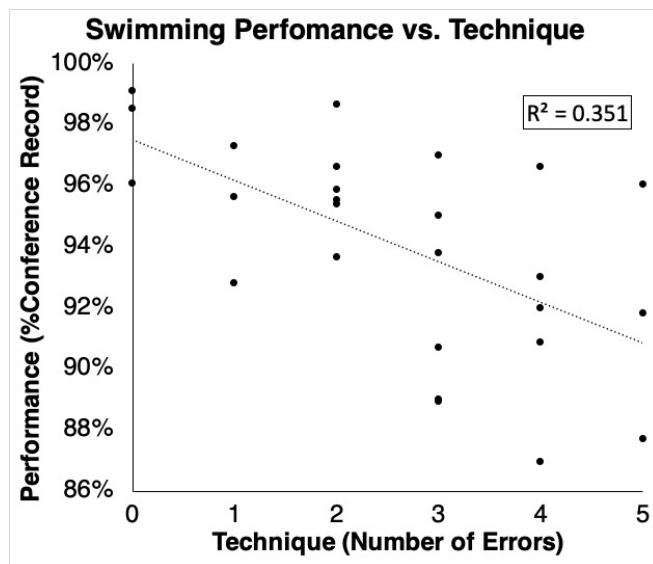
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Swimming technique is widely believed to influence performance, but few studies have quantified this relationship using an objective, pool-side technique assessment.

PURPOSE: To determine the relationship between freestyle swimming technique and swimming performance using a poolside technique assessment. **METHODS:** Freestyle swimming was assessed for technique errors during normal practice near the beginning of the season in 27 Division III college swimmers (16 females, 19±1 years, 1.75±0.11 m, 71.0±10.4 kg). Seven freestyle swimming techniques were considered errors: (1) hand crossing the midline of the body at entry, (2) straight-arm recovery, (3) hand entering with the thumb first, (4) inadequate or excessive shoulder roll, (5) hand crossing the midline of the body during the underwater pull-through, (6) elbow dropping during the pull-through, and (7) excessive neck flexion/extension. Six of the errors were assessed bilaterally, resulting in a maximum possible score of 13 errors. Swimming performance was determined by each participant's best freestyle event from the end-of-season meet as a percentage of the conference record. The correlation between errors and performance was assessed with Pearson's r. One participant was removed due to a late-season injury that affected their ability to train and compete.

RESULTS: Participants averaged 2.7±1.7 errors (range: 0-5). Their performance averaged 94±3% of the conference record (range: 87-99%). There was a significant negative correlation of moderate strength between number of errors and performance: r = -0.59, p = 0.01, R² = 0.35 (Figure). Fewer errors corresponded with better performance. **CONCLUSION:** The fewer freestyle technique errors a swimmer made, the faster their best freestyle race time was as a percentage of the conference record. Technique explained 35% of the variance in performance. This study is one of the first to demonstrate this relationship using objective, pool-side assessment criteria.



3784 Board #102 May 30 8:00 AM - 9:30 AM

Acute Effects Of Squat Position And Whole-body Vibration Frequencies On Muscular Function And Jump Performance

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(No relevant relationships reported)

PURPOSE: To determine the acute effects of different whole-body vibration (WBV) frequencies and squat depths on lower extremity isometric and isokinetic muscle function and vertical jump performance.

METHODS: Thirteen healthy male (age = 23.8 ± 5.3 years) and fifteen healthy female subjects (age = 22.45 ± 3.04 years) performed six randomized sessions of vibration protocols (VPs) in different squat positions with 90° (low-squat) and 140° (high-squat) knee flexion angle at 30 Hz (30Hz90°; 30Hz140°), 40 Hz (40Hz90°; 40Hz140°) & 50 Hz (50Hz90°; 50Hz140°). Each subject performed 5 sets x 1-min of static squats with 30-sec rest between each set. Then they rested for 5-min and repeated 5 more sets. Once completed, vertical jump performance was measured. Furthermore, subjects were tested for maximum 5-sec right knee extensor isometric contractions at 60° of knee flexion, and isokinetic concentric knee extension and flexion at 180°/sec, utilizing standard Biodex protocol. All VPs were performed on the same commercial side to side alternating vibration platform and foot placement for all squats was recorded to ensure consistency.

RESULTS: Two-way repeated measures ANOVA indicated a significant condition main effect in average jump height ($p < .01$) and average jump time ($p < .001$), denoting enhanced jump performance following 40Hz140° ($p < .05$) and 50Hz140° ($p < .01$) compared to 50Hz90°. A significant condition main effect was found in peak-torque during the isokinetic test, where observed changes were greater for both 30Hz140° and 40Hz140° compared to 30Hz90° ($p < .05$) and 50Hz90° ($p < .01$). Lastly, the best performance on peak-torque during the isometric test was significantly higher after 30Hz140° ($p < .05$) and 40Hz140° ($p < .05$) compared to 50Hz90°.

CONCLUSIONS: The findings are suggestive of greater muscular strength and explosive power production following a high-squat WBV warm-up compared to low-squat WBV warm-up. This can be attributed to augmented muscle fatigue and/or increased muscle length due to the plasticity of skeletal muscle while performing low-squat WBV warm-up, resulting in impaired ability to produce muscular force.

3785 Board #102 May 30 8:00 AM - 9:30 AM

Circulating Brain Derived Neurotrophic Factor (BDNF) In Response To Three-day Ultra-endurance Racing

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Cardiovascular exercise is known to exert a variety of positive physiological and psychological benefits on neurocognitive function, glucose and fatty acid metabolism, and muscle recovery. Many of these effects are thought to be mediated by brain derived neurotrophic factor (BDNF), a neurotrophin produced both centrally and peripherally. The fate of BDNF during prolonged endurance exercise is unknown and may be implicated to mitigate potential negative consequences to ultra-endurance racing.

PURPOSE: To investigate the effects of a three-day ultra-endurance triathlon on serum BDNF concentrations pre- and post-race. **METHODS:** Twenty triathletes (age: 40 ± 8.8 yrs) who competed in the 2015 (N=13 men, 3 women) and 2017 (N=3 men, 1 woman) Ultraman Florida triathlon participated in the present study. Blood samples were collected 24-36 hrs pre-race and within 12 hrs post-race. Serum BDNF levels were measured via ELISA. A paired sample t-test was used to evaluate differences between pre- and post-race BDNF concentrations. Values are reported as mean ± SD with significance accepted as $p < .05$. **RESULTS:** BDNF significantly increased from pre- to post-race (0.17 ± 0.9 pg/mL vs. 0.23 ± 0.14 pg/mL; +9.6%; $p < .05$). **CONCLUSIONS:** For the first time, BDNF is shown to significantly increase after a three-day ultra-endurance race. These findings may indicate that BDNF concentrations are elevated to potentially counteract any negative consequences derived from ultra-endurance exercise. The influence of both duration and intensity of exercise on BDNF concentrations need to be further elucidated due to its array of positive implications on cognitive and physical function and recovery from prolonged endurance exercise. Supported by the International Society of Sports Nutrition and Florida State University.

3786 Board #103 May 30 8:00 AM - 9:30 AM

Analyzing The Impact Of Body Composition On Vertical Jump Performance In Collegiate Female Volleyball Players

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(No relevant relationships reported)

The vertical jump (VJ) test is often used in sport and recreational performance sectors. Prior studies have examined the effects that anthropometric and body composition values have on VJ performance in no less than averagely fit populations. Yet, it appears that no study has evaluated the relationship between body fat percentage (BF), body mass index (BMI), lean leg mass (LLM), and trunk lean mass (TLM) on VJ performance using collegiate female volleyball players. **PURPOSE:** To assess the relationship between BF%, BMI, LLM, and TLM on VJ performance in collegiate female volleyball players. **METHODS:** After having descriptive data recorded, 12 female collegiate volleyball players had their BF%, BMI, LLM, and TLM assessed via dual-energy x-ray absorptiometry. Subjects had their reach height measured, participated in an 8 min dynamic warm-up, were then given a 4 min passive recovery (PR) period after the warmup, and then completed three familiarization jumps (ie. trials) using a VJ measurement device. After another 4 min PR period, subjects completed one series of six jumps with 30 secs of PR between each jump. Pearson Correlations were then performed between BF%, BMI, LLM, TLM, and VJ (ie. the highest of the six jumps) with significance differences determined at $p \leq 0.05$. **RESULTS:** A non-significant low negative correlation existed between BF% and VJ ($r = -0.350$, $p = 0.132$), yet a non-significant low correlation occurred between BMI and VJ ($r = 0.371$, $p = 0.117$), TLM and VJ ($r = 0.265$, $p = 0.202$), and LLM and VJ ($r = 0.372$, $p = 0.117$). **CONCLUSIONS:** BF% appears to have a low negative relationship with VJ performance in collegiate female volleyball players, while TLM, BMI, and LLM have a low relationship with VJ performance. Having a lower BF% may not necessarily predict higher jumping performance in collegiate female volleyball players. Further research may be required to determine if gender, fitness level, or a different type of body fat percentage measurement technique may play a factor when considering if BMI, BF%, LLM, and TLM have a relationship with VJ performance in athletes who specialize in sports with repetitive jumping movements.

3787 Board #104 May 30 8:00 AM - 9:30 AM
Effect Of A 2-km Swim On The Cycling Power-Duration Relationship

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PURPOSE: Triathlon combines three sports (swimming, cycling, and running) into a single race and, because triathletes must cycle after the swimming, it is important to understand how cycling power may be affected by prior swimming. Therefore, the purpose of this study was to determine the effects of a 2-km swim at a self-selected race pace intensity on the cycling power-duration relationship measured during a 3-min all-out cycling test (3MT). **METHODS:** Eighteen trained triathletes (12 M, 6 F; 37.1 ± 10.6 years, $\dot{V}O_{2max}$ 54.8 ± 10.1 ml·kg⁻¹·min⁻¹) performed two 3MTs on separate days with one 3MT immediately following a 2-km swim (swim-bike; SB) and one without prior swimming (bike only; BO). The power-duration relationship was expressed as the total work done and subdivided into the end-test power (EP) and work done above EP. To assess swimming intensity, heart rate (HR) was continuously monitored during the swim and blood lactate was assessed immediately following the 2-km swim. **RESULTS:** End-swim lactate was 4.2 ± 1.8 mM and mean swimming heart rate was 147 ± 18 bpm. The 2-km swim decreased total work done during the 3MT by 6% (BO: 62.8 ± 12.7 kJ; SB: 58.9 ± 13.4 kJ; p = 0.001) though neither EP (BO: 281 ± 65 W; SB: 269 ± 68 W; p = 0.102) nor work done above EP (BO: 12.1 ± 3.8 kJ; SB: 10.5 ± 4.2 kJ; p = 0.096) differed between trials. Peak power was also assessed during the 3MT and did not differ between trials (BO: 552 ± 142 W; SB: 541 ± 147 W; p = 0.097). The change in EP was inversely correlated to the change in work above EP (r = -0.624; p = 0.006). **CONCLUSIONS:** Total work done while cycling decreases following a 2-km race pace swim, although neither EP nor work above EP changed significantly. Triathletes may want to determine race cycling power following swimming because prior swimming affects performance during the 3MT. Future studies should look at how different swim pacing strategies affect the cycling power-duration relationship.

3788 Board #105 May 30 8:00 AM - 9:30 AM
The Effect Of Team Winning Percentage On BCS Football Recruit Strength And Speed Characteristics

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Due to the volatility of NCAA Division I BCS Football coaching and support staffs, it is difficult to collect reliable, longitudinal data using consistent physical performance tests on players entering the program. The data set in the current study represents a twenty-nine - year period collected by the same Head Strength and Conditioning Coach in the same football program. **Purpose:** The purpose of the study was to compare the physical testing of the players entering the program in the early years, (1987 -1998) of the Head Football Coach's tenure, when the team studied winning percentage was (56.5%) to a later period (1999-2014) when the team's winning percentage improved to (73.3%). **Methods:** A cohort of 1094 NCAA Division I BCS level football players that played at the same institution under the same Head Football Coach and Head Strength and Conditioning Coach during the years of 1987-2104 were divided into two groups depending on the era in which they played. Group One (G1 n=581) played between 1987 and 1998 (12 year period). Group One's win/loss record was 77-59, with a (56.5% winning percentage). Group 2 (G2 n=513) played between 1999 and 2014 (16 year period) the team win/loss record was 154-56 during this period representing a (73.3% winning percentage). Data were collected when each athlete joined the team in the following areas across the entire twenty-nine-year period. Measurements were collected in Height (HT), Body Mass (BM), One Repetition Maximum (1RM) in the Bench Press (BP), the Vertical Jump (VJ), and 40-yard dash (40YD). All data were collected by the same Head Strength and Conditioning Coach. All data were analyzed using paired t-tests for each parameter tested. **Results:** G2 had significantly better initial test results in each of the following tests: BM (106.9 vs 101.7 kg.; P<0.01), BP (133.3 vs 124.9 kg.; P<0.01), VJ (30.1 vs 27.0 in.; P<0.01), and 40YD (4.8 vs 5.0 sec.; P<0.01). **Conclusions:** The results suggest that having a successful football program at the Division I BCS level may attract recruits that are bigger, stronger in the upper body, with greater lower body power and running speed. Although it may not be the only thing that affects the decision of 4 and 5-star athletes to sign with a Division I BCS football team, it appears to be a major factor.

3789 Board #106 May 30 8:00 AM - 9:30 AM
Predicting Success In NCAA Division I Football Linemen Based On Physical Performance Test Results

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A recent study looked at the relationship between performance variables and success in the NFL among players who participated in NFL combine events, which featured college seniors aspiring to make an NFL roster in different positions. To date no studies have looked at a similar relationship among college football players, who aspire to make an NCAA Division I football starting roster. **Purpose:** The purpose of the study was to identify performance variables that predict success among aspiring Division I (D-I) college football Linemen. **Methods:** Archival data were analyzed from 403 college football linemen, which focused on their best physical test results, who played during a period from 1987-2015 at a highly ranked NCAA D-I university. Players were categorized by position either as offensive linemen (OL; n=246) or defensive linemen (DL; n=157). Data were collected at various intervals throughout each athlete's playing career, and included personal best measures in included height (HT), body mass (BM), 1 repetition maximum (1RM) in the squat (SQ), bench press (BP), power clean (PC), push jerk (PJ), vertical jump (VJ), sit and reach test (SR), 40-yard dash (40YD), 10-yard dash (10YD), and 20-yard shuttle (20YS). All data were collected by the same strength coach over the 29-year period. Success was determined by three criteria: level 1 included players who never made the starting line-up in their college careers, level 2 were players that made the starting line-up but never made it to the NFL, and level 3 were player that played at least one full year in the NFL. Data were analyzed using ordinal regression analysis. **Results:** The statistically significant predictors by position were as follows: for OL, BM (P<0.01), BP (P<0.01), PC (P< 0.05) and 40YD (P<0.01); for DL, BM (P< 0.05), 40YD (P< 0.05) and VJ (P< 0.05). **Conclusions:** These results suggest that it may be possible to predict the success of NCAA Division I football linemen in the positions tested, by looking at selected performance parameters. Our data suggests that for OL a large body mass combined with speed, upper body strength and explosive hip extension is important. For DL, a large body mass combined with speed and lower body power are good predictors of success.

3790 Board #107 May 30 8:00 AM - 9:30 AM
Predicting Success In NCAA Division I Football Skill-players Based On Physical Performance Test Results

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A recent study looked at the relationship between performance variables and success in the NFL among players who participated in NFL combine events. Our aim was to look at a similar relationship among college football players in skill-positions, who aspire to make an NCAA Division I football starting roster. **Purpose:** The purpose of the study was to identify performance variables that predict success among aspiring Division I (D-I) college football skill-position players. **Methods:** Archival data were analyzed from 712 college football skill-position players, which focused on their best physical test results, who played during a period from 1987-2015 at a highly ranked NCAA D-I university. Players were categorized by position either as offensive skill-position players (OSP which includes running backs, quarterbacks and wide receivers; n=311); defensive backs (DB; n=157); or linebackers, tight ends and fullbacks (LTEFB; n= 244). Data were collected at various intervals throughout an athlete's playing career, and included personal best measures in height (HT), body mass (BM), 1 repetition maximum (1RM) in the squat (SQ), bench press (BP), power clean (PC), push jerk (PJ), vertical jump (VJ), sit and reach test (SR), 40-yard dash (40YD), 10-yard dash (10YD), and 20-yard shuttle (20YS). All data were collected by the same strength coach over the 29-year period. Success was determined by three criteria: level 1 included players who never made the starting line-up in their college careers, level 2 were players that made the starting line-up but never made it to the NFL, and level 3 were player that played at least one full year in the NFL. Data were analyzed using ordinal regression analysis. **Results:** The statistically significant predictors by position were as follows: for OSP, VJ (P<0.01), PC (P<0.05), and 40YD (P<0.01); for DB, BM (P< 0.05), and 40YD (P< 0.01); and for LTEFB, BM (P<0.05), 40YD (P< 0.01), and PJ (P< 0.05). **Conclusions:** These results suggest that it may be possible to predict the success of NCAA Division I football skill-position players in the positions tested, by looking at selected performance parameters. For OSP, lower-body power and explosive hips combined with speed are important; for DB it's large body mass combined with speed; and for LTEFB, explosive hips combined with body size and speed are important.

3791 Board #108 May 30 8:00 AM - 9:30 AM
Physical Demands Of Professional Golf Caddy: A Case Study

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Few studies have investigated the physical demands of golf caddying during high-level golf competitions, yet recent fatalities have raised questions regarding demands relative to physical fitness. **PURPOSE:** The purpose of this study was to examine the physical demands of a professional golf caddy during a single round of a European Tour Tournament. **METHODS:** A professional male golf caddy with 27 years of caddying experience (age=47 yrs, HRmax=161 bpm, VO₂max=29 ml/kg/min) volunteered for this study. During the first round of 2018 Irish Open, the caddy wore a global positioning system (GPS) device and a heart rate (HR) monitor continuously throughout the round of golf for the recording of displacement and HR responses, respectively. **RESULTS:** The total time (TT) of the round was 226 min with 53.5% walking and 46.5% standing, and the total distance covered by the caddy was 8.63 km, with mean and peak traveling speeds by of 2.3 km/h and 9.7 km/h respectively. The mean HR was 110 bpm (68.3% HRmax), with a peak of 136 bpm (84.5% HRmax). The caddy spent most (62.3%) of the TT at moderate intensity (64-<77% HRmax; ACSM's guidelines, 2013), 27.5% of the TT at light intensity (50-<64% HRmax), and only 10.2% of the TT at high intensity (77-<94% HRmax). In general, uphill movements elicited a higher HR response. **CONCLUSIONS:** These results suggest that cardiovascular demands of golf caddying were primarily moderate intensity activity during the round of elite golf. However, high intensity activity was also observed when the caddy climbed hills continuously. These findings may provide useful information for justifying the need for aerobic training programs for a professional golf caddy, relative to a low current cardiovascular fitness level.

3792 Board #109 May 30 8:00 AM - 9:30 AM
Effect Of Aikido, Brazilian Jiu Jitsu, And Yoga On Functional Movement

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PURPOSE: To identify the impact of Brazilian Jiu Jitsu (BJJ), aikido and yoga on functional movement. **METHODS:** One hundred seven college students completed 22 fifty-minute sessions of one of 3 possible modes of exercise (aikido- N=31, BJJ- N=38- & yoga- N=38) over a 12-week period. Aikido is a throwing and pinning martial art that focuses primarily on standing movements. Classes include meditation, breathing exercises, stretching and strengthening exercises. In addition, students will be introduced to Aikido stances, footwork, handwork, and partner practices, while connecting the study and practice of Aikido with their path toward optimum wellness across the lifespan. BJJ is primarily a ground based martial arts system where students learn to effectively control an opponent on the ground. Yoga is a movement based exercise where postures are practiced to align, strengthen and promote flexibility in the body. Breathing techniques and meditation are also integrated, with an emphasis on simplicity, repetition, and ease of movement. The Functional Movement Screen (FMS) and Mobility, Activation, Posture, and Symmetry (MAPS) assessments were administered at baseline and following 12 weeks of exercise participation to determine functional movement. A repeated measures ANOVA was used to determine if there were differences in body weight and functional movement status (p < 0.05). **RESULTS:** No statistical differences in body mass were observed for either exercise type (Table 1). FMS and MAPS scores improved from pre to post for Aikido and FMS scores improved in yoga. No statistical differences were observed in BJJ.

Table 1: Weight, FMS, and MAPS scores pre and post (mean ± SE)

Exercise	Assessment	Body mass (kg)	FMS	MAPS
Aikido	Pre	76.5 ± 4.9	14.6 ± 0.4	47.8 ± 2.1
	Post	77.4 ± 4.6	15.5 ± 0.5 *	51.9 ± 9.3 *
BJJ	Pre	70.9 ± 2.6	15.1 ± 0.4	46.5 ± 1.7
	Post	71.2 ± 2.5	14.9 ± 0.3	48.3 ± 2.0
Yoga	Pre	64.3 ± 2.4	14.4 ± 0.4	43.1 ± 1.6
	Post	65.1 ± 2.6	15.5 ± 0.4 *	44.8 ± 1.7

* p ≤ 0.05

CONCLUSION: Twelve weeks of Aikido or yoga exercises improved functional movement. Brazilian Jiu Jitsu did not have a significant impact on functional movement.

3793 Board #110 May 30 8:00 AM - 9:30 AM
Influence Of Prior 3-min All-out Exercise On The Power-duration Relationship

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PURPOSE: To evaluate the parameters of the power-duration relationship (i.e., critical power, CP; curvature constant, W') derived from the performance of two 3-min all-out tests (3MT) separated by 60 s passive recovery. We aimed to: 1) establish the effect of a prior 3MT on CP and W'; 2) examine whether current models accurately predict inter-bout W' reconstitution; and 3) determine the physiological factors that are related to W' reconstitution. **METHODS:** We analysed 19 datasets from 17 participants (age, 22 ± 3 years; body mass 82.2 ± 13.6 kg) who took part in two separate studies, and 10 datasets have previously been published (Black et al. 2018 *Front Physiol.* 9:11). Datasets included a ramp incremental test and the performance of two 3MT separated by 60 s passive recovery. Paired samples t-tests were used to assess differences in: peak power; end test power (EP, indicative of CP); work performed above bout 1 end test power (W>EP1), indicative of W', and; total work done (TWD), between bouts 1 and 2. Reconstitution of W' between exercise bouts was estimated using: the intermittent CP model (W'_{INT-CP}); a differential equation (W'_{BAL-DIFF}); and; a continuous integrating equation (W'_{BAL-INT}). Differences between the actual and predicted reconstitution of W' were evaluated using paired samples t-tests and limits of agreement were determined via Bland-Altman analyses. **RESULTS:** EP and W>EP1 were significantly reduced in bout 2 compared to bout 1 (Bout 1: EP 273 ± 43 W, W' 17.0 ± 3.3 kJ; vs. Bout 2: EP 258 ± 39 W, W' 4.3 ± 2.8 kJ; both P<0.05). The W' reconstitution was significantly overestimated (P>0.05) and was not significantly correlated with the predictions provided by W'_{INT-CP} (16.4 ± 2.6 kJ, r = -0.42), W'_{BAL-DIFF} (9.6 ± 1.2 kJ, r = -0.22) or W'_{BAL-INT} (7.2 ± 1.7 kJ, r = -0.11). Inter-bout W' reconstitution was correlated with relative VO_{2max} (r=-0.66, P=0.002) and power output at the gas exchange threshold (r=-0.57, P=0.012). **CONCLUSIONS:** The powerduration relationship (i.e., CP and W') is adversely impacted by prior all-out exercise, and current models do not adequately describe the subsequent rate of W' recovery. These results have important implications for the design and use of mathematical models describing the energetics of exercise performance.

3794 Board #111 May 30 8:00 AM - 9:30 AM
Effects Of Exercise Modality And Structure On Physiological And Perceptual Responses To Exercise

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Moderate intensity continuous training (MICT) and high intensity interval training (HIIT) in the form of cycling and running, are effective types of exercise for improving fitness and health. However, cycling may cause higher levels of local muscle fatigue due to the greater contribution of anaerobic metabolism, while more muscle mass is active during running, resulting in higher oxygen uptake (VO₂) and energy expenditure.

PURPOSE: To examine the effects of exercise modality (cycling vs. running) and structure (continuous vs. interval exercise) at an individualized exercise intensity, on physiological and perceptual responses. **METHODS:** Seven healthy young individuals (3 M and 4 F, age = 21 ± 1 years) performed four 20 min trials in random order: continuous cycling and running (MICT) at an intensity corresponding to 80% of the individual ventilatory threshold (VT) and intermittent cycling and running (HIIT) including 10 x 1 min bouts at 120% VT, with 1 min active recovery at 60% VT. Blood lactate concentration was measured at rest, midway during exercise and 3 min after exercise, while VO₂, heart rate (HR) and rating of perceived exertion (RPE) were measured continuously. Data were analyzed using 3-way repeated measures ANOVA. **RESULTS:** VO₂max (40.0 ± 5.8 vs. 36.0 ± 5.3 ml/kg/min, p<0.001) and VT (70.8 ± 7.6 vs. 51.4 ± 4.2 %VO₂max, p<0.001), were higher in running than cycling. This resulted in energy expenditure that was highest in HIIT and MICT during running (217 ± 47 and 199 ± 61 kcal, respectively, p<0.001) and lowest in HIIT and MICT during cycling (142 ± 19 and 142 ± 17 kcal, respectively). Average HR was higher in running versus cycling (159 ± 15 and 138 ± 9 bpm, p=0.008) and in HIIT versus MICT

(155 ± 10 and 142 ± 11 bpm, $p=0.03$), but there was no 3-way interaction ($p=0.79$). In contrast, blood lactate concentration was not different between cycling and running ($p=0.44$), while RPE was slightly higher during running than cycling (2.75 ± 1.15 and 2.10 ± 1.0 units, $p=0.03$)

CONCLUSIONS: Running, especially in the form of HIIT at an individualized intensity close to VT, results in greater energy expenditure, while blood lactate and RPE are similar to cycling HIIT or MICT. Thus, HIIT running at this intensity may be used as an effective and tolerable exercise modality for healthy individuals when available time is limiting.

3795 Board #112 May 30 8:00 AM - 9:30 AM
Relationship Between Weighted Standing Long Jump And 20 Meters Sprint Performance

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The standing long jump (SLJ) is intensively used in fitness preparation as a measure of lower limb power. The SLJ has also been shown to be related to maximal sprint speed. The power deployed during a SLJ can be calculated, but it is unknown what the effect of body weight has on the relationship between sprint speed and power. **PURPOSE:** Explore the relationship between a 20m sprint and the SLJ under 5 loading conditions (0%, 1%, 3%, 10% and 15% of bodyweight). **METHODS:** Anthropometric measures ($n=13$) were taken prior to testing sessions (Age 16.0 ± 0.7 years; Height 1.80 ± 0.10 m; weight, 90.4 ± 20.0 kg). The loads used during different loading conditions were confirmed using a bodyweight scale (Omron, Canada). SLJ distances were measured from toes (starting line) to the closest heel using a jump mat (Javy Sports, Singapore). Peak velocity (PV), peak power (PP) and relative power (RP) to body weight were measured using a linear transducer (TENDO SPORTS MACHINES, London, UK) for each loading condition. The protocol consisted of 2 sprints of 20m with 3 minutes of recovery between sprints. The best of 2 completed attempts per loading condition was retained same for the best sprint time. The time at 10m and 20m were measured with photocell timing gates (Brower Timing System, Utah, USA). Linear regressions and 2-tailed Pearson correlations were calculated (SPSS Ver 26). **RESULTS:** Multiple significant ($p<0.05$) correlations were observed ($r=0.573$ to 0.892). Findings show that PV ($r=-0.640$, $r=-0.619$, $r=-0.646$) with a load of 3, 10 and 15% respectively, RP ($r=-0.635$) with a load of 3%, and SLJ distance ($r=-0.573$, $r=-0.736$) with a load of 10 and 15% respectively were significantly correlated with the 10m during sprint time. Also, PV ($r=-0.577$, $r=-0.892$) with a load of 1 and 15% respectively, PP ($r=-0.656$) with a load of 15%, RP ($r=-0.859$) with a load of 15% were significantly correlated with the 20m sprint time. **CONCLUSION:** Weighted SLJ using 15% of bodyweight is better correlated to 10m or 20m sprint times than a standard SLJ. We propose different formulas to predict peak velocity, 10m and 20m sprint time all based on SLJ distance. Peak velocity(m/s) = (Distance(m) x 2.50) - 0.88 $R^2=0.601$, $p \leq 0.01$, SEE=0.38 10m time(s) = 2.98 - (SLJ15% distance(m) x 0.55) $R^2=0.541$, $p \leq 0.01$, SEE=0.08 20m time(s) = 4.89 - (SLJ15% peak velocity(m/s) x 0.54) $R^2=0.796$, $p \leq 0.01$, SEE=0.10

3796 Board #113 May 30 8:00 AM - 9:30 AM
Acute Differences Of Passive Myofascial Release And Dynamic Stretching On Lower Body Explosive Power

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Passive myofascial release using a steel roller (PMRS), popularized as body tempering, is an emerging modality for performance enhancement and injury rehabilitation. Currently no evidence exists showing its effectiveness for performance or injury rehabilitation. **PURPOSE:** To determine the acute differences between a dynamic stretching protocol (DS), PMRS, and a combination of PMRS and DS on lower body explosive power.

METHODS: Fourteen recreationally active subjects (height = 163.5 ± 2.5 cm, weight = 68.3 ± 3.9 kg) were recruited from the University of Texas Rio Grande Valley. Once informed consent was obtained, subjects were familiarized with the testing protocol. Subjects were asked to refrain from participating in exercise for 48 hours before each testing session. Three randomized sessions consisted of a five-minute light treadmill warm up, followed by one of three different modalities; DS only, PMRS only, or a combination of PMRS and DS (COMB). DS protocol consisted of five exercises (forward leg swings, twisting reverse lunges, lateral lunges, bent knee leg swings, and plantar flexion/extension). PMRS protocol consisted of rolling the hamstrings and

quadriceps for 2.5 minutes each. Following the protocol, lower body explosive power was tested using a countermovement vertical jump and standing long jump. The best of three trials was recorded.

RESULTS: Repeated measures ANOVA found significant condition main effects for the ($p=0.01$) countermovement jump and ($p<0.001$) standing long jump. Post-hoc pairwise comparisons, using Bonferroni adjustment for multiple comparisons, found COMB (45.9 ± 3.2 cm) to have a significantly ($p<0.05$) greater vertical jump height than DS (42.1 ± 3.0 cm) alone. PMRS (179.91 ± 11.1 cm) and COMB (177.9 ± 9.9 cm) had significantly ($p<0.005$) longer standing long jumps than DS (166.1 ± 10.3 cm) alone.

CONCLUSIONS: The current data demonstrated that passive myofascial release with a steel roller or in combination with a dynamic stretching routine may increase lower body explosive power when compared to a dynamic stretching routine alone. Further research should use an athletic population to determine its efficacy in highly trained individuals.

3797 Board #114 May 30 8:00 AM - 9:30 AM
Acute Differences Of Passive Myofascial Release And Dynamic Warm Up On Lower Body Anaerobic Muscular Endurance

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Body tempering is a form of passive myofascial release used amongst athletes, physical therapists and trainers, and is a hands-on application of pressure to the muscles using a heavy steel roller. There is little to no evidence in the literature showing its effectiveness for performance or injury rehabilitation.

PURPOSE: To determine any acute differences between passive myofascial release with a steel roller (PMfR) and a dynamic warm up (DWU) on lower body anaerobic muscular endurance.

METHODS: Ten participants, 5 females (23.0 ± 1.3 years; 75.5 ± 5.2 kg; 159.8 ± 1.2 cm) and 5 males (24.6 ± 2.1 years; 82.5 ± 3.8 kg; 168.0 ± 2.8 cm), were asked to participate in this study. The first session was a familiarization session to test leg press one repetition maximum (214.3 ± 32.7 kg). The following two randomized sessions, separated by at least 72 hours, began with a five-minute cycle ergometer warm-up at 1.0kP for females and 1.5kP for males at 50RPM. Subjects performed a PMfR protocol or a lower body DWU prior to beginning a leg press specific warm-up. The PMfR protocol involved rolling the quadriceps and hamstrings for approximately two minutes each. The DWU protocol involved ten repetitions of six exercises (inchworms, hip-bridges, side-lying hip abduction, mountain climbers, lateral lunges, and squat jumps). Subjects then performed a set of ten repetitions at 25% and 50% and six repetitions at 75%. After a three-minute rest period, subjects performed repetitions to failure at 85%. One-way Analysis of Variance (ANOVA) was used to determine significant differences in repetitions.

RESULTS: Repetitions were significantly ($p<0.002$) different between protocols. Subjects performed more repetitions following the PMfR (25.4 ± 7.0 repetitions) condition than the DWU condition (16.8 ± 4.5 repetitions).

CONCLUSIONS: The current pilot data demonstrates that PMfR may be an effective warm up modality in combination with a specific warm up to assist in lower body anaerobic endurance. Precaution must be taken with the current data, as some subjects had as many 40 repetitions at 85%, which is not congruent with that percent 1RM. The current DWU protocol seems to have possibly decreased performance due to fatigue. Further studies should use a multi-set approach with a resistance trained population approach to better determine its efficacy.

3798 Board #115 May 30 8:00 AM - 9:30 AM
Metabolic And Perceived Exertion Outcomes During Maximal Runs At Ends Of The Day

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Training programs may be individualized to the particular needs and preferences of the exerciser. Controlling training and exercise characteristics, such as morning versus night, may alter exercise-related outcomes. **PURPOSE:** The purpose of this project was to investigate metabolic and perceived exertion outcomes during maximal runs at ends of the day (early morning and late-night) following a standardized, pre-run meal. **METHODS:** Thirteen participants (females: 8, males: 5, age: 20.7 ± 1.4 yrs., BMI: 24.9 ± 3.0 kg/m²) volunteered to complete two, randomized maximal runs, separated by 24-72 hours (condition 1: 06:00-09:00 and condition 2: 21:00-24:00). The starting

treadmill speed (perceived effort of 12-13 on the Borg 6-20 RPE) for each condition was determined during a familiarization trial. Pre-run nutrition was standardized with use of a yogurt-based smoothie drink prepared based on each individual's body mass and activity level (approximately one-quarter of their total daily calories as 80% carbohydrate, 3% fat, and 17% protein). Drinks were ingested 2 hours prior to the testing. During the maximal runs, speed was maintained at the previously described intensity, and grade was increased 2% every 2 minutes until volitional fatigue. Metabolic data were gathered via a metabolic cart using a 15-breath moving average. Paired sample *t*-tests were used to compare appropriate data with significance accepted at $p < .05$. Total fat oxidation during the tests was derived from VO_2 and RER. **RESULTS:** The morning and night runs lasted 10.2 ± 2.3 and 9.9 ± 2.6 minutes, respectively. No statistical difference was found between morning and night runs for relative $\text{VO}_{2\text{max}}$ (47.0 ± 7.0 vs. 47.3 ± 8.0 ml/kg/min, $p = .721$), total fat oxidation (24.8 ± 16.7 vs. 27.7 ± 22.3 kcal, $p = .597$), or maximal RPE (18.9 ± 1.1 vs. 18.8 ± 1.5 , $p = .794$). **CONCLUSIONS:** Relative $\text{VO}_{2\text{max}}$, total fat oxidation, and RPE did not differ between maximal runs performed early morning and late-night. Running maximally at ends of the day may not elicit any differences in these variables among a group of younger, recreationally active adults provided a standard, pre-run meal.

3799 Board #116 May 30 8:00 AM - 9:30 AM
Effects Of Pilates Exercise On Core Stability And Joint Flexibility In College Athletes

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Although Pilates improves flexibility, balance, and posture of symptomatic elderly or sedentary middle-aged adults, there has been little focus on studying the effect of Pilates in young athletes. **PURPOSE:** This study aimed to examine whether Pilates exercise improve core stability and joint flexibility in college athletes. **METHODS:** Fifteen healthy college students (control group) and 15 female college athletes (athlete group) participated in this study. Each student engaged in a 30-min Pilates session with a licensed instructor once a week over 12 weeks. The Functional Movement Screen (FMS) was used to evaluate core stability and joint flexibility before and after this intervention. The FMS focuses on seven fundamental movements: shoulder mobility (SM), hurdle step (HS), in-line lunge (ILL), active straight leg raise, trunk stability push up, rotary stability (RS), and deep squat. A repeated-measures ANOVA was performed to compare the groups (control group vs. athlete group). **RESULTS:** Although there were no significant between-group differences, the results indicated significant main effect for the Pilates intervention ($F = 62.5$, $p < 0.001$, $\eta^2 = 0.82$), Pilates intervention \times FMS interaction ($F = 35.6$, $p < 0.001$, $\eta^2 = 0.72$), and FMS ($F = 2519.6$, $p < 0.001$, $\eta^2 = 0.99$). After 12-week intervention, SM (before: 2.37 ± 0.2 vs. after: 2.73 ± 0.1 , $p < 0.05$), HS (before: 2.30 ± 0.1 vs. after: 2.70 ± 0.1 , $p < 0.01$), ILL (before: 2.10 ± 0.1 vs. after: 2.30 ± 0.1 , $p < 0.01$), RS (before: 2.13 ± 0.1 vs. after: 2.63 ± 0.1 , $p < 0.001$), and total score (before: 16.17 ± 0.4 vs. after: 18.13 ± 0.3 , $p < 0.001$) had significantly improved. **CONCLUSION:** Pilates exercise is effective for improving FMS scores, strengthening core stability, and flexibility for healthy controls and college athletes. Supported by JSPS KAKENHI Grant Number JP18K10973.

3800 Board #117 May 30 8:00 AM - 9:30 AM
Effect Of Eccentric Overload Training On Change Of Direction Performance: A Meta-analysis

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Effect Of Eccentric Overload Training on Change of Direction Performance: A Meta-Analysis

PURPOSE: This study systematically reviewed and quantified the scientific evidence regarding the effectiveness of EOT on COD performance. **METHODS:** Keyword and reference search of EOT interventions was conducted in eight bibliographic databases (i.e., SPORTDiscus, PubMed, Web of Science, Academic Search Complete, Cochrane Library, Scopus, CINAHL, and Google Scholar) for studies published until October 1, 2019. Meta-analysis was conducted to estimate the standardized pooled effect of EOT on COD performance. **RESULTS:** Twelve studies, including nine randomized controlled trials, two pre-post studies, and one randomized crossover trial, met the eligibility criteria and were included in the review. Time of overall COD task completion among the EOT group was 0.34 standard deviations (95% confidence interval [CI] = -0.49, -0.19; $I^2 = 98.8\%$) shorter than that in the control group (Table 1). Among the interventions employing the T-test, time of task completion among the EOT group was 0.81 standard deviations (95% CI = -1.51, -0.11; $I^2 = 98.7\%$) shorter than that in the control group. Among the interventions employing the 180° COD task, time of task completion among the EOT group was 0.24 standard deviations (95% CI =

-0.53, -0.05; $I^2 = 97.5\%$) shorter than that in the control group. There was no evidence of publication bias based on the Egger's test and Begg's test. **CONCLUSIONS:** EOT was found effective in improving COD performance. Future studies should adopt a randomized experimental design, recruit large and representative samples from professional team sports, and examine the effect of EOT on various measures of COD performance among population subgroups.

Table 1 Results from meta-analysis and publication bias tests

Measure	First author, year	I ² index	Pooled effect size (95% CI)	Model	Publication bias test	
					P-value for Egger's test	P-value for Begg's test
Overall COD task	Coratella, 2019; Sanchez-Sanchez, 2019; Chaabene, 2019; Siddle, 2019; Coratella, 2018; Maroto-Izquierdo, 2017; Bourgeois, 2017; Gonzalo-Skok, 2017; Tous-Fajardo, 2016; de Hoyo, 2015; Lockie, 2014	98.8%	-0.34 (-0.49, -0.19)	Random-effect	0.15	0.48
180° COD task	Coratella, 2019; Siddle, 2019; Bourgeois, 2017; Gonzalo-Skok, 2017	97.5%	-0.24 (-0.53, -0.05)	Random-effect	0.26	1.00
T-test task	Coratella, 2019; Chaabene, 2019; Coratella, 2018; Maroto-Izquierdo, 2017; Lockie, 2014	98.7%	-0.81 (-1.51, -0.11)	Random-effect	0.55	1.00

3801 Board #118 May 30 8:00 AM - 9:30 AM
Differences In Heart Rate And Pedal Frequency On A Cycle Ergometer With And Without Music

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Research has demonstrated the effects of music on exercise performance such as heart rate, cadence, and rate of perceived exertion. Specifically, music tempo is considered a significant factor influencing physiologic changes and is measured in beats per minute (bpm). The preference for music with fast tempos may be due to a stimulus that increases physiological arousal. However, results have differed depending on population, exercise modality, and experimental protocol. **PURPOSE** The purpose of this study was to determine the differences in heart rate and pedal frequency on a cycle ergometer with and without music. **METHODS** Participants (N=20) were collegiate level students who were recreationally active and met physical activity standards. Each participant completed two 20 minute cycle sessions, one while listening to a predetermined music playlist and the second without any music. The predetermined music playlist included 4 songs at tempos of 77 bpm, 132 bpm, 82 bpm, and 126 bpm. Participants pedaled at a self-selected frequency. Heart rate and pedal frequency were recorded for each minute of exercise. A paired T-Test was used to determine statistical significance between variables ($p < 0.05$). Analysis of Variance was also used to determine statistical significance between heart rate and music tempo ($p < 0.05$). **RESULTS** Results from this study show average heart rate with music at 140 ± 15.7 bpm and without music 130 ± 15.7 bpm. Pedal frequency averaged 62.7 ± 10.7 and 57.8 ± 7.5 revolutions with music and without respectively. There was a statistically significant difference between heart rate ($p < 0.01$) and pedal frequency ($p = 0.01$) from music to no music. A statistically significant difference in heart rate was observed between the music tempo groups, $F = 24.51$, $p = 0.001$, with a large effect size, $\eta^2 = 0.304$. Bonferroni post-hoc tests indicated the heart rates for 77 bpm (126 ± 19), 132 bpm (140 ± 16), and 82 bpm (145 ± 17) was significantly higher than each other ($p < 0.01$). **CONCLUSION** The results indicate that music increased heart rate and pedal frequency significantly compared to no music. Additionally, there was a significant difference in music tempo on heart rate. The results from this study support the notion that music does increase physiologic changes during exercise.

3802 Board #119 May 30 8:00 AM - 9:30 AM
Relative Contributions Of Strength, Anthropometric, And Demographic Characteristics To Rock Climbing Performance
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PURPOSE: The purpose of the present study was to determine the relative contributions of handgrip and individual finger strength, body size, climbing experience, and training habits for the prediction of climbing performance in a bouldering competition.

METHODS: Sixty-seven climbers (males: $n = 46$, females: $n = 21$; mean age \pm SD = 21.1 ± 4.0 yrs; body mass = 69.5 ± 9.8 kg; height = 173.5 ± 8.3 cm; climbing experience = 2.7 ± 2.6 yrs; climbing frequency = 3.0 ± 1.2 sessions-wk⁻¹) volunteered for this study. Data collection occurred immediately before an indoor bouldering competition and involved the assessment of handgrip and individual finger maximal force production using an electronic handheld dynamometer. Individual finger strength was defined as the maximal force generated using a tip-to-tip pinch between each finger and the thumb. All measures of strength were normalized to body mass (kg). Subjects also completed a questionnaire to determine climbing experience and training habits (i.e. climbing frequency). The bouldering competition consisted of 70 routes graded V0 (easiest) - V8 (most difficult) with higher point values awarded for completing more difficult routes. Stepwise multiple regression analyses were used to examine the relative contributions of handgrip and individual finger strengths, body mass, height, climbing experience, and climbing frequency to the prediction of performance scores in the competition.

RESULTS: The results indicated there were significant [$F(3, 63)=12.499, p < 0.001$] predictors of climbing performance in our model. Specifically, ring finger pinch strength, climbing experience, and climbing frequency significantly ($p < 0.05$) contributed to the model ($R^2 = 0.373$), whereas body mass, height, full handgrip strength as well as index, middle, and little finger pinch strengths did not. The β -weights showed that ring finger pinch strength ($\beta = 0.430$) was the most significant contributor followed by climbing experience ($\beta = 0.331$) and climbing frequency ($\beta = 0.244$).

CONCLUSIONS: These findings illustrated the importance of ring finger pinch strength on climbing performance in a bouldering competition. Our results also suggested that increasing climbing experience and frequency of training may contribute to greater ring finger pinch strength and overall climbing performance.

3803 Board #120 May 30 8:00 AM - 9:30 AM
Gender Differences In Time-trial Based Predictions Of Vo2max And Training Paces For Collegiate Track Athletes
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PURPOSE: Compare the accuracy of predicted $\dot{V}O_2\max$, interval pace, and threshold pace from Jack Daniels' VDOT Running Calculator between male and female NCAA Division 1 track athletes. **METHODS:** Male ($n = 10$) and female ($n = 8$) athletes completed an indoor 5k time-trial used to obtain predicted data from the VDOT calculator. Predicted variables were compared to laboratory tested $\dot{V}O_2\max$, $\dot{V}O_2\max$ pace, and lactate threshold pace. Follow-up analyses were conducted to compare predicted-actual difference scores between groups. **RESULTS:** $\dot{V}O_2\max$ was underestimated by the VDOT calculator in males ($t(9) = -5.90, p < .001, d = .65$) but not females ($t(7) = -1.44, p = .19, d = .31$). No difference was found between predicted and laboratory tested interval pace for males ($t(9) = 1.90, p = .09, d = .18$) or females ($t(7) = 1.44, p = .19, d = .45$). Predicted and laboratory tested threshold pace were also similar for men ($t(9) = -0.41, p = .68, d = .07$) and women ($t(5) = 1.39, p = .23, d = .91$). Follow up analyses indicated that the difference between VDOT and $\dot{V}O_2\max$ was significantly greater for male athletes ($p = .025, d = .33$). However, between-groups differences scores were similar for interval ($p = .94, d = .01$) and threshold paces ($p = .15, d = .28$). **CONCLUSION:** The VDOT Calculator may underestimate $\dot{V}O_2\max$ for male track athletes. However, practitioners can be confident in the accuracy of interval and threshold training paces provided by the VDOT running calculator irrespective of an athlete's sex.

3804 Board #121 May 30 8:00 AM - 9:30 AM
Assessing Performance Variability Across Two Major National USA Powerlifting Competitions
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National level USA Powerlifting (USAPL) raw powerlifters typically compete at two major competitions (COMP): Raw Nationals (COMP1) and The Arnold Classic (COMP2). Small performance changes may have a large impact on a powerlifter's national level eligibility. Further, typical variation in powerlifting COMP performance is needed to determine meaningful changes in response to training and gauge athlete's progression. **PURPOSE:** To determine the typical COMP performance variation amongst raw powerlifters and assess differences between sexes. **METHODS:** Data was gathered from 2013-2019 on USAPL powerlifters competing at COMP1 and COMP2 successively (<8mon apart). After removing outliers ($\pm 3IQR$), 140 males and 123 females were included in the analysis. Paired sample t-tests, coefficient of variation (CV) and smallest worthwhile change (SWC) were calculated to assess differences between COMP1 to COMP2 for back squat (BS), bench press (BP), deadlift (DL), powerlifting total (PT), and Wilks Score (WS) for each sex. Percentage change for absolute difference in each variable from COMP1 to COMP2 was compared between sexes using an independent samples t-test with criterion alpha < 0.05 . **RESULTS:** Typical variation in COMP performance was small and similar for each sex: BS (CV: 2.8%; SWC: 0.84%), BP (3.1%; 0.93%), DL (3.1%; 0.92%), PT (2.1%; 0.62%) and WS (2.1%; 0.64%). There were significant differences between COMP1 and COMP2 for each variable within each sex ($p < 0.05$); however, the magnitude of difference was small (percent change $< 4.5\%$ for all variables). There was a significant difference in relative performance change for females compared to males on BP (4.4% vs 3.1%, $p = 0.001$), and a near significant difference for PT (2.6% vs 2.2%, $p = 0.070$). Relative changes were similar between sexes for BS (3.3% vs 2.9%), DL (3.3% vs 3.4%), and WS (2.5% vs 2.2%). **CONCLUSIONS:** Consistent performances were expected considering the caliber of powerlifters. Importantly, the data from this study indicate that changes greater than $\sim 1\%$ on COMP lifts are meaningful in raw powerlifters. However, it is apparent for female powerlifters, the limiting factor for maintaining or improving national level performance may be BP. Thus, female powerlifters and their coaches may consider emphasizing BP training to improve consistency in COMP.

3805 Board #122 May 30 8:00 AM - 9:30 AM
The Role Of The Coach In Determining Success At A National Powerlifting Competition
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Purpose: To compare rates of success in coach- versus self-supervised performance at the USA Powerlifting Collegiate National Championships from 2016-2019.

Methods: Using a repeated measures ANOVA design with specific post-hoc analysis, 88 members of the powerlifting team at a United States Service Academy had individual performances tracked during the annual USA Powerlifting Collegiate National Championships from 2016-2019. Performance metrics included: number of successful and non-successful attempts, total weight lifted, and Wilks total (a relative strength metric used in powerlifting).

Results: A total of 88 competitors were tracked over the duration of this investigation. Successful attempts (7.9 ± 1.2 vs. 5.4 ± 1.2), total weight lifted (530.2 ± 146.9 kg vs. 416.8 ± 235.0 kg), and Wilks total (408.9 ± 86.0 vs. 352.3 ± 186.7) were significantly greater in the coach-supervised versus self-supervised population. Lifters following a coach-supervised versus self-supervised competition plan performed significantly better across all performance metrics ($p < 0.001$).

Conclusion: The coach plays a significant role in determining performance outcomes during powerlifting competition. An abundance of research exists on the importance of a coach in developing long-term, periodized strength training for improving strength outcomes, but minimal research exists on the role of the coach in predicting success in individual competitions. These findings support the notion that supervisory mentorship is integral to the success of athletes during both training and competition.

3806 Board #123 May 30 8:00 AM - 9:30 AM

The Impact Of Sleep Deprivation On Agility Performance And Pattern Recall

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PURPOSE: With sleep having the potential to affect both memory and physical performance associated with learning and performing sport related tasks, this study sought to determine the effects of sleep deprivation and college athletes on their ability to remember and perform agility drills similar to that which would be performed in practice or game. **METHODS:** Ten physically active college athletes (21-26 years) participated in the study (5 males and 5 females). Participants were tested under two conditions, 2-4 hours and 7-9 hours of overnight night sleep. The night before each test day, participants were instructed in detail about a four-part agility pattern they had to recall and perform the following morning. The agility drill included: forward sprinting, back pedaling, in and out box stepping drills, Icky Shuffle, and a vertical jump. For each testing day participants performed a warm-up and then the agility drill three times. They rated their perceived exertion (RPE) for each trial, and the best time for each drill was used for analysis. **RESULTS:** Completion speed was not significantly different after 2-4 hours sleep (26.9 ± 2.0 sec) compared to 7-9 hours sleep (26.1 ± 2.6 sec). RPE was also not significantly different for 2-4 hours sleep (8.4 ± 2.2) compared to 7-9 hours sleep (7.9 ± 1.3). There was also no gender difference for speed or RPE. However, participants who were instructed to undergo 2-4 hours of sleep for their first test took significantly longer to perform the drill for the first testing day compared to those who received 7-9 hours of sleep for their first testing day, taking on average 2.2 ± 1.7 sec longer. **CONCLUSION:** Although no difference was seen overall in agility performance times when comparing prior sleep, there was a difference in performance times when comparing the ordering of learning a new task. Learning a new agility pattern when sleep deprived first resulted in slower agility times than when seeing the new pattern for the first time with a full night sleep. Physically active college students are at risk of decreased performance times for drills they are seeing for the first time on minimum sleep. Coaches often stress getting good sleep prior to competition but it may be important for adequate sleep prior to practice sessions where new play routes are being taught.

3807 Board #124 May 30 8:00 AM - 9:30 AM

The Acute Effects Of External Pneumatic Compression On Anaerobic Performance And Blood Lactate Concentration

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The use of External Pneumatic Compression (EPC) among athletes as a recovery modality is rising. However the evidence supporting efficacy of EPC on recovery and performance is limited thus it warrants for further investigation. **PURPOSE:** To determine the acute effects of EPC on anaerobic performance and blood lactate (BLA) concentration following a fatigue protocol. **METHODS:** In a randomized, counterbalanced cross-over study design, 10 healthy university male athletes, aged (25.2 ± 1.1 yrs), were recruited to complete 3 experimental sessions with two 30-second trials of maximum effort Wingate Anaerobic Test (WAnT)(T1 & T2) on a cycle ergometer with a constant load of .075 kg per kilogram of body mass, separated by a 20-min recovery period where either passive recovery (PR), active recovery (AR) or EPC treatment were administered. BLA levels, heart rate and ratings of perceived exertion were recorded. Power output in Watts (PO), fatigue index in %(FI) and total work in Joules(TW) were examined. **RESULTS:** Mean power output (MP) in Watts following AR (T1: 634.90 ± 81.18 , T2: 638.06 ± 99.98)($p = .022$) and EPC (T1: 642.55 ± 78.38 , T2: 637.85 ± 95.62)($p = .020$) were significantly higher than PR (T1: 623.21 ± 91.08 , T2: 620.38 ± 103.03). However, MP between AR and EPC treatment were not significant ($p = .567$). Similarly, TW were significantly higher following AR (T1: 19.09 ± 2.54 , T2: 19.02 ± 2.97)($p = .028$) and EPC treatment (T1: 19.14 ± 2.33 , T2: 19.04 ± 2.83)($p = .013$) than PR (T1: 18.58 ± 2.73 , T2: 18.47 ± 3.03) but mean differences were minimal between AR and EPC treatment. PO (PR T1: 954.90 ± 206.78 , T2: 890 ± 178.42 , AR T1: 1001.60 ± 187.16 , T2: 928.50 ± 172.46 , EPC T1: 970 ± 135.71 , EPC T2: 943.00 ± 152.58)($p = .481$) and FI (PR T1: 62.23 ± 17.05 , T2: 57.40 ± 15.98 , ER T1: 64.80 ± 17.41 , T2: 59.42 ± 17.78 , EPC T1: 63.40 ± 18.03 , T2: 56.86 ± 15.15)($p = .780$) were not significant. BLA concentration decreased significantly from peak BLA at 5 minute post-WAnT to 20 minutes post-WAnT in all trials (PR: $p = .000$, AR: $p = .000$, EPC: $p = .000$). However the mean difference in BLA (mmol·L⁻¹) levels at 20 minutes post-WAnT and 5 minutes post-WAnT were 2.6 in PR, 4.0 in AR and 2.7 in EPC. **CONCLUSIONS:** Results indicated performance was better maintained with the use of EPC and AR. Therefore, the use of EPC may be a feasible alternative method when static recovery is desired.

3808 Board #125 May 30 8:00 AM - 9:30 AM

Analysis Of The Water Polo Shots In Positions 1 And 2 In The Simple Temporal Numeric Inequality With Possession During The 15th Fina World Championship In Barcelona 2013

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Introduction: The Simple Temporal Numeric Inequality With Possession (FJs) is defined as a concrete micro-situation of the Water Polo, which after the amount of players (+1) in favor of the team that owns the ball. Left-handed (LH) players may have an important role.

Aim: First, to know if the LH players were more effective in the goal categories and getting positive actions in position 1 and 2 than the right-handed (RH) in the FJs; second, to know if the shots in position 1 and 2 were less effective than the rest of the positions in the goal categories.

Methods: An observational, multidimensional, nomothetic and punctual study was developed, following Anguera (2003). The sample consisted on all the throws during 24 games, including male and female teams (n=127) corresponding to the 15th FINA World Championship using an *ad hoc* instrument for observation through SportCode software. Games were recorded with a video camera (SONY, FDRAXP33B.CEN). Descriptive of all variables and Chi-square test were obtained to compare throws.

Results: The LH players performed from position 1 more total shots compared to the RH players. Adding the categories related to the goal, the LH got 30.8% and the RH 23.1%. When adding the categories related to positive actions (exclusion, penalty, rebound and corner), the LH got 42.3% while the RH 25%. From position 2 the RH players make more shots compared to LH players (50 vs 25). Adding the categories related to the goal, the LH got 10.7% and the RH 26.7%. If we add the categories related to positive actions, the LH got 16% while the RH 38.7%. The Specific Position (PE) and Player's Laterality (LJ) of the shots from position 1 and 2 that finish in goal in FJs, there were significant differences ($p < .05$).

Conclusions: The LH players were more effective in the goal categories and getting positive actions in position 1 than the RH, but not in position 2. Only the shots in position 1 were less effective than the rest of the positions in the goal categories.

3809 Board #126 May 30 8:00 AM - 9:30 AM

Physiologic Evaluation Of A Collegiate Mascot During Football Games And Related Activities

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PURPOSE: Our purpose was to collect collegiate mascot pilot data to determine physiological HR responses during two football games and pregame-related activities.

METHODS: A physiological tracking system was used to evaluate HR and movement from individuals (N=7 [1 female]; avg ht=1.82m, wt=75.6kg) who performed mascot activities "in suit" (weighing ~14kg) before and during two NCAA Division I University football games. Both games were played at night under moderate ambient conditions (temp=22-14 °C, rh=64%, wind speed=4 mph). Prior to the study, individuals' HRmax values were determined during graded treadmill tests performed to volitional exhaustion. Variables analyzed during the games were time in suit, time in pre-established HR zones [including HRzone1 (50-59%HRmax), HRzone2 (60-69%HRmax), HRzone3 (70-79%HRmax), HRzone4 (80-90%HRmax), and HRzone5 (>90%HRmax)], and distance covered per minute. Differences in time per HRzone were evaluated using 95% confidence intervals. Differences in average HR between pre-game and game conditions were evaluated via a t-test.

RESULTS: Sessions in suit lasted 43.5 ± 10.5 min, and distance traveled was 47 ± 22 m/min. HR averaged $82 \pm 8\%$ of HRmax, with over half the time spent in HRzone4 ($34 \pm 20\%$; $p < 0.05$) and HRzone5 ($23 \pm 27\%$), with only $2 \pm 2\%$ spent in HRzone1. HR values were significantly lower during pregame ($74 \pm 4\%$ HRmax) compared to game ($85 \pm 6\%$ HRmax) activities ($p < 0.001$).

CONCLUSIONS: The mascot suit environment posed significant physiological strain on the wearer, despite relatively little activity or movement performed per session.

3810 Board #127 May 30 8:00 AM - 9:30 AM
Profiling Of High-intensity Events In Elite Chinese Female Field Hockey Matches

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Physical performance in field hockey (here on in referred to as hockey) is determined by many different factors. Recently, the development of small wearable inertial measurement units (IMUs) has provided new possibilities to profile the physical demands in different team sports, especially in the high intensity events (HIEs) aspect of competition and training.

PURPOSE: The aim of this study was to profile the position-specific HIEs in elite female hockey matches with the use of IMUs.

METHODS: Sixteen matches analyzing 22 elite Chinese female hockey players (height: 168.5±4.6 cm, body mass: 62.4±5.3 kg) were record by using IMUs (OptimEye S5, Catapult Sports, Australia) during the 2016-2017 Chinese national competition season. Players were categorized in three different playing positions: strikers, midfielders and defenders. Mean speed (MS), PlayerLoad™ (PL), accelerations (Acc), decelerations (Dec), changes of direction (CoD) and the sum of later three, HIEs, were extracted from raw-data files using the manufacturer's software (OpenField, version 1.14.0). All Acc, Dec, CoD and HIEs >2.5 m/s² were analyzed. Data were reported as mean±SD. Multiple paired t-test was used to compare data between different positions. Significance was set at P≤0.05.

RESULTS: The mean on-field time for individual players was 48.8±15.8 min and the mean PL and MS when combining all playing positions were 9.4±1.3 PL/min and 108.6±12.3 m/min respectively. The mean HIEs, Acc, Dec and CoD combined for all players were 1.1±0.3 HIEs/min, 0.2±0.1 Acc/min, 0.2±0.1 Dec/min and 0.7±0.2 CoD/min respectively. Defenders showed significantly lower PL and MS (8.7±1.2 PL/min, 100.7±11.9 m/min) than strikers (9.7±1.4 PL/min, 114.2±10.6 m/min) and midfielders (9.8±1.0 PL/min, 111.9±9.2 m/min) (P<0.01).

CONCLUSIONS: The mean playing time reported in the present study was similar to data from international hockey matches (48.8 ± 15.8 vs. 44.7±11.0 min), yet PL and MS from the present study was lower than that of elite international players (9.4±1.3 vs. 11.2±2.1 PL/min; 108.6±12.3 vs. 113.3±13.5 m/min). Competition level (national vs. international) is the most likely reason for these differences. Further research should focus on the HIEs' performance of elite international level hockey players. Supported by CSC (No. 2018083110192).

3811 Board #128 May 30 8:00 AM - 9:30 AM
Relationship Between The Attractiveness And Athletic Achievement In Track And Field Athletes

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 (No relevant relationships reported)

previous studies have reported that males with superior attractiveness tended to have superior athletic achievement. **PURPOSE:** To examine the relationship between attractiveness and athletic achievement in male and female track and field athletes.

METHODS: Ninety-three athletes (42 males and 51 females, aged 19.8 ± 1.2 years) participated in the present study. Using a questionnaire, subjects answered questions about specialized events, athletic achievements, and personal bests, among others. Male subjects included 13 national tournament prize winners, 14 national tournament participants, and 15 others. Female subjects included 21 international tournament prize winners, one national tournament prize winner, 15 national tournament participants, and 15 others. Attractiveness was evaluated using the Visual Analogue Scale (VAS) by evaluators who were of the opposite sex and did not know the subjects. Two-hundred and forty-one evaluators (124 males and 117 females, aged 20.81 ± 1.5 years) evaluated the attractiveness of the subjects. Each subject was evaluated by 32-37 evaluators. **RESULTS:** Average attractiveness was 3.78 ± 0.6 (range, 2.7-5.2) and 3.68 ± 0.8 (range, 1.5-5.9) in males and females, respectively. In female subjects, athletes with superior attractiveness tended to have superior athletic achievements. There was a negative correlation between attractiveness and personal best times in the 100-meter (n=13, r=-0.52, p=0.069) and the 100-meter hurdle events (n=9, r=-0.72, p=0.028) in female athletes. However, there was no relationship between attractiveness and personal best time of the 100-meter and the 110-meter hurdle events in male athletes.

CONCLUSIONS: Female athletes with superior attractiveness tended to have superior athletic achievement. In addition, there is a negative correlation between attractiveness and personal best performance in female sprinter events. However, there was no relationship between attractiveness and personal best performance in male sprinter events.

3812 Board #129 May 30 8:00 AM - 9:30 AM
Effects Of Different Warm-up Protocols On Throwing Performance

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Power is essential in throwing performance. Past research indicated that high-intensity dynamic warm-up enhance the subsequent explosive performance, which is referred as post-activation potentiation (PAP). At present, there is no research explored the effect of maximal isometric contraction as warm-up on throwing performance.

PURPOSE: This study aimed to investigate the impact of maximum isometric squat (MIS) and counter movement jump (CMJ) as warm-up exercises on subsequent throwing performance. **METHODS:** 16 healthy experienced baseball or softball players (30.5±5.98 years old) performed two warm-up protocols (MIS and CMJ) in counter-balanced order. Throwing performance was examined at 15 minutes before and 4 minutes after warm-up. Distance of underhand medicine ball throw (MBT) and baseball throwing velocity (BTV) were used to evaluate throwing performance.

RESULTS: The results revealed that after performing two types of warm-up exercises, the average and best distance of MBT improved significantly (P<0.05). The average and best speed of BTV increased significantly (P<0.05) after warm-ups. Performance of MBT after MIS (average: +5.35%; best: +6.05%) showed greater improvement compare to warm-up with CMJ (+4.82%; +4.47%) (P<0.05). **CONCLUSION:** Both MIS and CMJ as warm-up exercise are beneficial in subsequent throwing performance. MIS showed better effect than CMJ for underhand medicine ball throwing distance.

3813 Board #130 May 30 8:00 AM - 9:30 AM
Competing In A Big City: Effects Of Air Pollution On Performance And Physiological Parameters During A 50-km Cycling Time-trial

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PURPOSE: Air pollution is one of the main health risks caused by the environment. Exposure to particulate matter smaller than 2.5 microns in diameter (PM_{2.5}) leads to an increase in risk for cardiovascular and respiratory disease. Although many major sporting events are held in large, polluted cities (e.g. the Beijing 2008 and Rio 2016 Olympic Games), the effects of air pollution on performance and physiological parameters during endurance exercise remain unclear. Most laboratory research uses simulated air pollution which is not representative of actual "real-world" pollution exposure. Therefore, the aim of the current study was to investigate the effect of atmospheric air pollution on performance and physiological parameters during endurance exercise using "real-world" air pollution.

METHODS: Ten trained cyclists completed, in a counterbalanced order, two simulated 50-km cycling time-trials (50km-TT). These sessions were carried out in a modified shipping container capable of providing either a clean (filtered air) or polluted (ambient São Paulo air) environment. This design ensured that the participants were blinded to the polluted [POL] and filtered air [FA] conditions. Venous blood gas analysis was performed on 1mL samples taken from the forearm.

RESULTS: There were no differences in the performance in 50km-TT (FA= 90.4 ±5.8 vs. POL= 90.3±4.3 minutes, p=0.93). The power output was not different (FA= 200.2±30.4 vs. POL= 199.3±24 Watts, p=0.90). However, the inhaled PM_{2.5} was increased in polluted ambient (FA= 66.5±29 vs. POL= 222±62, p= <0.0001). In addition, the venous blood pO₂ and pCO₂ were not different between the two conditions.

CONCLUSIONS: Our findings showed that "real-world" air pollution exposure during a 50-km simulated TT exposure did not affect performance and physiological parameters.

- 3814** Board #131 May 30 8:00 AM - 9:30 AM
Practice Within 24 Hours Of Competitive Play Compromises Performance In Collegiate Basketball
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The NCAA regulates collegiate basketball practice schedules, imposing limitations on daily and weekly practice duration. Coaches seldom schedule fewer hours than permitted and commonly maximize participation within those limitations. There is reason to wonder: does maximum engagement correspond to optimal preparation? **PURPOSE:** To test the effect of pre-game practice on in-game performance in women's collegiate basketball. **METHODS:** We analyzed 15 female basketball players on an NCAA D1 team throughout the 2018-2019 season. Heart rate monitors and GPS trackers were worn during all games (n=33) and practices. Data collected were maximum heart rate (HR_{max}) and total distance moved in games and practices, whether the team won, win-loss margin, and individual athlete rebounds and points scored per game. Paired-samples t-tests, linear regressions, and logistic regressions tested the effect of pre-game practice on in-game performance. **RESULTS:** The analyzed team won 60.6% of games. When practice was performed within 24hr of a game, winning percentage was 33.3% compared to 70.8% in games without prior practice ($p<0.001$). Holding constant the opponent's rank ($p<0.001$) and whether it was a home game ($p<0.001$), practicing within 24hr of competition reduced the odds of winning by 98.2% ($p<0.001$; 95% CI of OR: 0.007 to 0.049) and reduced the win-loss margin by 4.7 points ($p=0.001$; 95% CI: -7.398 to -1.962). During games, players ran $6,735.1 \pm 2,268.4$ meters and had a HR_{max} of 98.6 ± 9.3 . There was no difference in HR_{max} during practices that did and did not occur within 24hr of a game ($p=0.598$). During games, HR_{max} was elevated 2.4 bpm if practice occurred in the previous 24hr ($p=0.045$; 95% CI: -4.6 to -0.1) despite no difference in on-court movement ($p=0.243$). Holding confounding variables constant, practicing within 24hr prior predicted trends for each player to score 1.8 fewer points ($p=0.067$; 95% CI: -3.7 to 0.1) and accomplish 0.9 fewer rebounds ($p=0.079$; 95% CI: -1.8 to 0.1). **CONCLUSION:** These data do not support a "more is better" approach to collegiate basketball practice schedules. When practice occurs within 24hr of a game, despite elevated in-game cardiovascular effort of the athletes, individual and team performances are compromised.

- 3815** Board #132 May 30 8:00 AM - 9:30 AM
The Effects Of Kinesio Tape On Throwing Velocity And Accuracy In Collegiate Softball Players
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 (No relevant relationships reported)

The act of overhead throwing is a series of complex tasks that require synergy between multiple joints and muscle groups, lack of this synergy may lead to a decrease in performance and injury over time. In recent years, Kinesio tape has gained popularity as modality for the treatment and prevention of some of these injuries. To date, there is little research that looks at the use of Kinesio Tape in female athletes during the dynamic movement of overhead throwing. **PURPOSE:** The purpose of this study was to investigate the effects of Kinesio Tape on throwing velocity, accuracy and range of motion, and angle of ball release after the application of Kinesio Tape. **METHODS:** NCAA Division II softball players (n=9) participated in this study. The study was a randomized crossover design, subjects were either allocated to the control group (no Kinesio Tape) or the experimental group (Kinesio Tape) at their first testing session and then switched for the second testing session. Each subject performed 15 overhead throws approximately 20 feet from the target. Velocity, range of motion and angle of ball release were measured using Dartfish software, and accuracy was calculated based on points earned for hitting different levels of concentric rings. **RESULTS:** Statistical analysis revealed no significant differences between all variables between the experimental and control conditions. However, when looking at the means there was an interesting trend in the data. Kinesio Taping showed an increase in throwing velocity of .69 m/s (21.3 m/s to 21.99m/s, $p=0.480$). There was a 92.78-point increase in throwing accuracy from the control, 81.11 points to 173.83 in the experimental group ($p=0.092$). The Kinesio Taping condition also demonstrated an increase in maximal external rotation from 79.74° to 86.11° ($p=0.621$). Finally, there was a 1.17° increase in the angle of ball release with Kinesio Taping (148.68° to 149.85° , $p=0.732$). **CONCLUSION:** In conclusion, there was an increase in throwing velocity, accuracy and range of motion with the addition of Kinesio Tape during overhand throwing in collegiate softball players. Although the data did not present as statistically significant, it does demonstrate that Kinesio Tape may be a practical way to improve performance.

- 3816** Board #133 May 30 8:00 AM - 9:30 AM
Mouthguard Efficacy In Baseball Pitching Velocity
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 (No relevant relationships reported)

Successful pitching in baseball may be due to a number of factors including the mechanics of the motion, the strength, power, flexibility of the athlete, as well as their intent and fatigue levels. The pitching motion is a very powerful, violent, complex and abnormal range of motion of the body. In recent studies, it has been widely evidenced that the ability to produce instantaneous high peak force outputs is related to success in sport. Therefore, the ability to produce higher peak force may be related to the ability to pitching in baseball. Mouthguards have been shown to significantly increase power production in a number of dynamic exercise movements. **Purpose:** The purpose of this study was to determine if maximal and average pitching velocity could be increased when wearing a mouthguard. **Methods:** Twenty-two male collegiate baseball pitchers participated in this study (age: 19.9 years old \pm 1.4 years, body mass: $87.1 \text{ Kg} \pm 11.6 \text{ Kg}$, body height: $182.5 \text{ cm} \pm 6.1 \text{ cm}$). All study participants were competitive athletes at the NCAA Division 1, Division 3, or University Varsity Club level. **Results:** Pitching velocity changes resulted in a mean increase of 0.732 km/h for all groups. Velocity change for each level tested resulted in mean increases of 1.652, 0.402, and 0.370 km/h for the university club, Division 3 and Division 1 levels, respectively. The results of a paired samples t-test analysis showed that there was a statistically significant improvement when using a mouthguard in pitching velocity across all groups combined; $t(109) = 2.958$, $p = 0.004$. Further, university club level pitchers experienced a statistically significant improvement; $t(29) = 5.972$, $p = 0.000$; while Division 3; $t(39) = 0.772$, $p = 0.445$; and Division 1; $t(39) = 1.014$, $p = 0.317$; players did not show a statistically significant improvement with the mouthguard. **Conclusion:** The authors found that a mouthguard may improve throwing velocity in male collegiate baseball athletes. These findings could be useful to both coaches and sport performance specialists that are working with pitchers to bring about increases in power output and subsequent increases in pitching velocity, simply by implementing the use of a mouthguard.

- 3817** Board #134 May 30 8:00 AM - 9:30 AM
Effect Of Self-controlled And Regulated Feedback On Motor Skill Performance And Learning: A Meta-analytic Study
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Previous research has reached conflicting conclusions regarding the effects of regulated (R) and self-controlled (SC) feedback during the practice of motor skill acquisition and retention. **PURPOSE:** Use the aggregate data meta-analytic approach to examine the effects of R and SC feedback on motor skill acquisition and retention in healthy participants of any age. **METHODS:** Randomized trials of SC and R feedback in motor learning published up to 2019 were included by searching eleven databases, cross-referencing and expert review. Studies were selected and extracted by two authors. Risk of bias was assessed using an adaptation of the TESTEX Scale (maximum points = 10). Random-effects models using the standardized mean difference effect size (ES) were used to pool results. Heterogeneity was examined using the Q statistic and inconsistency using I^2 . An alpha value <0.05 was considered statistically significant for changes in motor skill acquisition and retention. **RESULTS:** Of 238 studies screened, 17 were included, representing 42 ES for acquisition and 44 for retention. Risk of bias was $M \pm SD = 6.3 \pm 1.2$. The R group significantly improved performance during the acquisition phase ($ES = 0.85$; $CI_{95\%} = 0.61, 1.09$, $n = 31$, $I^2 = 69.6\%$, $Q = 98.7$, $p < 0.01$) but decreased performance during the retention phase ($ES = -0.82$; $CI_{95\%} = -1.21, -0.43$, $n = 33$, $I^2 = 86.6\%$, $Q = 238.7$, $p < 0.01$). The SC group significantly improved performance during the acquisition phase ($ES = 1.87$; $CI_{95\%} = 1.01, 2.73$, $n = 8$, $I^2 = 82.0\%$, $Q = 39.0$, $p < 0.01$) but there were no statistically significant changes during the retention phase ($ES = -0.05$; $CI_{95\%} = -0.76, 0.66$, $n = 8$, $I^2 = 80.7\%$, $Q = 36.3$, $p < 0.01$). A yoked group to SC feedback significantly improved performance during the acquisition phase ($ES = 1.50$; $CI_{95\%} = 0.27, 2.72$, $n = 3$, $I^2 = 80.9\%$, $Q = 10.5$, $p < 0.01$) with no change during the retention phase ($ES = -0.88$; $CI_{95\%} = -2.11, 0.35$, $n = 3$, $I^2 = 83.4\%$, $Q = 12.2$, $p < 0.01$). **CONCLUSIONS:** The overall results suggest that SC and R feedback improve performance during the acquisition phase, with greater improvements observed for SC feedback. SC feedback had no significant change during the retention phase, while R feedback decreased performance. These findings suggest that SC feedback may be the better choice for enhancing motor skills.

3818 Board #135 May 30 8:00 AM - 9:30 AM
The Effect Of Percussive Massage Versus Foam Rolling Aided Warmup On Vertical Jump Performance
 Peter Byrne, Michele Aquino, Casey Spor, Jacob Virginia, Jessica Diaz, Ryan Mullin, John Petrizzo, Robert Otto, FACSM, John Wygand, FACSM. *Adelphi University, Garden City, NY.*
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Reported Relationships: P. Byrne: Industry contracted research; Theragun®.

Vertical displacement is a vital component of success in many power sport activities including volleyball and basketball. The Vertical Jump test (VJ) is a common, easy to use measure of power production applicable to many athletic populations. Treatments or preparations, such as Percussive Massage (PM), and Foam Rolling (FR) have been introduced to warm up routines on the premise that they will enhance power output and performance. **Purpose:** The purpose of this study was to assess vertical jump performance following a warm up of one of three treatments, including no massage (N), (FR) and (PM). **Methods:** 11 male and 7 female recreationally active college-age students (age: 23.4 ± 3.7 yr., height: 171.6 ± 11.4 cm, body mass: 68.2 ± 15.8 kg.) volunteered to participate in a randomized single-blind crossover design study. Three trials of 3 VJ separated by 2 minutes between jumps were conducted. During the 2 minutes of rest, an intervention (N, FR, or PM) was administered. For both FR and PM, treatment was administered bilaterally for 30 seconds per muscle group (Gluteus Maximus, Hamstrings, Quadriceps, and Gastroc/Soleus) for a total of 2 minutes. Vertical jump height was recorded after each jump using a standard vertical jump tester. **Results:** Statistical analysis by ANOVA ($P < .05$) revealed no significant difference (NSD) between best jumps. The best jumps for N, FR, and PM were 54.11 ± 2.5 cm, 54.96 ± 2.3 cm, and 54.05 ± 2.7 cm, respectively. In addition, subjects were very consistent among the first, second, or third trials across all conditions (NSD). **Conclusion:** The results of this study suggest that neither percussive nor non-percussive massage improve or detract from vertical jump performance and the use of either as a pre vertical jump warm-up may be an individual choice. Supported, in part by a grant from Theragun®.

3819 Board #136 May 30 8:00 AM - 9:30 AM
The Effect Of Percussive Massage Or Foam Roller Aided Warmup On Wingate Power Test Performance
 Jacob Virginia, Michele Aquino, John Wygand, FACSM, Jessica Diaz, John Petrizzo, Ryan Mullin, Casey Spor, Peter Byrne, Robert Otto, FACSM. *Adelphi University, Garden City, NY.*
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Reported Relationships: J. Virginia: Industry contracted research; Theragun®.

Percussive massage tools (PMT) have recently become a topic of interest in the realms of fitness, wellness, pop culture, and athletics. PMT are designed to be implemented during warmups, pre-competition, and recovery processes. Little is known about the warm-up effects of these relatively new tools on muscular power. **Purpose:** The purpose was to determine the efficacy of a PMT aided warmup on Wingate Anaerobic Power Test (WAPT) performance. **Methods:** 20 college-aged subjects (16♂, age 22.6 ± 2.8 yr., height 176 ± 8.4 cm, body mass 78.6 ± 15.4 kg) volunteered to participate in the WAPT following familiarization and 3 randomly assigned warm-up protocols. All warm-up protocols began with 3 minutes of cycling at 50 watts. The cycling was followed by: 2 minutes of (PMT) on the lower extremity, 2 minutes of foam rolling on the lower extremity (FR), and no intervention (C). The Wingate Test was performed at 100g/kg body mass on a Lode cycle ergometer. ANOVA with repeated measures was used to analyze these data ($*p < 0.05$). **Results:** PP-Peak Power (watts) and MP-Mean Power(watts) were: PMT 1328 ± 368 & 640 ± 173 , FR: 1139 ± 284 & 623 ± 155 , and C 1183 ± 386 & 634 ± 160 , respectively. PP was significantly higher following PMT than both FR 189 (+16.6%) and C 145 (+12.2%). There were no significant differences in MP among trials. Fatigue index (FI) of (PMT): $80.8 \pm 9.6\%$ FR: $77.7 \pm 11.9\%$ C: $76.1 \pm 9.3\%$. PMT FI was 4.7%* higher than C trials. Blood lactate values obtained 3 minutes post WAPT were not significantly different among the trials and were as follows: PMT 10.9 mmol ± 2.3 mmol, FR 11.2 mmol ± 2.7 mmol, and C 11.0 mmol ± 2.1 mmol. **Conclusion:** A PMT aided warm-up may be an effective means of improving PP production and possibly performance in acute power-based events lasting 30 seconds or less. The greater FI of PMT may be partially attributed to the significantly greater PP. Supported, in part by a grant from Theragun®.

3820 Board #137 May 30 8:00 AM - 9:30 AM
The Acute Effect Of Percussive Massage Or Static Stretching On Hamstring Flexibility
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The effectiveness of techniques to enhance joint range of motion including static and dynamic stretching, have been studied for more than 50 years and is well documented. However, there is a paucity of research on the effect of a new percussive massage technique on flexibility. Percussive massage provides a machine generated series of rapid movements over specific areas of the body with a variation in both the depth and speed of percussion. **Purpose:** The purpose of this study was to assess the effect of percussive massage (PM), static stretching (ST) and no massage (NM) on low back and hamstring flexibility. **Methods:** 30 subjects (age 22.2 ± 2.2 yr., height 174.2 ± 8.6 cm., weight 75.6 ± 14.2 kg., BMI 24.6 ± 4.3 Kg/m²) volunteered to participate in this single blind, crossover study. Subjects reported to the lab on three separate days in a resting state. Pre sit and reach measurements were taken immediately upon arrival. Thereafter, they participated in randomly assigned interventions of PM, ST, and NM. PM performed on both hamstrings and gluteal muscles simultaneously, 30 seconds at each muscle origin, muscle belly and insertion; total time of 90 seconds on each muscle. Static stretching consisted of a seated unilateral hamstring stretch and a supine unilateral leg cross-over stretch both held for 30 seconds. Following each intervention, post sit and reach measurements were obtained. A maximum of two minutes separated all pre and post- test measurements. **Results:** Mean pre and post-test Sit and Reach measures (cm) were: 29.2 ± 8.1 and 31.6 ± 7.9 , 28.7 ± 8.1 and 31.5 ± 7.8 , and 28.6 ± 7.8 and 30 ± 8.1 for PM, ST, and NM, respectively. Statistical analysis by repeated measures ANOVA at $p < .05$, was applied to assess pre-post intervention differences. The changes (cm) between pre - and post-interventions were 2.4 ± 2 , 2.8 ± 2.9 , and 1.5 ± 1.5 for PM, ST, and NM, respectively. A significant difference was evident between ST and NM ($p = .004$), with NSD ($p > .05$) between PM and ST and PM and NM. **Conclusion:** PM and ST elicit similar, acute improvements in low back and hamstring flexibility. Supported, in part by a grant from Theragun®.

3821 Board #138 May 30 8:00 AM - 9:30 AM
Effects Of Self Natural Posture Exercise On Pain Perception, Functional Movement, And Physical Fitness In Women With Chronic Pain
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 (No relevant relationships reported)

PURPOSE: While Self Natural Posture Exercise, SNPE, widely practiced in Korea is claimed to be effective, it has not been systematically demonstrated. This study examined whether SNPE is effective in pain, functional movement, and fitness improvement. **METHODS:** Twenty four women with chronic pain at least last 3 month prior to study participated (27.5 ± 5.8 yrs, 23.0 ± 3.8 kg/m²) and were divided into two groups; SNPE group (EG; n=12) and non-exercise group (NG; n=12). Subjects in EG participated in 12 weeks of exercise program consisted of 60 min per session, twice a week, while those in NG did not. Those in EG were tested before and after the program, and those in NG were tested twice in the same time interval. The pain perception was evaluated by Short-Form McGill Pain Questionnaire (MPQ). Movement tests were performed using Functional Movement Screen (FMS). Physical fitness was evaluated by grip and lower back strength, sit-and-reach, and back extension. **RESULTS:** Pain perception in EG was decreased (pre; 9.5 ± 7.2 vs. post; 3.5 ± 2.8), and group difference was noticed ($p < 0.01$). Deep squat in EG increased (1.3 ± 0.5 vs. 1.9 ± 0.5 , $p < 0.005$). Hurdle step in EG increased (1.0 ± 0.0 vs. 1.6 ± 0.4 , $p < 0.005$), and group difference was noticed ($p < 0.05$). Inline lunge both in EG (1.4 ± 0.6 vs. 2.6 ± 0.4 , $p < 0.001$) and in NG (1.5 ± 0.5 vs. 2.2 ± 0.7 , $p < 0.001$) increased. Shoulder mobility in EG increased (1.9 ± 0.7 vs. 2.9 ± 0.2 , $p < 0.001$), and group difference was found ($p < 0.05$). Active straight leg raise in NG decreased (2.7 ± 0.4 vs. 2.1 ± 0.7 , $p < 0.05$), but not in EG (2.7 ± 0.4 vs. 3.0 ± 0.0). Push up in EG increased (1.0 ± 0.2 vs. 1.6 ± 0.4 , $p < 0.005$). Rotary stability both in EG and NG did not show pre and post trial differences, but group differences were noticed ($p < 0.05$). FMS total score both in EG (11.4 ± 1.5 vs. 15.4 ± 1.7 , $p < 0.001$) and in NG (12.1 ± 1.7 vs. 13.2 ± 2.0 , $p < 0.05$) increased, and group differences were noticed ($p < 0.05$). Strength parameters were not changed. Sit-and-reach in EG (19.7 ± 6.4 vs. 22.7 ± 6.0 , $p < 0.01$) and back extension in EG (53.4 ± 8.4 vs. 58.5 ± 7.8 , $p < 0.05$) increased, and group differences in both were noticed ($p < 0.05$).

CONCLUSIONS: It is demonstrated that SNPE is valuable exercise modality to release pain perception, to improve functional movement, and to enhance flexibility in women experiencing chronic pain.

3822 Board #139 May 30 8:00 AM - 9:30 AM
Relationship Of Body Composition, Cutaneous Body Temperature & Muscle Power Of Lower Limbs In Folk Dancers

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PURPOSE: Scientific evidence establishes that the practice of physical exercise increases the cutaneous body temperature, but the relationship with muscle power and body composition in dancers has not been established. **METHODS:** Twenty healthy professional dancers (11 men) and (9 women) participated in this study. The 20 dancers participated in a normal dance session (1 hour duration). Body composition was measured with electric bioimpedance BC-601FS FitScan evaluating Weight; P Body fat%; P Body water%; P Muscle mass; P Daily Caloric Intake; P Metabolic age; P Bone mass P Visceral fat. Muscle power was evaluated with DMJump jumping platform. Evaluating the Bosco Ergo Jump Protocol including (Squat Jump (SJ); Squat Jump with extra weight (SJ +); CounterMovement Jump (CMJ); Abalakov Jump (ABK); Drop Jump (DJ) calculating the elasticity index: elastic energy and the upper limbs coordination index The cutaneous body temperature was measured by infrared thermography before the session and during a session of 15, 30, and 60 minutes and 5 minutes after the session. The temperature was evaluated in the anterior tibial muscle of the gastrosoleo muscle. Achilles and sole, denominating "region of interest" (ROI). **RESULTS:** The behavior of the cutaneous body temperature in the different indoor regions increased during exercise and then returned to its basal state. It is evidenced that there is a direct relationship between muscle mass and cutaneous body temperature R = 0.91 (p <0.01). There is an inverse relationship between% fat and body temperature R = -0.89 (p <0.01). The behavior of the cutaneous body temperature in the lower limbs is inversely related to the muscular power R = 0.76 (p <0.05). **CONCLUSIONS:** The findings found in the present study establish the importance of the management of body composition and muscle power in cutaneous body temperature. In the future, the impact of dance on ligament and muscle structures can be detected to prevent injuries.

Characteristics of the participants, by sex.			
Characteristics	Men (11)	Female (9)	P value
Age mean (SD)	20 (3.1)	21 (2.6)	0.299
Anthropometric and body composition			
Height mean (SD) (cm)	171.9 (7.0)	157.9 (4.1)	<0.001*
Weight (SD) (kg)	66.7 (6.6)	56.3 (5.1)	<0.001*
Mass body index (SD) (kg/m ²)	22.5 (1.2)	22.7 (1.7)	0.833
Fat % (SD)	12.9 (3.2)	25.6 (3.2)	<0.001*
Muscle mass % (SD)	55.0 (3.3)	36.4 (8.08)	<0.001*
Weight status %			

Table 2.

ROI	Pre-Ss n 20 Mean, SD.	Post 15-SS n 20 Mean, SD.	Post 60'-ss n 20 Mean, SD.
Anterior Knee Left	23.3±2.64	34.2±3.5	28.5±3.0
Anterior Knee Right	24.1±4.3	32±2.5	28.4±6.4
Posterior Knee Left	24.3±3.2	27.5±7.7	24.±4.3
Posterior Knee Right	25.5±3.3	28.1±2.5	25.3±4.1
AT Left	28.5±4.2	33.7±3.7	28.8±5.2
AT Right	29.4±2.2	32.5± 4.7	26.3±2.3

Table 3.

Correlations	Muscle power peak	Fat % (SD)	Muscle mass % (SD)
Cutaneous body temperature means	R = 0.76 (p <0.05).	R = -0.89 (p <0.01)	R = 0.91 (p <0.01).

3823 Board #140 May 30 8:00 AM - 9:30 AM
Nathan McMillan
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 (No relevant relationships reported)

PURPOSE: A pre-resistance training (RT) counter-movement jump (CMJ) has been proposed as a convenient neuromuscular readiness test to predict specific RT

performance and thus guide acute program modification. The present study assessed whether fatigue-related decrements in CMJ were associated with concomitant reductions in barbell squat performance.

METHODS: Adult males (n = 12, 25 ± 5 years; 178 ± 5 cm; 89 ± 12 kg) with >1 year RT experience performed 6 sets to failure with 90% of their 10 repetition maximum in the squat, bench press and latissimus dorsi pull-down. Relative changes (Δ) from pre- to 24 and 48 h post-RT were calculated for CMJ height (derived from force plate computed take-off velocity) and mean concentric barbell velocity (derived from a linear position transducer) in the barbell squat with loads corresponding to 1.0 (V1.0) and 0.8 m·s⁻¹ (V0.8). Differences in variables across time were assessed with repeated measures analysis of variance (for CMJ) or Friedman's test (for V1.0 and V0.8). Associations among Δ variables were quantified with Pearson's correlations. **RESULTS:** Squat V1.0 was significantly reduced at 24 (median ± interquartile range, 0.95 ± 0.07 m·s⁻¹, p = 0.04) and 48 h (0.93 ± 0.11 m·s⁻¹, p = 0.03) post-RT. Squat V0.8 was also significantly reduced at 24 (0.70 ± 0.09 m·s⁻¹, p <0.01) and 48 h (0.75 ± 0.04 m·s⁻¹, p = 0.03) post-RT. CMJ height was significantly reduced at 24 (mean ± standard deviation, 33.66 ± 5.20 cm, p = 0.02) but not 48 h (34.51 ± 5.12 cm) relative to pre-RT (36.00 ± 5.26 cm). No significant associations (all p <0.05) were observed between ΔCMJ and ΔV1.0 or ΔV0.8 at 24 (r = -0.06 - 0.29) or 48 h (r = 0.17 - 0.37) post-RT. **CONCLUSIONS:** Recovery of CMJ performance did not parallel recovery of barbell squat performance. CMJ height should not be used to predict daily barbell squat performance.

3824 Board #141 May 30 8:00 AM - 9:30 AM
Workload Demands Of Position Players In Major League Baseball

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PURPOSE: The injury burden within Major League Baseball (MLB) is significant in terms of events, days missed and financial cost. The types of injuries experienced by MLB players is diverse and differs by position; likely reflecting different running, throwing and batting-related workload demands. Understanding in-game demands is critical to athlete preparation, monitoring and management as well as return to play following injury however, little is known about the workload demands of position players in Major League Baseball across each of the key activity-domains. This study seeks to describe the physical demands of position players within Major League Baseball to inform physical preparation, monitoring and return to play. Given the uniquely demanding MLB playing schedule (6.3 games per week), demands across a single game, typical 5-day and worst 5-day periods are presented.

METHODS: Total and high-speed running distance (>75% Vmax), high-speed running count, hard accelerations (>3.0 m/s/s), defensive and baserunning minutes, total and hard throws (>80% Vmax), and bat swings were calculated from the Statcast Data provided by MLB to each club. Data were limited to players with 100 games or more in the 2018 championship season. 129 players met the inclusion criteria including: 18 1B, 17 2B, 20 3B, 21 SS, 12 C, 16 CF, 10 LF, 12 RF, and 3 DH. Levene's test was used to assess for Heteroscedasticity. Between group (position) differences were assessed using ANOVA (Bonferroni adjustment; criterion Alpha p=0.05).

RESULTS: Significant positional differences were evident across running and throwing but not bat swing metrics. Outfielders did more total (941.9 ± 135.5 yds per game), and high-speed running (87.3 ± 16.9 yds per game) than other positions. First-basemen did more hard accelerations (33.4 ± 8.7 per game). Middle infielders made more throws (3.5 ± 0.6 per game), and shortstops (0.9 ± 0.3 per game) made more hard throws. Bat swings were similar across positions (7.6 ± 1.0 per game).

CONCLUSIONS: This is the first description of workload demands for position players in Major League Baseball. This information can inform pre-season physical preparation, in-season monitoring and management and return to play progressions for injured professional baseball players.

3825 Board #142 May 30 8:00 AM - 9:30 AM
Analysis Of The Use Of Sodium Bicarbonate In Performance Of Surfing Athletes

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PURPOSE: Surf is a sport that presents variations of intensity and duration during its practice. Therefore, strategies that contribute to muscle buffering in periods of high intensity, may be efficient to improve the performance of practitioners of this modality. **Objective:** To evaluate the efficiency of sodium bicarbonate in the performance of surfing athletes.

METHODS: Twenty surfers with an average age of 18 years were submitted to a sodium bicarbonate solution (0.5mg / kg) 40 minutes prior to the practice tests performed in the pool, alternating the same method, but with a solution containing chloride sodium and water (placebo), the other day, at random, in a cross over style. Upon arrival at the test site, the volunteers had blood lactate collected by a Roche® lactimeter pre and post practice and underwent a progressive paddling test on the pool on their own surfboard. They were instructed to shoot at a maximum speed of 20 meters to determine the time to be adhered as a basis for further testing. Subsequently, the athlete rested for 2 minutes and was instructed to perform up to 20 shots from 20 meters at 80% of his maximum speed with an interval of 100% of the time taken in the shot. The test was interrupted when the subject increased by 2 seconds of the maximum time performed, two consecutive times, or when completed the 20 idealized shots of the test. At the end of each test, blood samples were collected for lactate concentration analysis.

RESULTS: See table 1.

Evaluation	Bicarbonate	Placebo	P value
Lactate	16,43±3,1	14,83±2,7	0,04
Maximum time	10,68±0,8	10,88±0,6	0,05
Shots	16,35±5,2	16,35±5,2	

Table 1: Description, by the Student's t-test, of mean and standard deviation of lactate values; maximum time; and number of shots in relation of the use of bicarbonate and sodium chloride (placebo). The accepted significance level was p≤0.05.

CONCLUSIONS: The administration of sodium bicarbonate positively impacted the performance of the surfer athletes, leading to a maximum paddle test time improvement and an increase of the blood lactate.

3826 Board #143 May 30 8:00 AM - 9:30 AM
Effect Of Pedaling Feedback On 20-km Time Trial Gross Efficiency And Power Output

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(No relevant relationships reported)

INTRODUCTION: Gross efficiency (GE) is a crucial factor in endurance cycling performance. Elite cyclists have superior pedaling technique, sustaining a greater average power output (PO) through the pedaling cycle than non-elite cyclists. Previous studies have demonstrated that pedaling technique can be improved with visual feedback (FB), however, the effect of pedaling feedback on GE and PO has not been investigated. **PURPOSE:** Determine the effect of FB on pedaling technique software on GE and PO during a 20-km time trial completed with feedback (WF) and without feedback (WO). **METHODS:** Eight recreationally-trained males (39 ± 6 y, VO_{2peak}: 47.5 ± 6.1 mL·kg⁻¹·min⁻¹ at 282 ± 43 W) with at least six months of consistent cycling or triathlon training completed three 20-km TT. The first TT served to familiarize subjects with the FB software and cycle ergometer. During the other two sessions, subjects completed the time trial in the fastest time possible in both WF and WO conditions completed in randomized order. For WF, subjects received feedback regarding the smoothness of their pedal stroke cycle and attempted to optimize their pedaling technique real-time. Both GE and PO were calculated at 25, 50, 75, and 100% completion time. Statistical analyses of GE and PO for all stages of both WO and WF were completed using a 2x4 repeated measures ANOVA. **RESULTS:** GE and PO tended to be greater in all stages of WF when compared to WO (GE: 25%: 20.2 vs. 19.1%, 50%: 19.0 vs. 16.9%, 75%: 19.0 vs. 17.1%, 100%: 19.7 vs. 19.0%) (PO: 25%: 195 vs. 194 W, 50%: 203 vs. 171 W, 75%: 203 vs. 195 W, 100%: 221 vs. 213 W), but none were statistically significant (GE p = 0.084, PO p = 0.119). The biggest differences in GE and PO between the WF and WO conditions were at 50 and 75% completion. **CONCLUSIONS:** The monitoring of pedaling technique with FB of pedaling technique during a 20-km TT may lead to an improvement in GE without a reduction in PO during a single session using FB.

3827 Board #144 May 30 8:00 AM - 9:30 AM
Self-reported Training Variables Are Poor Predictors Of Laboratory Measures In A Heterogenous Group Of Cyclists

Bryan Saunders, Bruna Mazzolani, Pedro Perim, Fabiana Infante Smaira, Nathalia Saffioti Rezende, Giulia Cazetta Bestetti, Alina Dumas, Luana Farias de Oliveira, Paul Swinton, Eimear Dolan. *University of Sao Paulo, Sao Paulo, Brazil.*
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PURPOSE: Cycling is a predominantly aerobic activity that depends on a range of physiological attributes, as well as genetic, dietary and lifestyle factors. It is unknown

to what extent laboratory-measured physiological and performance characteristics are predicted by individual training factors such as intensity, duration, distance, coach supervision, level of competition and training experience in cycling. **METHODS:** Fifty-two men and 18 women completed a training questionnaire and performance tests generating 14 outcomes (incremental cycling test [8 outcomes]; 30-s Wingate test [4 outcomes]; and 4-km cycling time-trial [2 outcomes]). LASSO (least absolute shrinkage and selection operator) regression was performed for each performance outcome including demographic and training factors as potential predictors. Continuous regression inputs were scaled by dividing values by two standard deviations to facilitate comparisons with binary predictors and assist with model interpretation. Models were generated using the glmnet package in R with associations described by regression coefficients and percentage inclusion in 10000 bootstrap samples. **RESULTS:** Laboratory measures indicated a heterogenous group of athletes, as demonstrated by the range of maximal oxygen uptake values (VO_{2max}, range: 26.3 - 69.8 mL·kg⁻¹·min⁻¹). LASSO models identified that demographic factors were the most influential predictors of laboratory variables, with sex (76±37% inclusion), age (55±27% inclusion) and height (55±40% inclusion) featuring consistently in bootstrap samples across outcomes. In contrast, no discernible patterns were identified for training factors. When training factors did appear consistently in a model, the regression coefficients were small and median estimates of the best training predictors were equal to 15.1±7.4% of sex or 30.6±14.5% of the next most influential demographic factor. **CONCLUSIONS:** Self-reported training variables were poor predictors of physiological and performance measures in a heterogenous group of cyclists, while demographics such as sex, age and height were greater predictors of these variables. A lack of a properly structured or implemented training program might explain the low predictive ability of training variables towards these laboratorial outcomes.

3828 Board #145 May 30 8:00 AM - 9:30 AM
Dynamic Vision Training Transfers Positively To Batting Performance Among Collegiate Baseball Batters

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PURPOSE: A growing body of evidence has demonstrated that visual, perceptual, and oculomotor abilities contribute to batting performance in baseball. As such, an important question is whether training such abilities can transfer positively to batting performance.

METHODS: The current study tested this question through a pre-registered, randomized, and placebo-controlled training intervention, conducted with 24 collegiate baseball players at two Division 1 universities. Athletes were randomized into two groups and received either active dynamic vision training consisting of stroboscopic, anticipatory timing, and eye quickness drills, or placebo drills stylized after control procedures in previous vision therapy studies. Visual-motor and batting performance data were collected and compared between the two cohorts to test the transfer of training effects, while controlling for covariates such as expectations and site. Generalized near-transfer of training was tested with a digital visual-motor task battery, while sports-specific intermediate and far transfer of training were evaluated through tracking metrics collected during structured batting practice and box score performance in NCAA-sanctioned games, respectively. Participants averaged 8.5 hours of training with no significant group differences in adherence, expectations, or baseline assessments.

RESULTS: Analysis of covariance revealed no group differences in measures of generalized visual-motor skills or NCAA game statistics. However, structured batting practice results revealed consistent gains in batting performance, with significant improvements in the Launch Angle (delta = 8°, p <0.001, Cohen's d = 0.66) and Hit Distance (delta = 41 ft, p <0.001, Cohen's d = 0.61) for the active cohort relative to the control group. This finding was present at each individual study site and in both the complete-case and intent-to-treat analyses.

CONCLUSIONS: These findings indicate that the use of sports vision training programs can result in improved performance beyond the direct skills trained, warranting further study and creating new opportunities for training baseball athletes.

3829 Board #146 May 30 8:00 AM - 9:30 AM
The Athlete Specific Chronotype Index (ACTi)

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The circadian variation of athletic performance has been observed to coincide with daily peaks in body temperature. Chronotypes (CT) take into account inter-individual variations in circadian rhythms, yet there is discord regarding the relationship between

CT and athletic performance. This may be due to the most common chronotyping method, the Morningness-Eveningness Questionnaire (MEQ), lacking validity for athletic populations. **PURPOSE:** The purpose of this study was to develop and validate an athlete specific CT index (ACTi). **METHODS:** 297 athletes completed a CT questionnaire in MEQ (19) and newly-developed questions (15). Principle component analysis (PCA) was used to identify common themes and reduce the final number of questions. 10 respondents from each CT category, as determined by the MEQ, then participated in a 24-hour laboratory study. Participants abided by their typical sleep/wake cycle, provided hourly saliva samples (for dim light melatonin onset (DLMO) analysis) whilst awake and hourly core body temperature (CBT) readings (ingestible thermistor) for the 24-hours. Stepwise multiple linear regression analysis to predict DLMO onset and CBT was used to further refine the ACTi.

RESULTS: PCA of the extended ACTi responses were performed, identifying 7 themes. Multiple regression identified 11 questions that explained DLMO ($r^2=0.81$), forming the final ACTi. DLMO CT differences were observed between MEQ morning-type (MT) and intermittent-type (IT) (64 ± 61.6 min, $p=0.02$); and MT and evening-type (ET) (114 ± 71.2 min, $p=0.002$). No CT differences were observed in CBT for MEQ or ACTi. Cohen's Kappa revealed moderate CT classification changes between MEQ and ACTi (0.62). **CONCLUSION:** The ACTi is an 11-point index that enhances CT determination of athletes versus MEQ, based on the criterion measure DLMO. The ACTi may be used in team-sports to examine the impact of CT upon performance, monitoring of training responsiveness and athlete wellbeing.

3830 Board #147 May 30 8:00 AM - 9:30 AM
Effects Of Yoga On A Vibration Platform With Or Without Blood Flow Restriction

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PURPOSE: To investigate acute effects of yoga performed on a vibration platform (VP) with and without blood flow restriction (BFR) on hemodynamics, flexibility, and lower extremity explosive power.

METHODS: Total 17 healthy subjects, 8 males (age= 22 ± 4.2 years) and 9 females (age= 24.2 ± 2.9 years), were screened by questionnaires, read and signed informed consent, and participated in the study. Subjects completed 4 separate randomized yoga sessions (on the floor, on the floor with BFR (FL+BFR), on the VP (VP), and on the VP with BFR (VP+BFR)) with at least 48-hr in between. The sessions involving BFR consisted of application of specialized cuffs on the uppermost portion of both thighs restricting blood flow. All sessions started with the measuring of resting heart rate (HR) and blood pressure (BP), followed by a 5-min treadmill warm-up session. Then vertical jump performance (VJ) and flexibility were assessed. The yoga sessions consisted of a series of 8 different yoga poses (Garland pose, Downward dog, Lunge, Chair pose, Twisted chair, Warrior, Squat and Lord of the dance), each lasting 30-sec with 1-min of rest in between poses. During each pose, breathing was monitored by using a metronome to prevent subjects from holding their breath during exercise. VJ and flexibility were again tested immediately post-exercise. HR and BP were also measured immediately after and every 5-min for 25-min following completion of the yoga session.

RESULTS: Two-way ANOVA showed significant condition main effect ($p<.05$) for flexibility, indicating enhanced flexibility following VP compared to floor ($p<.05$) and VP+BFR ($p<.05$). Significant time main effects were detected for flexibility ($p<.01$), HR ($p<.01$), SBP ($p<.01$) and DBP ($p<.01$) indicating higher post-exercise values.

CONCLUSIONS: Enhanced flexibility in response to yoga on VP can be attributed to a vibration-induced activation of Golgi tendon organ causing the related muscle to relax and desensitization of stretch reflex due to activation of muscle spindles by the rapid changes in muscle length. However, no significant improvements in flexibility following the VP+BFR session could be due the placement of BFR cuffs on the uppermost portion of thighs, interfering with vibration-induced muscle length alteration and excitation of Golgi tendon organs.

3831 Board #148 May 30 8:00 AM - 9:30 AM
GLOBAL PERFORMANCE INDEX IN TRIATHLON

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(No relevant relationships reported)

PURPOSE: The aim of this study is to evaluate the relative importance of each modality in the result of the IRONMAN® World Championship race at Kona.

METHODS: All the analyses were made from 1981 until 2018, considering just the male professional triathletes that appeared, at least, 5 times between the TOP 10 finishers. 24 triathletes were selected. Their racing times were converted into seconds. The analysis was made in a global way and by modalities (swimming, cycling and

running). A global performance index (GPI) and a specific performance indexes were created for the triathletes for each modality: swimming performance index (SPI), cycling performance index (CPI) and running performance index (RPI). Afterwards, we calculated the correlation between the stages and made a regression with the overall performance as an independent variable and the relative performance in each stage (SPI, CPI and RPI) as dependent variable. In the regression analysis, we used the "Enter" method to force the entry of all the dependent variants.

RESULTS: The final equation to evaluate the Global Performance was: $GPI = (0,324 \times SPI) + (0,871 \times CPI) + (1,07 \times RPI)$. When the correlation between the stages was analyzed, we observed a negative correlation between SPI and RPI (0,403). This finding contradicts most of the studies that put cycling as the crucial stage in a long term triathlon race like IRONMAN®

CONCLUSIONS: This results can confirm that in triathlon races, being a good swimmer can be very important, despite the swimming stage be less representative. In general, the running stage is the most important of the race, based in the analysis of the correlation between the 3 modalities. Running is crucial, but this analysis is very complex, because the 3 stages are not independent as far as the effort made in one stage tends to impact the performance on the next one.

3832 Board #149 May 30 8:00 AM - 9:30 AM
Sex Differences In Fatigability During Metabolically-matched Locomotor Exercise: An Integrative Approach

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Purpose: To compare the cycling power-duration relationship between males and females and assess fatigability in the heavy and severe exercise intensity domains.

Methods: Eighteen cyclists (age: 25 ± 6 years, 10 males, 8 females) performed an incremental ramp test, then three constant-load cycling trials to task failure (110, 90, and 80% of maximum ramp test power (P_{max})). Critical power (CP) and the curvature constant (W') of the power-duration relationship were subsequently calculated and constant-load experimental trials were performed to task failure at 110% CP, and to task failure or for 60 mins at 90% CP, whichever occurred first. Near-infrared spectroscopy of the vastus lateralis (VL) and pulmonary gas exchange were monitored during exercise, and neuromuscular function assessed before and after experimental trials.

Results: Males had a greater P_{max} (362 ± 29 vs. 241 ± 42 W, $P<0.001$) and $\dot{V}O_{2max}$ (60.5 ± 8.2 vs. 44.2 ± 4.8 mL·kg⁻¹·min⁻¹, $P<0.001$) vs. females. In absolute units, CP (260 ± 28 vs. 179 ± 32 W, $P<0.001$) and W' (18.5 ± 4.8 vs. 12.7 ± 3.2 kJ, $P=0.009$) were greater in males, but when expressed relative to P_{max}, no differences existed ($P \geq 0.209$). There was no sex difference in time to task failure at 110% CP (752 ± 329 vs. 681 ± 277 s, $P=0.645$), but throughout the trial, females experienced a smaller decrease in VL oxygenation (-20 ± 8 vs. $-7 \pm 4\%$, $P<0.001$), and a smaller post-exercise reduction in twitch force (-35 ± 17 vs. $-15 \pm 10\%$, $P=0.010$) compared to males. During the 90% CP trial, three males and three females reached task failure prior to 60 mins (mean duration: 3073 ± 835 vs. 2937 ± 964 s, $P=0.758$). Females demonstrated a smaller decrease in VL oxygenation (-21 ± 9 vs. $-1 \pm 6\%$, $P<0.001$), as well as a lesser reduction in twitch force (-24 ± 11 vs. $-10 \pm 11\%$, $P=0.020$) and voluntary activation (-9 ± 6 vs. $-4 \pm 3\%$, $P=0.036$) post-exercise compared to males. Cortical ($-20 \pm 32\%$, $P=0.039$) and spinal ($-22 \pm 45\%$, $P=0.039$) excitability were reduced following the 90% CP trial, but no sex difference existed ($P \geq 0.132$).

Conclusions: No sex difference exists in the power-duration relationship when data are expressed relative to P_{max}. However, females demonstrate a greater fatigue resistance of the knee-extensors during both severe and heavy intensity cycling, likely due to lesser reductions in locomotor muscle oxygenation during exercise.

G-35 Free Communication/Poster - Physical Activity: Injury and Illness

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
Room: CC-Exhibit Hall

3833 Board #150 May 30 8:00 AM - 9:30 AM Running Injury According To Training And Performance Related Data

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(No relevant relationships reported)

PURPOSE: A runners training and performance history over the previous 12 months is rarely considered in data related to running injury and participation level. The purpose of this on-line questionnaire was to gather self-reported history of exposure, performance and injury over the preceding 12 months in runners of different abilities. Self-reported history of barefoot running and injuries was also collected.
METHODS: An on-line questionnaire (QualtricsSM software) was developed by the investigators and then distributed to a sample of runners recruited via social media and running clubs. Runners declared their participation level as; Non-competitive/recreational (NCR), represent club (RC) and represent county (RCOUN).
RESULTS: There were 224 respondents (59% = NCR, 35% = RC and 6% = RCOUN). Respondents reported (mean \pm SD): fastest 5km run time (minutes) = NCR 24.4 \pm 6.6, RC 21.05 \pm 4.06 RCOUN 16.53 \pm 1.61; 'on average' kilometres ran per week = NCR 28.8 \pm 18.50, RC 43.52 \pm 20.44, RCOUN 82.35 \pm 36.0; 'on average' minutes ran per week = NCR 190.36 \pm 142.28, RC 268.10 \pm 126.21, RCOUN 428.21 \pm 157.92. There were 175 respondents (78%) reporting at least one injury over the previous 12 months (total injuries = 348). Injury rates were; 10.99 injuries/1000hrs for NCR, 4.52 injuries/1000hrs for RC and 2.48 injuries/1000hrs for RCOUN. The most common injury sites were; knee for NCR (17%, 30/176), Achilles (19%, 21/109) for RC and calf (21%, 5/24) and/or shin (21%, 5/24) for RCOUN. There were 31 respondents (14%) that reported participating in barefoot running at least once per week, of which 20 (65%) reported having at least one injury with a relative risk of 0.803 (95% CI, 0.613-1.053), and an odds ratio of 0.613 (95% CI, 0.197-1.009). The Achilles was the most common site of injury (30%, 9/30).
CONCLUSIONS: These findings offer insights to the injury characteristics of runners from different participation levels. The findings should serve to catalyse prospective studies, including exploration of the risk of barefoot running on injury.

3834 Board #151 May 30 8:00 AM - 9:30 AM Characterizing OA Phenotype Response To Emerging Science In Sports (COMPRESS) Trial

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Osteoarthritis (OA) is among the most prevalent and debilitating chronic diseases worldwide affecting the general population as well as athletes. Despite that, no therapies have been proven to modify disease progression or to be highly effective for symptomatic relief, other than joint replacement surgery. Accordingly, recent effort has been aimed to define a classification of OA phenotypes for the purpose of better identifying individuals at higher risk of progression and to better delineate subpopulations attributable to distinct risk factors and disease mechanisms that may be suitable for targeted treatment and prevention strategies. Purpose: To characterize using the Dell'Isola criteria, the frequency of knee OK (KOA) phenotypes (6 in total) in new patients presenting to a single tertiary care institution. Methods: Following IRB approval, patients were phenotyped by the senior author (TMB) at their initial clinic visit. Kellgren-Lawrence (KL) readings were evaluated by the senior author and verified by a board certified MSK radiologist. Results: We successfully characterized 242 patients (30 - 70 years of age) with the Dell'Isola system. Due to requirements for specific biomarkers for the classification of the bone and cartilage metabolism phenotype, we were only able to classify five phenotypes (chronic pain, inflammatory, metabolic syndrome, mechanical overload, minimal joint disease). The most common phenotype was minimal joint disease (30% or 73 patients) followed by metabolic syndrome (19% or 45), mechanical overload (15% or 36), chronic pain (15% or 36), and inflammatory (6.3% or 15). For both the minimal joint disease and chronic pain phenotypes, there was unequal distribution of Latino to non-Latino subjects (70% vs. 30%). Discussion: OA is a complex disease increasingly recognized to be a disorder of multiple phenotypes. This study begins to phenotype a culturally and ethnically diverse population of patients with KOA in an academic Sports Medicine clinic. Ongoing investigations include validated functional evaluation (KOOS, WOMAC) of

our subjects to determine if certain phenotypes are associated with poorer functional outcomes. Reference: Dell'Isola A et al. *MJBmd. Identification of clinical phenotypes in knee osteoarthritis: a systematic review of the literature.* 2016; 17(1): 425.

3835 Board #152 May 30 8:00 AM - 9:30 AM Abstract Withdrawn**3836 Board #153 May 30 8:00 AM - 9:30 AM Abstract Withdrawn****3837 Board #154 May 30 9:00 AM - 10:30 AM Head Impacts In Women's Collegiate Club Lacrosse**
Nicholas J. Cecchi, Derek C. Monroe, Gianna M. Fote, Steven L. Small, James W. Hicks. *University of California, Irvine, Irvine, CA.*
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(No relevant relationships reported)

Women's lacrosse is an 'incidental contact' sport meaning that intentional contact with an opponent is not permitted by the game's rules. Despite this, women's lacrosse played at the high school and collegiate varsity levels of competition carry a risk of repetitive head impact exposure and sport-related concussion. Head impact exposure at the collegiate club level of women's lacrosse has not yet been described.

PURPOSE: To characterize the anticipated and observed incidence of head impacts in women's collegiate club lacrosse.

METHODS: Experienced women's collegiate club lacrosse players (n=10) filled out questionnaires reporting how often they sustained head impacts (per game exposure) during the past year. Headband-mounted head impact sensors were worn by athletes (n=11) during eight collegiate club lacrosse games sanctioned by the Western Women's Lacrosse League. The sensors reported the peak linear acceleration (PLA) and peak rotational acceleration (PRA) associated with each recorded accelerative event. Head impacts were confirmed by two researchers independently reviewing competition video time-synced with sensors. Video review was also used to determine the mechanisms of confirmed impacts.

RESULTS: Athletes had a median 4 (range: 0.25 - 8) years of lacrosse experience and expected to sustain a median 0 (range: 0 - 3) head impacts per game. 75 accelerative events were recorded by the head impact sensors across 81 total game exposures. Six head impacts were confirmed using video and 69 accelerative events were rejected as false positives. Confirmed impacts had a median PLA of 21.0 g (range: 18.3 g - 48.3 g) and PRA of 1.1 krad/s^2 (range: 0.7 krad/s^2 - 5.7 krad/s^2). Four impacts resulted from contact with an opponent's body and two impacts resulted from contact with an opponent's stick. Only one head impact incurred a penalty against the opposing player.
CONCLUSIONS: Athletes anticipate and sustain infrequent head impacts in women's collegiate club lacrosse relative to lacrosse and contact sports played at the high school and collegiate varsity levels of competition. Those impacts that are sustained are of relatively low magnitude. Head impact sensors are prone to high false positive rates and the use of video recordings to filter sensor data is necessary.

3838 Board #155 May 30 8:00 AM - 9:30 AM Effects Of Adolescent Sports Specialization On NFL And MLS Players' Injury Propensity

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Adolescent single sport specialization has been linked to a higher rate of overuse injuries and has even been shown to be detrimental to the health and career longevity of NBA players (Rugg et al).

Purpose: To evaluate a potential relationship between adolescent sports specialization and injury propensity in elite NFL and MLS players.

Methods: 570 first and second round NFL draft selections from 2010-2018 and 202 first round MLS draft selections from 2005-2018 with reliable sport specialization, injury history, and playing career data were identified. Publicly verified internet sources were used to classify adolescent sport participation, number and type of severe injuries sustained during pro football or soccer games, and number of total possible games played and missed due to injury. Subjects for each league were divided into 2 cohorts: multisport (MS) and single sport (SS). Sports specialization comparisons were made as follows:

(1) Average % of games missed due to injury (APGM) using 2 sample T test and (2) % of players who sustained at least 1 major injury (%MI) using one-tailed Fisher's exact test.

Results:

APGM was lower in the NFL MS group (11.4±0.7% vs 18.7±2.3%; $p<.01$) but not in the MLS MS group (6.51±1.9% vs 5.8±1.0%; $p=0.377$) [Figure 1]. %MI was also lower in the NFL MS group (54.2 vs 68.8%; $p<.01$) but not in the MLS MS group (41.7 vs. 35.1%, $p=0.4528$) [Figure 2].

Figure 1. APMG Sports Specialization Comparison in NFL and MLS

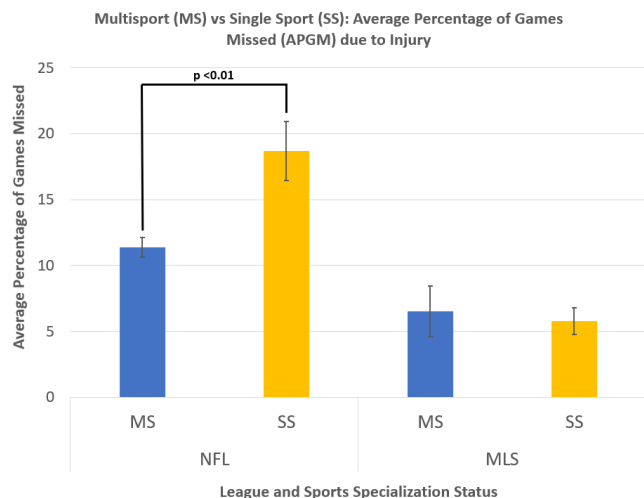
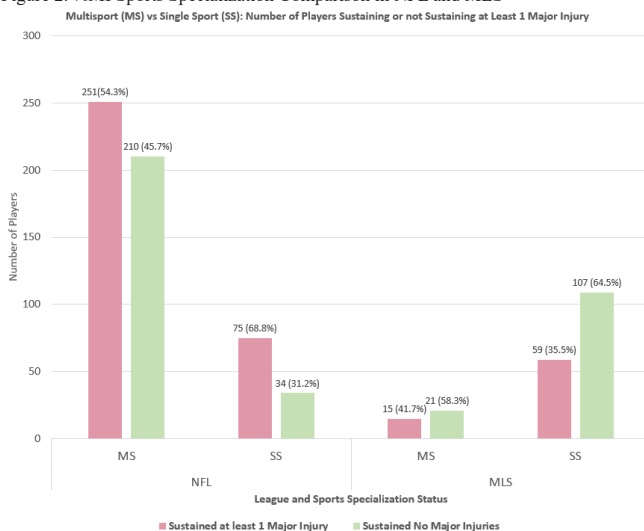


Figure 2. %MI Sports Specialization Comparison in NFL and MLS



Conclusion:

Adolescent MS specialization contributes to a reduction in injury predisposition in NFL athletes but not in MLS athletes.

3839 Board #156 May 30 8:00 AM - 9:30 AM Epidemiology Of Sudden Death In Organized School Sports In Japan

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There are approximately three-million four-hundred thousand registered student athletes in middle and high school in Japan. Despite a large number of participants, health and safety policies for student athletes in Japan are at its infancy and there is paucity of data-driven policies to reduce catastrophic and fatal injuries from sports. **PURPOSE:** Describe the epidemiology of sudden death in organized school sports in Japan. **METHODS:** Data submitted to Japan Sport Council (JSC) Injury and Accident Mutual Aid Benefit System between 2005-2016 were retrieved from JSC website for

analysis (n=1,137). Case information on fatal incidents occurred during organized school sports in middle and high school students were extracted for further analysis (n=198). Descriptive statistics related to information about activity type, sex, sport, diagnosis, and presence of on-site trained medical personnel were calculated using frequency and proportion. Sudden death incidence rates were expressed per 100,000 athlete-years and 95% confidence intervals (CI). **RESULTS:** Fatalities were reported in practice (n=120/198, 60.6%), scrimmage (n=16/198, 8.1%), game (n=10/198, 5.1%), training camp (n=16/198, 8.1%), and other (n=36/198, 18.2%). The average incidence rate of sport related fatality was 0.39 death per 100,000 athlete-years (95% CI= 0.31-0.47). Most fatalities were in male student athletes (n=149/162, 92%), which yielded to 7.5 times greater fatality rate in male than female student athletes (male, 0.60 death per 100,000 athlete-years, 95% CI= 0.46-0.73; female, 0.08 death per 100,000 athlete-years, 95% CI= 0.03-0.13). Baseball (n=25/162, 15.4%), judo (n=24/162, 14.8%), soccer/futsal (n=20/162, 12.3%), and basketball (n=18/162, 11.1%) accounted for 53.7% of fatalities. Sudden cardiac death (n=68/162, 42.0%), head trauma (n=32/162, 19.8%), and heat related injury (n=25/162, 15.4%) were the top three diagnosis of fatality. Only three cases (2%) reported of having trained medical personnel on-site at the time of incident. **CONCLUSIONS:** Sports-related fatality among Japanese student athletes was highest in male baseball players during practice due to sudden cardiac death. Almost no incidents had trained medical personnel on-site at the time of catastrophic injuries during school organized athletics in Japan.

3840 Board #157 May 30 8:00 AM - 9:30 AM Removal From Activity Following Sport-related Concussion In Sex-comparable Sports

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As sport-related concussion (SRC) awareness has increased, timely reporting and immediate removal from play have become a focal point of proper management. Delayed removal may result in additional injury and protracted recovery. Research has demonstrated that girls are more honest and likely to report their concussion symptoms compared to boys. However, it is unknown if these reporting behaviors correspond with immediate removal from play in girls compared to boys in sex-comparable sports. **PURPOSE:** To compare the incidence of high school athletes not removed from activity following SRC in sex-comparable sports in Michigan. **METHODS:** An epidemiological study of athletes diagnosed with SRC participating in Michigan High School Athletic Association-sponsored basketball, baseball/softball, and soccer from 2016-2019 was performed. All SRCs were recorded in a Head Injury Reporting System by certified athletic trainers, administrators, or coaches. Removal from activity indicated the athlete was removed from play at the time of an injury event. Lack of removal does not indicate mismanagement at the time of the event, but that the injury was not reported. Incidence was calculated by dividing SRCs not removed by total SRCs in each sport. Risk ratios were calculated by dividing the incidence of girls not removed by boys not removed in each sport. **RESULTS:** A total of 3696 (2425 female, 1271 male) SRCs were reported, with the most occurring in girls' soccer (n = 1024). Overall, 442 girls and 182 boys were not removed from activity, resulting in incidences of 0.18 (95% CI, 0.17-0.20) and 0.14 (95% CI, 0.12-0.16), respectively. Across all sports, girls were 1.27 (95% CI, 1.09-1.49) times as likely to not be removed from activity compared to boys. Girls had 1.16 (95% CI, 0.91-1.50), 1.19 (95% CI, 0.77-1.84), and 1.41 (95% CI, 1.12-1.78) times the risk of not being removed from basketball, softball, and soccer, respectively, when compared to the equivalent boy sports. **CONCLUSIONS:** Girls were at greater risk of not being removed from activity compared to boys in sex-comparable sports. Although girls are more likely to report symptoms of SRC, there is still a gap in their removal from play, potentially due to a delayed onset or recognition of symptoms. Future research and initiatives should target reporting and removal in female sports.

3841 Board #158 May 30 8:00 AM - 9:30 AM Domain-specific Physical Activity, Pain Interference, And Muscle Pain After Activity

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(No relevant relationships reported)

PURPOSE: The context in which physical activity is performed may affect self-reported indicators of pain. Using the Melbourne Collaborative Cohort Study, we examined associations between occupation, household, transport, and leisure physical activity with pain interference and muscle pain after activity. **METHODS:** The analysis included 9,577 working and 12,281 non-working participants. Physical activity was assessed using the International Physical Activity Questionnaire-Long

Form. Pain interference was assessed using SF-12, and muscle pain after activity was assessed using Sphere-12. Ordered logistic regression was used to estimate odds ratios (OR) and 95% confidence intervals (CI), and restricted cubic splines were used to graphically represent the dose-response association between each physical activity domain and pain outcome. **RESULTS:** Compared to those in the lowest quartile, participants in the highest quartile for transport activity had less pain interference (workers OR: 0.84, 95% CI: 0.74, 0.95; non-workers OR: 0.80, 95% CI: 0.71, 0.89) and muscle pain after activity (workers OR: 0.82; 95% CI: 0.69, 0.98; non-workers OR: 0.81, 95% CI: 0.71, 0.93). Similarly, participants in the highest quartile of leisure activity had less pain interference (workers: OR: 0.82; 95% CI: 0.69, 0.98; non-workers OR: 0.81, 95% CI: 0.71, 0.93) and muscle pain after activity (workers OR: 0.79; 95% CI: 0.64, 0.96; non-workers: OR: 0.89, 95% CI: 0.76, 1.03). In workers only, participants in the highest quartile of household activity reported more pain interference (OR: 1.37; 95% CI: 1.20, 1.57) and muscle pain after activity (OR: 1.34; 95% CI: 1.12, 1.61) than those in the lowest quartile. Occupational activity was not associated with either pain outcome. **CONCLUSIONS:** Within the transport and leisure domains, physical activity was inversely associated with pain-related outcomes, whereas more household physical activity was positively associated with pain scores within the working sample.

3842 Board #159 May 30 8:00 AM - 9:30 AM
Characterizing Impacts In Girls' High School Lacrosse Using Video Analysis

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 (No relevant relationships reported)

Participation in high school girls' lacrosse is increasing, commensurate with concerns of risks for head impacts. Wearable sensors coupled with video analysis have characterized the incidence of head impacts in girls' lacrosse. However, due to high sensor measurement error, the true incidence of game-related impacts remains unclear. **Purpose:** Characterize the incidence of impacts in girls' high school lacrosse using video analysis.

Methods: Forty participants volunteered in 16 games during the 2019 lacrosse season. All games were filmed using a digital camera affixed to a tripod to capture impacts. Descriptive statistics were reported for all video-identified game-related impacts (VIGI), including impact rates (IR) and 95% confidence intervals (CI).

Results: There were 208 VIGI, for 297 player-games (IR=.70 impacts/player-game, CI: 0.61, 0.80). Overall, midfielders had the most impacts (n=88, 42.3%) followed by attackers (n=79, 38%) and defenders (n=41, 19.7%). The most common impact mechanisms were player (n=105, 50.5%), stick (n=88, 42.3%), and ground (n=13, 6.3%) contact. Most impacts occurred during offense-defense transitions (n=44, 21.2%) and settled game play (n=39, 18.8%), defending (n=33, 15.9%) and shooting (n= 34, 16.3%). Of all impacts, 29 (13.9%) were direct head impacts (IR=.10, CI: 0.06, 0.13). The most common head impact mechanisms were contact with stick (n=24, 82.8%), ground (n=4, 13.8%), and ball (n=1, 3.4%). The most common game play impact characteristics were shooting (n=7, 24.1%), settled game play (n=7, 24.1%), offense-defense transitions (n=4, 13.8%) and defending (n=4, 13.8%). A penalty was called by the referee for 17 (58.6%) head impacts.

Conclusion: The incidence of overall VIGI was considerably greater than previously reported studies using a sensor driven approach to identify and subsequently verify impacts using video. However, the rate of head impacts was lower, but similarly stick and ground contact remained the most common mechanisms despite their prohibition in the sport. Our findings reinforce the need for rule enforcement of prohibited game play behaviors. Prospective video analysis of head impacts in girls' lacrosse may assist with characterizing impacts and their incidence, especially as the sport shifts toward the intervention of headgear.

3843 Board #160 May 30 8:00 AM - 9:30 AM
How Many Snaps Are Too Many? Survival Analysis Of Concussions In The National Football League.

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Current methods used to estimate concussion risk in American football generally do not account for within-season variation in exposure between individual players. Thus, utilizing individual snap count data to quantify exposure may be beneficial for epidemiologic studies evaluating concussion risk in football.

PURPOSE: To determine the association between football exposure, quantified using snap count data, and concussion within the regular season in the National Football League (NFL), and how this varies by playing position.

METHODS: Weekly snap count and injury report data were obtained for every player who participated in the 2012 through 2017 NFL regular seasons, using the Football Outsiders database. Exposure was quantified as the cumulative total number of snaps that a player participated in for a given season, and used as the time-dependent variable in a Cox proportional hazard model. Concussion status (concussed vs. not-concussed) served as the event variable. If an individual received multiple concussions within a season, only the first within a season was included in the model. The effect of playing position on time to concussion were independently assessed as a categorical covariate. Hazard ratios (HR) were computed, with special teams positions (kicker, punter, and long snapper) as the reference category. **RESULTS:** A total 5,289,149 player-snaps were analyzed from 4231 distinct players, representing 12,004 player-seasons. Position was significantly associated with concussion hazard (p<0.001), with defensive backs [HR (95% confidence interval); median (interquartile range) number of snaps to first concussion = 2.8 (1.2, 6.3); 324 (377)], running backs [3.0 (1.3, 6.9); 200 (225)], tight ends [3.5 (1.5, 8.2); 290 (334)], and wide receivers [2.7 (1.2, 6.1); 227 (251)] having significantly greater hazard than special teams players. Across positions, the median number snaps before first concussion was 295 (355).

CONCLUSIONS: Survival analysis using snap count to quantify football exposure provides similar results to other epidemiological studies regarding which positions are at greatest risk of concussion. Future research should examine whether using this metric of exposure provides any additional insight into other potential risk factors for concussion or concussion-related outcomes.

3844 Board #161 May 30 8:00 AM - 9:30 AM
Assesment Of Physical Activity Levels And Quality Of Life In Different Clinical Populations

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Impaired quality of life (QoL) has been reported in different clinical populations such as patients suffering from cancer (CA), multiple sclerosis (MS) or cardiovascular diseases. A growing body of evidence indicates that physical activity (PA) affects subjective QoL while there is a dose-response relationship between the volume of exercise and its health benefits. **PURPOSE:** The present study assessed and compared PA levels and QoL of different clinical populations and age-matched healthy adults. **METHODS:** One hundred and thirteen volunteers, i.e., 29 with CA under chemotherapy (age: 56.0 ± 10.4 yrs, BMI: 27.2 ± 5.4 kg/m²), 20 with MS (age: 53.3 ± 14.4 yrs, BMI: 25.9 ± 3.5 kg/m²), 14 with hypertension (HYP) (age: 55.0 ± 11.0 yrs, BMI: 31.0 ± 6.0 kg/m²) and 50 healthy controls (CON) (age: 51.3 ± 6.5 yrs, BMI: 25.3 ± 3.1 kg/m²), participated in the study. Levels of PA and QoL were self-estimated with the International Physical Activity Questionnaire and the SF-36 Health Survey questionnaire or the EORTC-QLQ30, respectively. **RESULTS:** The weekly energy expenditure was higher (p<0.01) in the CON group (2658.4 ± 2763.6 METs) compared with all clinical populations examined (CA: 2176.5 ± 2033.6 METs; HYP: 1560.9 ± 760.2 METs; MS: 64.2 ± 67.6 METs). Moreover, the metabolic cost of vigorous intensity PA was low in CA (30.6 ± 114.9 METs), HYP (36.9 ± 92.1 METs) and MS (0 METs), in contrast with the controls (1020.0 ± 1472.5 METs) (p<0.001). Differences were also revealed in walking energy expenditure between CON and MS group (1653.4 ± 1726.4 vs 114.0 ± 163.1 METs; p<0.05). Physical functioning (PF) score was higher in CON (85.5 ± 15.1) compared with MS (31.3 ± 31.2; p<0.001) and CA (69.4 ± 22.0; p<0.05). Furthermore, QoL was assessed as poor in MS (29.5 ± 20.4) and moderate to high in CA, (59.8 ± 17.5) CON (71.10 ± 18.7), HYP (71.4 ± 14.3) (p<0.001).

CONCLUSIONS: Our findings revealed that clinical populations included in this study had a lower total weekly energy expenditure compared to healthy individuals, without engaging in high-intensity PA. In particular, MS patients exhibited the lowest rates of PA, PF and QoL, while CA and HYP group showed higher scores in of PA, PF and QoL, implying a potential relationship between PA and QoL. The specific nature of each disease may explain the differences observed among the clinical populations examined.

3845 Board #162 May 30 8:00 AM - 9:30 AM

Migraine In College Students: Relationships Of Exercise, Sleep And Stress

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(No relevant relationships reported)

Migraine headaches is a common disabling disorder which affect daily activities and academic performance in college students. There is disagreement in published research whether exercise triggers or prevents migraine. **PURPOSE:** The purpose of this study was to identify the relationships of migraine, regular exercise, sleep and stress in college students. **METHODS:** An online survey was sent to 9,675 students at a mid-sized university. A total of 675 students responded to the survey, with 557 respondents (5.7%) completing the entire survey [age: 21.01±4.86 y.o., females: 80.9% (n=451); males: 18.1% (n=101); other: 0.9% (n=5)]. Prevalence of migraine headache, self-reported triggers, exercise habits and perception of exercise in relation to migraine, and relationship between sleep (PSQI), stress (PSS) and migraine impact (HIT-6) were examined via SAS and MS Excel. **RESULTS:** Prevalence of self-reported migraine headache in the past six months was 63.5% (n=354) while prevalence of migraine headache confirmed by a physician was 26.7% (n=149). The top three identified trigger factors were life stress (96.6%), academic stress (96.0%) and lack of sleep (94.6%). About 40% of migraineurs reported that they did not have migraine 24 hrs after exercise. Participants who exercised regularly were less likely to get migraines (~21% less likely). Interestingly, those with migraines exercised more than those who did not have migraines (38.4% versus 23.7%). A higher sleep quality was inversely correlated to prevalence of migraine ($r=-0.335$). Impact of the headache on daily life was also correlated with perceived stress ($r=0.239$), and inversely correlated with sleep score ($r=-0.208$). **CONCLUSION:** Stress and lack of sleep are the most common self-reported migraine triggers in college students. Our study found that currently migraineurs do more regular exercise than those who did not report migraines. Quality of sleep is an important factor in migraine prevention. Regular exercise has the potential to prevent migraines but further studies need to be done to examine the exercise frequency, duration, intensity to determine long term outcomes.

3846 Board #163 May 30 8:00 AM - 9:30 AM

Sports Injury Model For Effective Prevention, Diagnostic And Rehabilitation

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In order to develop a model for a safe and effective return to sport after injuries, it is important to identify the risk factors associated with the occurrence of an injury. For the first time, we introduce the Tensiomyography (TMG) in the field of sport injuries (SI), a non-invasive and selective tool for the assessment of skeletal muscle contractile properties. As a recommendation from former experiences, a FC Barcelona documented a Muscle Injuries Clinical Guide 3.0 that explicitly emphasizes the use of TMG for the follow-up of muscle functional recovery and to help decide when the athlete can return to play. **PURPOSE:** To develop a thigh SI prediction model and explore factors of safe return to play. **METHODS:** The ongoing research project aims to monitor SI epidemiology in Slovenian premium soccer clubs. We monitored TMG of vastus lateralis and medialis, rectus femoris, biceps femoris and semitendinosus of both legs; body characteristics (body height, mass and fat), motor tasks (strength endurance in hamstrings; explosive lower-body strength, flexibility of lower body). **RESULTS:** Based on 11 thigh SI we were able to predict four (sensitivity 27%, specificity 99%). When predicting only 6 biceps femoris hamstring SI we could predict 4 (sensitivity 80%, specificity 100%). The predictive factors were derived only from TMG parameters. It appears that the worst-case scenario for the SI occurrence of biceps femoris is it short TMG-derived contraction time, high biceps femoris tone and low lateral symmetry. Interestingly, there were no significant predictors from body characteristics and motor tasks. **CONCLUSION:** Twenty-seven percent of all thigh SI and 80% of hamstring SI could be predicted solely from simple-to-use and non-invasive TMG screening. It seems that short contraction time (previously linked to high proportion of type II muscle fibers) and high muscle tone are risk factor for hamstring injuries, especially where imbalances between both lateral sides were present. Supported by Slovenian Research Agency (research core funding no. L5-8245).

3847 Board #164 May 30 8:00 AM - 9:30 AM

Injury Rates Among Elite Wushu Kung-fu Martial Artists And Access To Health Care

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Wushu Kung-Fu is a worldwide practiced martial art commonly known as “Kung-Fu”. The International Wushu Federation (IWUF) host a world competition every 2 years with more of 1,500 participants from countries all over the worlds. Musculoskeletal injuries are common among elite and amateur athletes of any sport. Access to health care can and might determine their proper treatment and return to sport. **PURPOSE:** To assess the injuries rate among Elite Wushu Kung-Fu Martial Artists and observe the relationship between access to health care and proper injury treatment. **METHODS:** One hundred and three athletes (n = 103; Males = 69, Females = 34) completed a survey prior before the 10th World Wushu Championships in China. Out of this sample, 94 were performance athlete (Taolu) and nine were professional fighters (Sanda). **RESULTS:** Out of the 103 responders, 49.5% reported Ankle injuries, 29.1% Lower Back, 18% reported an Anterior Cruciate Ligament (ACL) injury, 18.4% meniscus, 5.8% of combined ACL and meniscus, 16.5% Patella Tendinopathy, 14.6% leg adductors injuries, 7.8% Medial Collateral Ligament, and 6.8% Lateral Collateral Ligament injuries; from these injuries, only 48.5% reported a serious injury (time to heal > 8 weeks). About 50.5% of these injuries were reported to happened during technical training, 47.6% during jumping maneuvers, 17.5% during the warm-up and strength training, and 11.7% during competition. In terms of medical insurance, 46% reported to have private medical insurance, 29% government insurance, and 25% no insurance at all. In addition, 46.4% reported to have access to a Physical Therapist, and only 53.6% reported no access to Physical Therapist. A chi-squared showed no association between those who have medical insurance (governmental or private), or no medical insurance, and those who have access to proper physical therapy ($p > 0.05$). **CONCLUSIONS:** The great majority of injuries were reported to happen during technical training sessions and jumping maneuvers. The most common injuries sites were the Ankles, Lower back muscles, ACL, and Meniscus. Coaches and athletes might want to look into strategies on how to lower the risk of injuries at these specific sites for Martial Artists.

3848 Board #165 May 30 8:00 AM - 9:30 AM

Determinants Of Lower-extremity Injury Severity And Recovery Among High School Soccer Players In The U.S.

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Reported Relationships: A. Chandran: Other (please describe); This study would not be possible without the assistance of the many high school athletic trainers who participated in the NATION-SP. This project was funded by the National Athletic Trainers' Association Research and Education Foundation, and the Central Indiana Corporate Partnership Foundation in cooperation with BioCrossroads. The content of this report is solely the responsibility of the authors and does not reflect the views of the sponsors. All actions pertaining to the study analysis were performed at The George Washington University. The authors declare that they have no competing interests.

PURPOSE: Lower-extremity injuries are common among soccer players, yet few studies have attempted to identify determinants of lower-extremity injury severity in this group. We examined the impact of injury site, injury mechanism, sex, injury history, setting and playing surface on lower-extremity injury severity. **METHODS:** The NATION-SP captured soccer-related injury data collected by athletic trainers (ATs) during the 2011/12-2013/14 academic years. Lower-extremity injury sites of interest were hip/groin, thigh, knee, lower-leg/Achilles, and the ankle/foot. The nature/type of injuries, surgery for treatment (yes/no), season-ending outcomes (yes/no), and the recovery process (using observed time loss) were the outcomes of interest. Exposures of interest were injury site, injury mechanism (contact vs. non-contact), sex, injury history (new vs. recurrent), event-type (game vs. practice), and playing surface (natural vs. turf). Summary statistics (frequencies, %) were used to examine the nature/type of injuries. Multivariable logistic regressions were used to examine odds of season-ending outcomes, and surgery, as a function of the exposures; random effects Poisson regressions were used to examine exposure effects on the recovery process. Odds Ratios (ORs) and Time Loss Ratios (TLRs) with 95% confidence intervals (CI) excluding 1.00 were deemed significant. **RESULTS:** The majority of all lower-extremity injuries (n=2871) in this sample were sprains, strains/tears, or contusions (72%). Odds of a season-ending injury were higher in games than practices (OR_{adj}=2.64, 95%CI=1.39,5.01). Also, odds

of a lower-extremity injury resulting in time loss were significantly higher in female players compared to male players (OR_{adj}=1.34, 95%CI=1.05,1.71), and in games compared to practices (OR_{adj}=2.19, 95%CI=1.72,2.80). Sex, event-type, and playing surface emerged as significant determinants of any time loss following lower-extremity injuries, as well as predictors of recovery duration.

CONCLUSIONS: Sex, injury setting, playing surface differentially determine injury severity and recovery. Future studies using multi-method, multivariable approaches may be used to identify determinants of lower-extremity injury severity in this context.

3849 Board #166 May 30 8:00 AM - 9:30 AM
Incidence, Mechanism, And Severity Of Game-related High School And College Football Hand Injuries
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 (Sponsor: Michael C. Meyers, PhD, FACSM)
 (No relevant relationships reported)

Injuries among high school and college football players are recorded on a game-by-game basis; however, the prevalence of hand injuries is often overlooked in lieu of more prominent football trauma. Presently, few football studies have been published comparing specific high school and college hand injuries. **PURPOSE:** To quantify the incidence, mechanism, and severity of specific game-related high school and college football hand injuries. **METHODS:** Hand injury cases were divided into two groups by level of play (high school, college), involving 783 FBS university and 1,921 high school games over 9 competitive seasons. Outcomes of interest included total and specific hand extremity, injury mechanism, and injury severity. Data were subject to multivariate analyses of variance (MANOVA) and Wilks' λ criteria using general linear model procedures. Injury incidence rate (IIR) was determined by the (number of injuries/number of team games) x 10. **RESULTS:** Of the 2,704 total games documented, a total of 270 hand injuries were reported with 167 (62.0%) occurring in college competition, and 103 (38.1%) in high school games. MANOVAs (Wilks' λ) indicated no significant main effect by total hand extremity ($F_{2,267} = 0.230$; $P = 0.876$), injury mechanism ($F_{2,263} = 1.203$; $P = 0.298$), and severity ($F_{2,267} = 1.572$; $P = 0.210$). Tests of between-subjects effects indicated no significant differences in IIRs of Boutonniere deformity ($F_{2,267} = 0.123$; $P = 0.726$), gamekeeper's thumb ($F_{2,267} = 0.124$; $P = 0.725$), or mallet finger ($F_{2,267} = 0.121$; $P = 0.505$). There was a trend, however, for greater IIRs of Boutonniere deformity [0.1 (95% CI, 0.0-0.2) vs 0.5 (95% CI, 0.4-0.7)], gamekeeper's thumb [0.3 (95% CI, 0.2-0.4) vs 1.1 (95% CI, 0.9-1.4)], and mallet finger [0.0 (95% CI, 0.0-0.1) vs 0.4 (95% CI, 0.3-0.6)] during high school play when compared to collegiate competition, respectively. Blocking (10.3 vs 14.8%) and tackling (8.8 vs 18.9%) were the primary mechanisms of injury in both high school and college, respectively. **CONCLUSION:** A substantial number of hand injuries were documented between high school and college games, which may ultimately lead to long-term articular compromise. Therefore, further studies are warranted to reduce predisposition of hand trauma at all levels of football competition.

3850 Board #167 May 30 8:00 AM - 9:30 AM
Use Of Two Screening Tools To Determine Injury Risk In Collegiate Acrobatics And Tumbling Athletes
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 (No relevant relationships reported)

Participation in athletic teams, especially those that involve difficult stunts and acrobatic maneuvers increase the risk for injury. With this emerging sport and the skills needed to participate, it is important to identify those athletes at risk. Yet, it is unknown whether a functional screening or proprioceptive tool can be used to predict injury in this population. **PURPOSE:** To determine if compensatory movement patterns predispose acrobatics and tumbling athletes to injury, and to determine if a functional movement screening (FMS) and Lower Quarter Y Balance Test (LQ-YBT) could predict potential injury risk in the sport population. **METHODS:** 22 participants (age 19.25yrs \pm 0.91, height 161.97 \pm 7.03cm, weight 62.53 \pm 8.71kg) from one acrobatics and tumbling team were used in the study. All participants that volunteered for the study were current student-athletes at a NCAA DII institution on a NCATA recognized Acrobatics and Tumbling team. The participants were asked to complete the seven movement patterns and three clearing tests of the FMS along with the LQ-YBT test in three directions (anterior, posterolateral and posteromedial) for both limbs. A total of three practice trials were used. Screening data was gathered over a two-week period at the beginning of the season. A self-report demographic and injury questionnaire was also used. **RESULTS:** FMS score was 15.9 \pm 1.87, while the LQ-YBT was 98.36 \pm 11.63 for the right and 99.24 \pm 12.01 for the left. Cox Snell R² was used to determine the percentage of the variables used to fit the model. The best fit was for FMS Cut (≤ 14 , ≥ 15) and total accounted injury that produced a Cox Snell R² (0.342) with a significant OR=28.335 (95% CI 4.29 to 561.997, p=0.028) for FMS Cut (≤ 14 , ≥ 15). Years of competition and total accounted injury with a Cox Snell R² (0.276) and a significant OR= 1.451 (95% CI .980 to 2.149, p=0.05) for years of competition was a moderate fit. FMS Final, LQ-YBT (R) and (L) produced a Cox Snell R² (0.259) with

a non-significant FMS Final OR= 1.983 (95% CI 1.045 to 3.763, p=.36). All other results were not significant. **CONCLUSIONS:** Compensatory fundamental movement patterns, increased skill and years of competition can increase the risk of injury. A score of 14 or less on the FMS paired with a higher number of previous injuries resulted in a 28-fold increase in risk of injury

3851 Board #168 May 30 8:00 AM - 9:30 AM
Lower Suicide Risk In Former US Olympians
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 (No relevant relationships reported)

PURPOSE: To determine the suicide risk among Former US Olympians, according to their medal status and their sport, compared to the general population. **METHODS:** All female (n = 2,301) and male (n = 5,823) US athletes who participated in at least one summer or winter Olympic Games between 1912 and 2012 were followed until 2016 (the latest rates for specific mortality). Olympians' life statuses and causes of deaths were certified by the National Death Index and coded to the version of the International Classification of Diseases that was in effect at the time of their death. Intentional, self-inflicted deaths among Olympians were analyzed through the years lost/saved method accounting for their medal status and their sport. The model was adjusted by sex, age, and period, in relation to the general population. **RESULTS:** Overall 2,309 deaths occurred; the cause underlying 29 deaths was suicide (1 woman, 28 men). The cumulative probability of deaths for this cause was significantly lower among former US Olympians compared to the general population (p = 2.6e-08) for all ages between 20 and 90 years. The risk of death by suicide among former Olympians did not differ based on their medal status at the Olympics. Athletics, rowing, fencing, shooting, and swimming could be individually analyzed as each of these sports had more than 100 overall deaths. Olympians engaged in athletics, rowing, and swimming presented diminished suicide risk. Fencing displayed equivalent rates to the general population, and shooting had higher trends. However, limited power existed for significant statistical testing. **CONCLUSION:** Former US Olympians presented lower suicide risk compared to the general population, whether they were an Olympic medalist or not. The only sport presenting higher trends is shooting.

3852 Board #169 May 30 8:00 AM - 9:30 AM
Describing Red-s Outcomes And Potential Risk Factors In A National Cohort Of Ncaa Di Female Cross Country Runners
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PURPOSE: The purpose of this study was to assess the prevalence of self-reported Relative Energy Deficiency in Sport (RED-S) outcomes in National Collegiate Athletic Association (NCAA) Division One (DI) female cross country runners, and to describe environmental risk factors for RED-S. **METHODS:** This sample is composed of a nationally representative random sample of NCAA Division One (DI) collegiate female cross-country runners from the ongoing Female Athlete Study of Health Trajectories (FASHT) cohort (N=152), with 133 complete respondents and 29 partial respondents. Randomly selected athletes were emailed a web-based survey, including demographic information, individual and environmental risk factors, and the 10 physical health outcomes of the RED-S model. **RESULTS:** Preliminary results show that this sample is overwhelmingly White (91%, n=139), non-Hispanic (91%, n=138), with a "comfortable" financial background (61%, n=90), and a mean age of 20.6 (SD= 2.6) years. Of note, 62% (n=82) of athletes reported having at least one sport-related bone injury over their athletic career, 49% (n=65) reported any history of irregular menses and 15% (n=20) reported currently experiencing irregular menses. The burden of clinical mental health diagnosis in the population included Anxiety (25%, n=33), Depression (15%, n=20), and any Eating Disorder (14%, n=18). **CONCLUSIONS:** These results suggest that this population of collegiate female cross-country runners experience a high burden of physical and psychological health morbidities and have a significant need for focused prevention and intervention for RED-S. Importantly, forthcoming research will focus on associations between risk and outcomes to inform public health programming.

3853 Board #170 May 30 8:00 AM - 9:30 AM

Sport Participation And Sport-related Concussion Trends In High School Athletes

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(No relevant relationships reported)

Sport-related concussions (SRC) represent approximately 9% of high school athletic injuries. This high incidence has contributed to participation reduction, concussion legislation, and rule modifications. With these changes becoming more frequent, it is unknown if SRC trends are decreasing.

PURPOSE: To examine trends in contact sport participation and SRC clinical incidence in high school athletes during the 2015-16 to 2018-19 athletic seasons.

METHODS: A total of 724,784 athletes (male = 436,509; female = 288,275) participated on 15 sponsored teams in the state of Michigan during the 2015-16 to 2018-19 athletic seasons. Sport participation and diagnosed SRCs were reported by athletic trainers, coaches, or administrative officials using the Michigan High School Athletic Association Head Injury Reporting System. Clinical incidence was calculated for each sport by dividing the number of SRCs by the number of participants and is expressed per 100 athletes (95% CI). Linear regression was used to examine annual trends in participation and SRC clinical incidence for each sport. *a priori* < .05.

RESULTS: Football (144,708), boys' basketball (85,288), and girls' volleyball (76,950) had the highest sport participation. A total of 15,300 SRCs were reported yielding an overall clinical incidence of 2.11 (95% CI, 2.08-2.14) SRCs. Football (4.52 [95% CI, 4.41-4.62]), boys' ice hockey (3.51 [95% CI, 3.20-3.82]), and 8-person football (3.35 [95% CI, 2.85-3.85]) had the highest SRC clinical incidence. Trends in overall sport participation significantly decreased over time (-1983.0 athletes; *p*=.02). Only football yielded significant participation reduction (-1487.8 athletes; *p*=.01), while trends in 8-person football (182.8 athletes; *p*=.03) and boys' lacrosse (151.2 athletes; *p*=.03) increased. No significant trends were identified for overall SRC incidence (*p*=.14). Only girls' basketball had a significant reduction in SRC incidence (*p*=.04).

CONCLUSIONS: Contact sport participation, especially in football, may be decreasing due to concerns over athlete safety. With SRC incidence not declining, stakeholders should re-evaluate current initiatives to identify a more successful approach at reducing these injuries. Improving contact sport safety may then assist in increasing high school sport participation.

3854 Board #171 May 30 8:00 AM - 9:30 AM

Examining Acute Effects Of Concussion On The Child Scat5

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The Child Sport Concussion Assessment Tool 5th Edition (Child SCAT5) is recommended for the clinical assessment of concussion in children. To date, no studies have investigated how children perform on the Child SCAT5 acutely following concussion.

Purpose: We examined Child SCAT5 performance and symptom reporting among concussed middle school children assessed on the day of injury.

Methods: Certified Athletic Trainers diagnosed middle school student athletes (ages 11-13) with a sports-related concussion using the Child SCAT5 between 2017-2019. All assessments were administered on the day of injury ("day-of-concussion"). Day-of-concussion performance was compared to normative reference values derived from over 1,300 uninjured middle school athletes who underwent baseline, preseason Child SCAT5 assessments.

Results: There were 46 middle school student-athletes diagnosed with concussions [girls=17, boys=29, mean age=12.4±0.7]. The most commonly endorsed acute symptoms were: "I have a headache" (95.6%), followed by "I feel dizzy" (73.9%), and "I have problems remembering what people tell me" (63.0%). Middle school student-athletes day-of-concussion scores on the Child SCAT5 were: Total Symptoms (n=44, 10.4±5.9), Symptom Severity (n=44, 18.0±13.3), Immediate Memory (n=45, 13.0±2.6), Digits Backwards (n=45, 2.8±1.0), Concentration (n=45, 3.7±1.0), Total Balance (n=39, 8.5±5.9), Delayed Recall (n=44, 3.1±1.6), and Standardized Assessment of Concussion-Child Version (SAC-C n=44, 19.9±4.3). The mean number of total balance errors and the mean symptom severity scores were elevated relative to normative reference values.

Conclusion: Our results describe day-of-concussion Child SCAT5 scores in middle school children. The total symptom severity scores and total errors on the balance appeared to be most reflective of the acute effects of concussion. Further research is needed to establish the sensitivity and specificity of the Child SCAT5 to the acute effects of concussion in children.

3855 Board #172 May 30 8:00 AM - 9:30 AM

Physical Activity And Body Composition Of Women With Anterior Cruciate Ligament Reconstruction

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(No relevant relationships reported)

Women are 4 to 6 times more likely to sustain an anterior cruciate ligament (ACL) injury than men. Women with ACL reconstruction (ACLR) are also 2.36 times less likely to be active than healthy individuals. In addition to reductions in physical activity (PA), it has been reported that BMI remains elevated up to 2 years post-ACLR, but the effects of ACLR on body composition profiles following surgery is unclear.

PURPOSE: To compare PA engagement and body composition between women with ACLR and healthy controls. **METHODS:** Ten women with ACLR (less than 5yrs post-ACLR, age=21.4±3.8yrs, BMI=26.1±3.8kg/m²) and 10 healthy women (age=21.9±3.1yrs, BMI=21.8±2.5kg/m²) completed the Tegner Activity Scale to assess current PA level. Body fat percentage (%BF) was estimated using air displacement plethysmography. Objective PA was assessed using hip-worn accelerometers for 10 hours/day for 7 days and Freedson Adult VM3 cut points were used for PA data processing. Groups were compared using Mann-Whitney U tests due to limited sample size. Time (minutes/week) spent in moderate-to-vigorous PA (MVPA) and step count (steps/day) were compared between groups using a one-way ANCOVA with total wear time as a covariate. **RESULTS:** Women with ACLR had significantly higher %BF than controls (ACLR=32.7±6.7%, healthy=22.6±4.9%; *p*<0.01) and higher fat mass (ACLR=25.4±9.0kg, healthy=13.7±4.1kg; *p*<0.01). Healthy women participated in significantly more steps per day (ACLR=6650±3227 steps/day, healthy=9361±2626 steps/day; *p*=0.02) than women with ACLR, but no differences in MVPA time (ACLR=367.2±226.2 mins/week, healthy=448.9±164.0 mins/week; *p*=0.34) were observed. **CONCLUSIONS:** Women with ACLR engage in similar levels of MVPA compared to controls, but they may exhibit greater %BF and fat mass than women who have not experienced ACLR. Compared to controls, women with ACLR also have lower step counts, which is consistent with previous studies. Lack of PA, high %BF, and overweight status increase the risk of premature mortality and morbidity. Therefore, it is crucial to further assess these characteristics and determine potential interventions that would promote PA and maintenance of healthy body composition in the months following ACLR.

G-36 Free Communication/Poster - Diet and Obesity: Animal/Cell Models

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
Room: CC-Exhibit Hall

3856 Board #173 May 30 9:00 AM - 10:30 AM

HIIT Improves Insulin Resistance In T2DM Mice By Regulating Lipid Metabolism In Skeletal Muscle

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(No relevant relationships reported)

Abnormal skeletal muscle lipid metabolism is associated with insulin resistance in people with type 2 diabetes. Recent studies have indicated that high-intensity interval training (HIIT) lowers blood glucose and improves insulin resistance in individuals with type 2 diabetes. However, the physical mechanism is largely unknown.

PURPOSE: This study aimed to investigate whether HIIT improves insulin resistance in T2DM mice by regulating lipid metabolism in skeletal muscle.

METHODS: Diabetic mice were randomly assigned to the diabetes group (T2DM, n=11) and the HIIT group (n=11), and age-matched wild type mice were assigned as the control group (CON, n=11). HIIT was performed on a motored mice treadmill at 15° inclination 5 days/week for 8 weeks. The mice were trained with a starting speed of 10m/min, where after HIIT consisted of 10 bouts of 4 min high-intensity treadmill running, interspersed by 2 min complete rest. The pace during HIIT was increased gradually from 16 to 26 m/min over eight weeks. The fasting blood glucose, glucose tolerance was measured one week before the end of the experiment, and the gastrocnemius muscles of mice were collected 36h after the last exercise. The fat content of skeletal muscle was detected by Oil Red O staining. Protein expression of ACC, HMGCR, Cpt-1α, and CD36 was measured with Western blot.

RESULTS: The fasting blood glucose was decreased in the HIIT mice when compared to that in the T2DM mice (17.6±0.72 vs. 19.8±0.74 mmol/L, *p*<0.01). Glucose tolerance and the area under the curve (3325±126.4 vs. 3737±38. mmol/L·min, *p*<0.01) were improved after HIIT treatment when compared to that in the T2DM mice. Skeletal muscle exhibited a substantial amount of lipid deposition in the T2DM

group, which was markedly alleviated in the HIIT group ($p < 0.05$). In the skeletal muscle, HIIT treated mice showed significantly decreased protein expression related to lipogenesis, including reductions in ACC (0.39-fold, $p < 0.01$) and HMGCR (0.52-fold, $p < 0.01$). Expectedly, the protein expression level of Cpt-1 α (1.6-fold, $p < 0.01$) and CD36 (1.78-fold, $p < 0.01$) was significantly enhanced by HIIT.

CONCLUSION: HIIT improves insulin resistance was, at least partly, through deduces lipogenesis and increases lipolysis in skeletal muscle in the T2DM mice.

3857 Board #174 May 30 9:00 AM - 10:30 AM
High-fat Diet Induces Nr4a3-dependent Decrease In Respiratory Capacity Of Mouse Soleus Muscle

Nathan D. Marchant, Erik D. Marchant, Weston S. Elison, Jacob A. Herring, Haokun Yang, Jeffrey S. Tessem, Chad R. Hancock. *Brigham Young University, Provo, UT.*
(No relevant relationships reported)

The Nuclear Hormone Receptor 4A family of genes have been observed to play a role in proper metabolic function in various tissues, including skeletal muscle.

PURPOSE: To analyze the effect of the Nr4a3 gene on respiratory capacity of mitochondria in skeletal muscle of mice on a normal or high fat diet.
METHODS: Nr4a3^{-/-} and WT mice were fed a normal chow (NC) or high fat diet (HF) for at least 20 weeks. After euthanasia, soleus muscle was harvested and wet weight was measured. Muscle fibers were teased apart and permeabilized with saponin in preparation for respirometry. Mitochondrial respiration was evaluated using an Oroboros Oxygraph Respirometer. Respiratory capacity comparisons were made with a two-way ANOVA and Tukey multiple comparison test.

RESULTS: Oxygen consumption is reported as pmol/(s*mg wet tissue) and statistics are represented as mean \pm SEM. In the WT male mice there was a decrease in coupled complex I supported respiration in HF vs. NC diet (25.9 \pm 7.3 vs. 64.5 \pm 5.0, $p = 0.004$). In the HF WT group there was also a decrease in coupled complex I and II supported respiration (57.2 \pm 13.4 vs. 102.5 \pm 7.0, $p = 0.0005$) and uncoupled respiration (61.4 \pm 15.0 vs. 107.8 \pm 7.1, $p = 0.0004$) compared to NC WT. In female mice there was also a decrease between HF WT and NC WT in complex I (28.2 \pm 3.7 vs. 57.4 \pm 5.7, $p = 0.0005$) and complex I and II (78.2 \pm 6.1 vs. 108.8 \pm 6.7, $p = 0.0003$) supported respiration as well as in uncoupled respiration (87.1 \pm 7.1 vs. 119.4 \pm 8.9, $p = 0.0001$). However, there was no significant difference between the WT NC mice and either of the Nr4a3^{-/-} groups. Coupled complex I, complex I and II and uncoupled respiration states in both Nr4a3^{-/-} groups were not significantly different from WT.

CONCLUSIONS: The Nr4a3 gene plays a role in mitochondrial function in mouse skeletal muscle. Feeding mice a high fat diet impairs proper mitochondrial function in muscle when compared to a normal chow diet. The decrease in respiration from the HF diet is dependent upon the function of the Nr4a3 gene, as no decrease was observed in Nr4a3^{-/-} mice. A limitation of this study is that this effect could be due to the lack of Nr4a3 in the skeletal muscle, or a secondary effect of lacking the gene in other parts of the body.

3858 Board #175 May 30 9:00 AM - 10:30 AM
Transcutaneous Carbon Dioxide Attenuates Impaired Muscle Atrophy And Glucose Metabolism In The Spontaneously Diabetic Rat

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(No relevant relationships reported)

PURPOSE: Diabetes has been known to result in attenuated growth and atrophy in skeletal muscle. Recently, it has been reported the Carbon dioxide (CO₂) exposure leads to an increase of muscle mass in normal rats. Therefore, the aim of the present study was to investigate the effects of transcutaneous CO₂ exposure with the hydrogel (eCO₂GEL) on diabetic-associated muscle atrophy.

METHODS: Male Goto-Kakizaki (GK) rats were divided into control (GK) and CO₂ exposure (CO₂) groups and male Wistar rats used as a non-diabetic control. The hair on the lower limbs was shaved and the hydrogel (eCO₂GEL), which can increase the absorption of CO₂ from skin, was applied. The CO₂ adaptor was attached to the limbs and sealed, and CO₂ gas was administered into the adaptor for 30 min. The CO₂ exposure was performed everyday for 8 weeks.

RESULTS: The muscle weights of soleus and tibialis anterior in the GK group decreased compared with those of the control group. CO₂ exposure attenuated decreased muscle weights in diabetes-associated muscles ($P < 0.05$). In addition, the level of HbA_{1c} and fasting blood glucose were decreased by CO₂ exposure compared with non-CO₂ exposure condition ($P < 0.05$). Furthermore, the level of LDL cholesterol in the CO₂ exposure group was significantly decreased compared with the GK group ($P < 0.05$).

CONCLUSIONS: These results indicate that the transcutaneous CO₂ exposure may have a therapeutic potential for diabetic-associated muscle atrophy. This amelioration may associate with improved glucose metabolism in skeletal muscle.

3859 Board #176 May 30 9:00 AM - 10:30 AM
Enterococcus Faecium Strain R30 Attenuates Capillary Regression In Type 2 Diabetic Muscle

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It is widely accepted that diabetes affects the peripheral vascular bed. We found that *Enterococcus faecium* strain R30 (R30) supplementation caused increased velocity of red blood cells in capillaries of skeletal muscle. **PURPOSE:** We determined the effects of R30 supplementation on the three-dimensional capillary structure in the soleus muscle of Goto-Kakizaki (GK) diabetic rats. R30 supplementation was chosen, because it may be beneficial in management of skeletal muscle and to be safe for individuals with cardiovascular complications such as those associated with diabetes. **METHODS:** Thirty-six male (Wistar or GK) rats were assigned randomly either to a control (Con), control with R30 supplementation (Con+R30), diabetes (GK) or diabetes with R30 supplementation (GK+R30) group for 8 weeks. The capillaries of soleus muscle were stained with alkaline phosphatase. In addition, the three-dimensional capillary network of soleus muscle was visualized using a confocal laser scanning technique, and the capillary volume and diameter were measured. **RESULTS:** The blood glucose levels were higher in the GK and GK+R30 groups than in the Con and Con+R30 groups. There were no significant differences in the capillary-to-fiber ratio between the Con and GK+R30 although the ratio was lower in the GK group than in the Con group. The capillary volume and diameter in the muscle of GK group were lower than those in Con group. Meanwhile, R30 supplementation attenuated the decrease of capillary volume and diameter in diabetic muscle. **CONCLUSION:** These data suggest that R30 supplementation may be an effective treatment to counter the detrimental effects of type 2 diabetic complications in skeletal muscle.

3860 Board #177 May 30 9:00 AM - 10:30 AM
Aerobic Exercise Counteracts Mitochondrial Dysfunction In The Insulin Resistant Brain

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Insulin resistance (IR) increases the risk for Alzheimer's disease and other dementias; however, the underpinning mechanisms for this increased risk remain to be fully defined. Impaired mitochondrial function is one component contributing to cognitive impairment. **PURPOSE:** As insulin resistance impairs mitochondrial oxidative metabolism and increases reactive oxygen species (ROS) in skeletal muscle, we considered whether similar events occur in the brain, which like muscle is rich in insulin receptors and mitochondria. Further, we sought to determine whether aerobic exercise (AE) could prevent the hypothesized deficits in mitochondrial function accompanying diet-induced IR. **METHODS:** 12-week-old, male, C57BL6 mice were fed a standard (Chow) or high fat diet (HFD) (60% kcal from fat) for four-weeks and provided access to running wheels (EX) or sedentary (SED) conditions (n = 9-10 per group). Following treatment, mitochondria were freshly isolated from the cerebrum to assess mitochondrial respiration, ROS production, and ATP production. Insulin resistance was determined *ex-vivo* in the hippocampus by the ability of insulin to stimulate AKT-phosphorylation, mtDNA copy number, mRNA expression, and proteomic measurements were performed on isolated hippocampal tissue. **RESULTS:** HFD induced hippocampal insulin resistance ($p < 0.001$), which was corrected by AE. HFD decreased ATP production 12% ($p = 0.01$) and increased ROS emission 79% ($p < 0.01$) in isolated cerebral mitochondria, which were rescued with AE. Impairments in mitochondrial function with HFD were paralleled by reductions in mtDNA copy number (1.00 \pm 0.06 vs 0.85 \pm 0.06; $p = 0.02$) and mRNA expression of mitochondrial genes, such as PGC1 α 1 (1.00 \pm 0.05 vs 0.78 \pm 0.07; $p = 0.03$) and TFAM (1.00 \pm 0.08 vs 0.62 \pm 0.11; $p = 0.03$), which were corrected by AE. Proteomic analysis of the hippocampus showed that HFD led to oxidative post-translational modifications (PTMs) to 17 mitochondrial proteins (corrected p -value ≤ 0.05 and absolute log₂ fold change ≥ 0.5); however, this increase in oxidative PTMs to mitochondrial proteins with HFD was almost completely reversed by AE. **CONCLUSIONS:** HFD induces IR in the cerebrum and hippocampus, which associates with mitochondrial dysfunction. Brain IR and mitochondrial dysfunction accompanying HFD are prevented with AE.

3861 Board #178 May 30 9:00 AM - 10:30 AM

A High-fat Diet Causes Nr4a3-dependent Changes In Mitochondrial Respiration In Mouse LiverErik D. Marchant, Nathan D. Marchant, Weston S. Elison, Jacob A. Herring, Haokun Yang, Jeffrey S. Tessem, Chad R. Hancock. *Brigham Young University, Provo, UT.**(No relevant relationships reported)*

PURPOSE: To determine the role of the Nr4a3 gene in mitochondrial respiration in mouse liver, as well as how its role changes in obesity-induced diabetes (OID). **METHODS:** This study was designed using Nr4a3^{+/+} (WT) and Nr4a3^{-/-} (KO) mice that were fed a normal chow (NC) or a high-fat (HF) diet from the age of 4 weeks to ~24 weeks. Mitochondrial respiration was measured in liver tissue using high-resolution respirometry. Mitochondrial health was assessed by stimulating the different complexes of the electron-transport chain: glutamate, malate and ADP (complex I), cytochrome c (membrane integrity), succinate (complex II), FCCP (uncoupled respiration), and antimycin A (background respiration). Data were analyzed using a two-way ANOVA followed by a Tukey Multiple Comparisons Test. **RESULTS:** Oxygen consumption is reported as pmol/(s*mg wet tissue) and statistics are represented as mean ± SEM. In female WT mice, uncoupled maximal respiration was increased by a HF diet compared to NC (141.0 ± 9.8 vs. 95.3 ± 12.3, p<0.001). This increase was absent in KO mice, which indicates that Nr4a3 may be partially responsible for the increase in respiration in HF WT female mice. In males this trend was reversed, with a decrease in coupled complex I and II respiration in HF WT vs. NC WT (69.6 ± 5.1 vs. 98.7 ± 6.3, p<0.05), but an increase in HF KO vs. NC WT (control) (122.3 ± 8.3 vs. 98.7 ± 6.3, p<0.01). In an uncoupled state, HF KO was greater than NC WT (control) (129.2 ± 8.4 vs. 103.7 ± 7.8, p<0.001). No difference was observed between NC WT and HF WT. This indicates that the Nr4a3 gene plays a role in suppressing respiration when male mice are fed a HF diet. **CONCLUSIONS:** This study shows that OID caused an Nr4a3-dependent increase in respiration in females, and an Nr4a3-dependent reduction in respiration in males. As part of this study, muscle, kidney and adipose respiration are also being investigated, as well as glucose-stimulated insulin secretion of the pancreatic beta-cells. It is unclear if the observed changes here are due to a direct effect of knocking out Nr4a3 in the liver, or to a secondary effect because of the full-body KO. Therefore, further investigation is warranted.

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Effects Of Hypoxic Training On Gdnf In The Cortex Of Obese RatsYulin Shen, Yingli Lu, Xuebing Wang, Han Wang, Lianshi Feng. *China Institute of Sport Science, Beijing, China.*

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(No relevant relationships reported)

Glial cell-derived neurotrophic factor (GDNF) is an important indicator that represent the function of nervous system. Exercise and hypoxic environment both can reduce weight and improve nervous system function in obese rats. But the mechanism by which hypoxic training affects the nervous system is unclear.

PURPOSE: To determine the potential mechanisms of hypoxic training on GDNF in the cortex of obese rats. **METHODS:** Forty SD obese rats were assigned into one of the following groups (n=10 each): normal oxygen control group (NC), normal oxygen training group (NT), hypoxic control group (HC) and hypoxic training group (HT). Rats were kept continuous exercise 1 hour per day, 6 days per week for 4 weeks on a rat treadmill at a speed of 25 m/min in normoxic conditions or 20 m/min in hypoxic conditions (13.6% O₂). After 4 weeks, the expressions of GDNF in the cortex were detected by quantitative fluorescent PCR and Western blotting. The level of inflammatory cytokine interleukin 1β (IL-1β) and interleukin 6 (IL-6) in the cortex were measured by ELISA. The phosphorylation of ERK1/2 and JNK of cortex were detected by Western blotting. **RESULTS:** 1) The results of qPCR showed that the expression of GDNF in the cortex of HT were higher than NT and HC (2.75±0.69 vs. 1.66±0.88 and 1.06±0.45, p<0.05). 2) The results of Western blotting showed that the expression of GDNF in the cortex of HT were higher than NT and HC (489±23.58 vs. 337±46.22 and 387±36.98, p<0.05). 3) The results of phosphorylation of ERK1/2 and JNK showed that the ratio of ERK1/2 and JNK to β-actin integral optical density in the cortex showed no significant difference in all groups (p>0.05), while compared with NC, the ratio of p-ERK1/2 to ERK1/2 and p-JNK to JNK integral optical density in HC, NT and HT were significantly increased (P < 0.05, P < 0.05, P < 0.01). 4) The results of ELISA showed that IL-1β and IL-6 serum levels in HC, NT and HT were decreased compared with NC (19.28±1.41, 19.99±1.26 and 17.8±1.5 vs. 27.15±2.27, p<0.01; 53.82±2.54, 57.53±1.96 and 52.22±1.4 vs. 66.87±2.73, p<0.01). **CONCLUSION:** Hypoxic training can increase the expression of GDNF in the cortex of obese rats and improve the function of the central nervous system. Its mechanisms may relate to the activation of ERK1/2 and JNK signaling pathways and inhibit inflammatory cytokine IL-1β and IL-6 level in the cortex.

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The Role Of Cd36 In Relieving Lipotoxicity Of Skeletal Muscle Cells In High Free Fatty Acid Environment.Yajuan Su, Yaoting Han, Xiaobo Li, Jingyu Sun. *Tongji University, Shanghai, China, China.*

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(No relevant relationships reported)

PURPOSE: Lipotoxicity is closely related to the etiology and complications of type 2 diabetes mellitus (T2DM). Lipotoxicity in muscle cells induces insulin resistance, which is a key factor in the pathogenesis of T2DM. This study investigated the protective effect of Fatty Acid Translocase (FAT/CD36) against palmitic acid (PA)-induced lipoapoptosis.

METHODS: Cells at ~40-60% confluence were transfected with siCtrl or siCD36 for overnight using Lipofectamine RNAiMAX. Cells were treated with PA at 200μM for 16 h. The PA-induced viability in C2C12 cells was measured by MTT assay; the PA-induced apoptosis in C2C12 cells was monitored by flow cytometry. The differences in means were analyzed by t test.

RESULTS: PA treatment increased apoptosis (7.50% ± 0.21% vs. 10.40% ± 1.25%, p < 0.05) and decreased viability (100% ± 2.40% vs. 97.32% ± 3.60%, p < 0.05) in C2C12 cells in contrast to cells that were treated with PA-free media. After 16 h of PA treatment without CD36 protection, C2C12 cells had a significant increase in apoptosis when treated with siCD36 transfection, in contrast to cells that were negative control siRNA transfected (10.40% ± 1.25% vs. 16.04% ± 1.58%, p < 0.05), indicating that the existence of CD36 may protect high PA-induced lipoapoptosis by increasing cell uptake of FFA. Further statistical analysis confirmed a significant increase in the percentage of apoptotic cells both in early stage and late stage when subjected to CD36 deficiency (7.93% ± 0.57% vs. 10.70% ± 1.55%, p < 0.05; 2.47% ± 0.68% vs. 5.34% ± 0.06%, p < 0.05, respectively).

CONCLUSIONS: This study demonstrated a novel function of CD36 in preventing lipotoxicity in skeletal muscle cells when subject to high FFA environment, implicating a promising target for obesity and diabetic therapy.

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Beta-blocker Effects On The Adipose Tissue Of Trained RatsPatricia S. Rogeri, Luis Fernando B. P. Costa Rosa, Antonio H. Lancha Junior. *Universidade de Sao Paulo, Sao Paulo, Brazil.*

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(No relevant relationships reported)

Hypertension afflicts about 40% of the world population. Among the most important causes for high blood pressure are obesity and lack of physical activity. Evidences show that weight control and physical activity are effective in reducing blood pressure, associated or not to pharmacological strategies. One of the most common class of drugs used is the β-blockers that may act exclusively on adrenergic receptors β1 (heart) or on all β adrenergic receptors. The same receptors are present on the adipose tissue making lipolysis possible, and thus, weight loss.

PURPOSE to evaluate if cardio selective and non-selective β blockers may interfere with the body composition (fat) of trained rats. **METHODS** Adults Wistar rats, initial weight between 200-400g, were randomly distributed in three groups: non-treated (control), atenolol and propranolol treated groups. The drugs or water were given via oral gavage in the morning, before the training session. After six-weeks of training in a swimming pool system, the animals were euthanized and blood, liver, gastrocnemius muscle, and epididymal, mesenteric and retroperitoneal adipose tissues were removed for biochemical and fat content analysis. **RESULTS** Although randomly assigned, animals in the propranolol group had an initial weight significantly smaller than the control group (296.4g ± 15.25 x 250.5g ± 7.8, p<0.05), however from 4th week and on, animals treated with the non-selective β-blocker significantly gained weight when compared to their initial weight (250.5g ± 7.82 x 285.6g ± 7.8, week 1 x week 6, p<0.05). The animals treated with propranolol had a significant reduction in the amount of 14C-oleate incorporated in their carcass and adipose tissues when compared to the other two groups (p<0.05), as well as higher insulin (p<0.05). Propranolol-treated animals also tended to have higher levels of glucose and free fatty acids in their blood, and less glycogen in their muscle. **CONCLUSION** A non-selective β-blocker such as propranolol may not be the best course of action to treat people with high blood pressure who most of the time need to lose weight. These drugs seem to cause insulin resistance leading to high glucose levels in the blood, as well as lower activity of lipolytic enzymes. Cardio selective drugs, such as atenolol, may seem better for not causing similar side effects.

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Exercise Attenuates Weight Gain And Modulates Satiety Hormones In Female MiceCandace Rae Longoria, Paul J. Wisniewski, Robert A. Dowden, Natasha Malonza, Sara C. Campbell, FACSM. *Rutgers University, New Brunswick, NJ.* (Sponsor: Sara Campbell, FACSM)*(No relevant relationships reported)*

Exercise contributes to both caloric expenditure and nutrient partitioning. We have shown that lean sedentary (LS) male mice had lower levels of insulin and Interleukin-6 (IL-6) when compared to their high-fat fed sedentary (HFS) counterparts. Further, both exercise groups, lean (LX) and high-fat fed (HFX) demonstrated lower ghrelin, a hormone that regulates appetite and energy homeostasis levels compared to their sedentary counterparts. However, there is little work done in understanding the female response to blood biomarkers and exercise. **PURPOSE:** Therefore, the purpose of this study was to replicate our previous study in female mice to ascertain which biomarkers are similar across gender, and further evaluate any potential differences. We hypothesized that female mice would have a similar inflammatory biomarkers response as males, but a different hormonal profile. **METHODS:** Thirty-six, 6-week old C57BL/6NTac female mice were fed a normal or high-fat diet for 12-weeks and randomly assigned to exercise or sedentary groups. After 12 weeks animals were sacrificed, and blood was collected for metabolic hormone analysis using a magnetic bead-based multi-analyte panel. A total of seven biomarkers were analyzed including: insulin, peptide-YY (PYY), ghrelin, amylin, IL-6, tumor necrosis factor alpha (TNF- α), and pancreatic polypeptide (PP). **RESULTS:** HFS female mice had the highest body weight, kcal intake per day and percent weight increase compared to all other groups ($p < 0.05$). Exercise attenuated the body weight gain in HF-fed mice (24.7g vs. 30.3g). Exercised groups had significant decreases in levels of insulin (1286.925 pg/ml, 2819.299 pg/ml; $p = 0.021$) and amylin (67.233 pg/ml, 95.048 pg/ml; $p = 0.009$), and increased levels of PYY (18.840 pg/ml, 61.688 pg/ml; $p = 0.031$) compared to sedentary groups. Groups fed HF diets also had increased levels of PYY (64.673 pg/ml, 15.978 pg/ml; $p = 0.018$) compared to normal diet groups. **CONCLUSION:** Exercise attenuates body weight gain and the rise in insulin in mice fed high fat diet and this is consistent between genders. Further, appetite/glucose regulating hormones like amylin and PYY are significantly altered in females but display different responses in males. This continues to add to the exciting story of metabolic differences between males and females.

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Effects Of Exercise On The Expression Of Kiss-1/GPR54 In Testis Of High-fat Diet Rats In Growth PhaseJUNPENG FENG, YI YAN. *BEIJING SPORT UNIVERSITY, BEIJING, China.*

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(No relevant relationships reported)

PURPOSE: To explore the effect of exercise on localization and expression of KISS-1 and GPR54 in the growth period (PND 21st to 56th day) of high-fat diet rat testes. **METHODS:** 21D old weanling rats were randomly divided into group HC ($n = 32$) and group HE ($n = 32$). HE group took 5-weeks trained (60-70% vVO_{2max} , 1h/day, 5days/week). Groups HC and HE were fed with high-fat feed, which was purchased from Beijing Huafukang Biotechnology Co. Ltd. (LOT No: D12451). The rats of two groups were killed on the 21st D, 35th D, 43rd D, and 56th D old. The localization, mRNA expression and protein expression of KISS-1/GPR54 in the testis of each group were tested. **RESULTS:** The high-fat diet intervention resulted in a decrease in testicular index from pre-puberty ($p < 0.05$); testicular tissue testosterone decreased significantly from prepuberty ($p < 0.01$), and endocrine function was impaired; rat testicular tissue structure was loose, and the number of mature sperm decreased. The high-fat diet intervention had no significant effect on the localization of KISS-1/GPR54 system in rat testis, but affected the expression of KISS-1/GPR54 in rat testis and down-regulated the expression of KISS-1 protein ($p < 0.01$). Exercise intervention can improve testicular development in rats with high-fat diet, especially to improve sex hormone disorders caused by high-fat diet. Under exercise intervention, the testicular tissue testosterone decline caused by high-fat diet was improved ($p < 0.05$). Comparing with HC group, the expression of GPR54 protein increased significantly ($p < 0.01$), but the KISS-1 protein expression had no obvious change ($p > 0.05$). **CONCLUSION:** High-fat diet can inhibit the testicular development of male rats in the growth phase, and can also down-regulate the protein and gene expression levels of KISS-1/GPR54 system in testis tissue, and change the expression of KISS-1/GPR54 system, and its role needs further study. 60-70% VO_{2max} moderate-intensity aerobic exercise change the inhibitory effect of high-fat diet on testicular development in male rats, and up-regulate KISS-1/GPR54 in prepubertal stage and whether KISS-1/GPR54 in testicular tissue participates in its regulation remains to be further study.

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Western Diet And Exercise Training Increase Mitochondrial Lipid Respiration In Male But Not Female MiceErin M. McGowan, Sarah E. Ehrlicher, Harrison D. Stierwalt, Sean A. Newsom, Matthew M. Robinson. *Oregon State University, Corvallis, OR.*

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(No relevant relationships reported)

High-fat feeding in mice is a common model to investigate mitochondrial lipid metabolism during diet-induced obesity. Our previous work demonstrates 60% high-fat diet stimulates mitochondrial lipid respiration yet such fat content is higher than a typical western diet (~35% fat with higher sugar). Aerobic exercise training also stimulates mitochondrial lipid respiration, but the interaction with western diet is not clear. **PURPOSE:** We determined mitochondrial oxidative function in response to western diet in the absence and presence of concurrent exercise training. We hypothesized western diet would induce greater mitochondrial lipid respiration that would be further enhanced with exercise training. **METHODS:** Male and female C57BL/6J mice ($n = 5-7$ per group for each sex) ate either western diet (WD) or low-fat diet (LFD) for 4 weeks, with a group of WD mice randomized to perform concurrent treadmill training (WD+Ex). At week 4, dual-energy x-ray absorptiometry was used to measure body composition and in-vivo substrate oxidation was assessed using metabolic cage indirect calorimetry. Ex-vivo mitochondrial oxidation was measured via high-resolution respirometry using isolated mitochondria from quadriceps muscles collected 36-hours after final exercise session (or rest). Respiration protocols included lipid (octanoyl-carnitine+malate) and non-lipid (glutamate+succinate) substrates. **RESULTS:** Among sedentary mice, WD had higher body weight and fat mass than LFD ($P < 0.0001$), but only in males. WD had lower in-cage respiratory exchange ratio than LFD ($P < 0.05$) regardless of sex, indicating greater whole-body reliance on lipids. In males, WD+Ex stimulated mitochondrial lipid respiration more so than WD alone ($P < 0.05$). Females had no significant changes in mitochondrial lipid respiration. Non-lipid supported mitochondrial respiration was not significantly altered by WD or WD+Ex regardless of sex. **CONCLUSION:** In agreement with our hypothesis, WD stimulated lipid-specific mitochondrial respiration that further increased with Ex, but only in male mice. There were apparent sex differences such that females were protected against WD-induced weight gain alongside limited changes in mitochondrial lipid respiration.

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Genetic Deletion Of MicroRNA-16 In Muscle Results In Impaired Insulin Sensitivity & Exercise CapacitySeongkyun Lim, Megan Rosa-Caldwell, Wesely Haynie, David Lee, Tyrone Washington, Nicholas Greene, FACSM. *University of Arkansas, Fayetteville, AR.* (Sponsor: Nicholas P. Greene, FACSM)*(No relevant relationships reported)*

Type 2 diabetes mellitus (T2DM) has become the most common metabolic disease in Western society, leading to significant health problems and financial burdens. Numerous researchers have investigated different therapeutics to target T2DM, but the underlying molecular mechanisms are still not completely understood. Our laboratory and others have demonstrated consistent downregulation of the microRNA-16 (miR-16) in skeletal muscle across human, rodent, and tissue culture models of T2DM. **PURPOSE:** To investigate how deletion of miR-16 gene affects insulin sensitivity and exercise capacity during insulin resistance. **METHODS:** 10 wildtype (WT) and 12 muscle miR-16 knockout (KO) male mice were used for this study. At 9 wks of age, bodyweight, graded exercise test (GXT), glucose tolerance test (GTT; at 0, 30, 60, and 120 min) and insulin tolerance test (ITT; at 0, 15, 30, and 60 min) were measured. At 10 wks of age, half of the mice were given high-fat diet (HFD; 45% calories from fat) to induce insulin resistance, while the remainder were fed normal chow (NC; 17% calories from fat). At 13 wks, bodyweight, GXT, GTT, and ITT were repeated to examine the effect of HFD on miR-16 KO condition. Data were analyzed by two-way ANOVA and significance was denoted at $p < 0.05$. **RESULTS:** Bodyweight was increased by ~27% in WT HFD ($p < 0.05$) and ~21% in KO HFD group ($p < 0.05$) compared to WT NC group. Exercise capacity was decreased by ~46% in WT HFD, ~34% in KO NC, and ~153% in KO HFD group ($p < 0.001$) compared to WT NC group. GTT area under the curve (AUC) value was ~15% greater in WT HFD ($p < 0.05$) and ~20% greater in KO HFD group ($p < 0.05$) compared to WT NC group. ITT curve data indicated that glucose level was ~41% greater at 15 min in KO HFD ($p < 0.05$) compared to WT NC group. **CONCLUSION:** These data suggest prior observations of downregulated muscle miR-16 in human and animal models of T2DM may in part mediate impaired insulin sensitivity and exercise tolerance. Further research is warranted to elucidate molecular mechanisms of miR-16 and its potential role in insulin resistance. **ACKNOWLEDGEMENTS:** This study was funded by the Arkansas Bioscience Institute and American College of Sports Medicine Research Endowment Grant.

3869 Board #186 May 30 9:00 AM - 10:30 AM
The Role Of COX2 In The Regulation Of Brown Adipose Tissue In Obesity By Aerobic Exercise

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(No relevant relationships reported)

PURPOSE: The aim was to explore the regulation mechanism of aerobic exercise on brown adipose tissue (BAT) in obese mice and the role of COX2.

METHODS: The mice were randomly divided into the control group (C, normal diet), obesity group (H, high-fat diet to establish obesity model) and the obesity exercise group (HE, high-fat diet and medium intensity treadmill training). Blood lipid and glucose were detected after 4 weeks. Differentially expression genes in scapula BAT were determined by mRNA expression profiles, and functional annotation and signal pathway enrichment were carried out. COX2 (VEGF signaling pathway) involved in key biological processes (BP) and pathway. ADR β 3 agonist Isoprenaline (activating VEGF pathway) and NS-398 (COX2 inhibitor) were used, and the distribution of lipid droplets, the glycerol level, and the expression of mRNA and protein in VEGF pathway in brown adipocytes were detected.

RESULTS: High-fat diet could induce obesity, accompanied by increased blood glucose and lipid levels (2.03 \pm 0.09 vs. 4.54 \pm 0.3), reducing UCP1 levels (1 vs. 0.71 \pm 0.1) in BAT. Aerobic exercise could significantly reduce the obese mice weight (C: 26.21 \pm 0.57; H: 27.53 \pm 0.61; HE: 26.32 \pm 0.52) and blood glucose levels (C: 8.5 \pm 0.78; H: 10.22 \pm 1.77; HE: 8.25 \pm 1.33). The BP of up-regulated genes in group H/C were mainly enriched in immune system progression, inflammatory and immune response, down-regulated genes were lipid metabolism and oxidation reduction. The up-regulated genes in group HE/H were enriched in glycolipid metabolism, while the down-regulated genes were cell death and apoptosis. VEGF signaling pathway plays an important role in this process, and COX2 in the VEGF pathway played a central role by interaction analysis. Application of Isoprenaline could increase the glycerol level (12.8 \pm 1.38 vs. 31.27 \pm 3.49) and the protein expression of VEGFa (1 vs. 1.34 \pm 0.12), COX2 (1 vs. 1.49 \pm 0.22) and UCP1 (1 vs. 1.27 \pm 0.18); Simultaneous application of NS-398 could inhibit the protein expression of COX2 and UCP1 in brown adipocytes.

CONCLUSIONS: Obesity could lead to disorder of glycolipid metabolism and inflammation of BAT. Aerobic exercise could activate BAT activity through VEGF-COX2 pathway to reduce adverse effects of obesity. Funded by FRF for the Central Universities of China (2018GJ017)

3870 Board #187 May 30 9:00 AM - 10:30 AM
Mict Improves Fgf21 And Klb Expression Better Than Hiit In Obese Mice

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(No relevant relationships reported)

(No relevant relationships reported) **Background:** Fibroblast growth factor 21 (FGF21), a key factor to prevent and treat overweight and obesity, regulates glucose, lipid, and energy metabolism. Besides, FGF21 needs β -Klotho (KLB) as a co-receptor to combine with the FGF receptor (FGFR) effectively and inter the target cell. However, it is unclear what condition promotes FGF21 and KLB expression in different tissue. **Purpose:** The goal of this preliminary study is to explore FGF21 and KLB expression related to two forms of exercise: moderate-intensity continuous training (MICT) and high-intensity interval training (HIIT) **Methods:** Mice were randomly divided into four groups (n=8 per group): MICT, HIIT, sedentary lifestyle (SED), and control (CON). Three groups, MICT, HIIT, and SED were fed on the high-fat diet (HFD) to induce obesity and CON was fed on the standard chow (Con) for 12 weeks. Exercise was performed on a motorized treadmill for further eight weeks and the diet continued in each group. **Results and Discussions:** (1) In mRNA level, MICT was more effective than HIIT in promoting FGF21 and KLB expression in liver (fgf21: 12.44 \pm 3.95 vs. 0.91 \pm 1.09, p <0.01; klb: 5.17 \pm 3.54 vs. 0.225 \pm 0.10, p <0.01), brown adipose tissue (BAT) (fgf21: 96.37 \pm 29.72 vs. 58.30 \pm 21.73, p <0.05; klb: 12.33 \pm 5.20 vs. 0.32 \pm 0.20, p <0.01), and muscle (fgf21: 10.17 \pm 5.81 vs. 5.49 \pm 9.09, p >0.05; klb: 42.83 \pm 19.07 vs. 10.33 \pm 14.50, p <0.01); (2) In protein level, MICT was more effective than HIIT in promoting FGF21 and KLB expression in liver (fgf21: 1.63 \pm 0.31 vs. 1.31 \pm 0.27, p >0.05; klb: 3.51 \pm 0.58 vs. 1.63 \pm 0.32, p <0.01), BAT (fgf21: 3.35 \pm 0.32 vs. 1.42 \pm 0.27, p <0.05; klb: 2.34 \pm 0.50 vs. 0.74 \pm 0.25, p <0.01), and muscle (fgf21: 1.32 \pm 0.12 vs. 0.72 \pm 0.12, p <0.05; klb: 2.17 \pm 0.12 vs. 1.46 \pm 0.06, p <0.01). **Conclusion:** MICT improves FGF21 and KLB expression in the liver, BAT, and muscle better than HIIT in obese mice.

3871 Board #188 May 30 9:00 AM - 10:30 AM
LIRAGLUTIDE AND PHYSICAL ACTIVITY EFFECTS IN ADIPOCITE TISSUE OF MICE OBESE

Aline de Freitas Brito¹, CYBELLE DE ARRUDA NAVARRO SILVA², Hellen Christina De Belmont Sabino³, Fabiano Ferreira de Lima¹, Igor Henriques Fortunato¹, Rinaldo Silvino dos Santos¹, Telma Maria Araújo Moura Lemos¹. ¹University of Pernambuco, Recife, Brazil. ²UNIFACISA - Centro Universitário, Campina Grande, Brazil. ³UNIPÊ - Centro Universitário de João Pessoa, João Pessoa, Brazil. ⁴Federal University of Rio Grande do Norte, Natal, Brazil.
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(No relevant relationships reported)

PURPOSE: evaluating the effects of Liraglutide over the adipose tissue of Swiss mice subjugated to a cafeteria diet and physical activity, through swimming. **METHODS:** approved by the Ethics in Animal Use of UFRN (n. 003/2014). We have divided 74 animals (Swiss mice) into two phases: the initial phase had a pilot study (n=10) subdivided into the control group (PCON) (n=5) and the cafeteria group (PCAF) (n=5), to evaluate an attractive cafeteria diet to the animals taste, that would result in an increase of body weight. After the diet's introduction, the animals were weighed, euthanized, and had their intra-abdominal adiposity measured. The menu offered to the group PCAF was deemed attractive to taste and chosen for the development of the research. After, 64 animals were subdivided into two groups: the Cafeteria Base Study Group (EBCAF), further subdivided: cafeteria+exercise+liraglutide (CEL) (n=8), cafeteria+exercise+saline (CES) (N=8), cafeteria+liraglutide (CL) (n=8), and cafeteria+saline (CS) (n=8). And the Chow Base Study Group (EBR), that was further subdivided: exercise+liraglutide (EL) (n=8), exercise+saline (ES) (n=8), liraglutide (L) (n=8), and saline solution (SS) (n=8). All the animals were put through a cafeteria diet, following the physical activity with swimming and treating them with testing substances intraperitoneally (200 μ g/mL/kg). **RESULTS:** In the pilot study, the type of food did not significantly affect the increase in weight gain (PCAF = 47.38 \pm 0.70 vs. PCON = 46.48 \pm 1.08). However, it changed considerably the increase of intraabdominal adipose tissue: CAF = 0.74 \pm 0.05 vs. CON = 0.44 \pm 0.08 g (p < 0.05). The base study of the research showed that the treatment with liraglutide associated with physical activity when compared to saline had a significant reduction in the mass of adipose tissue: CEL-0.32 \pm 0.03 vs. CES-0.48 \pm 0.05 g; CL-0.41 \pm 0.09 vs. CS-0.76 \pm 0.09 g; L-0.24 \pm 0.04 vs. SS-0.52 \pm 0.08 g e CEL-0.32 \pm 0.03 vs. CS-0.76 \pm 0.09 g (p < 0.05 CEL vs. CES; p < 0.05 CL vs. CS; p < 0.01 L vs. SS; p < 0.001 CEL vs. CS.) (0.32 \pm 0.05 g), compared to the saline group (0.53 \pm 0.07 g).

CONCLUSIONS: the liraglutide supplied a weight loss in animals, especially in the intraabdominal adipose tissue and when associated with Physical activity has allowed greater efficiency in terms of adipose tissue decrease.

3872 Board #189 May 30 9:00 AM - 10:30 AM
Caloric Restriction Alters Bone Marrow Adiposity And Energy Metabolism

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(No relevant relationships reported)

BACKGROUND: Bone marrow adipose tissue (bMAT) refers to mesenchymal stem cell-derived adipocytes located within the bone marrow cavity. In adult humans, bMAT comprises ~15% of total body adiposity and is primarily located throughout the appendicular skeleton. bMAT is an extremely 'plastic' depot that rapidly responds to fluctuations in nutrient sensing and energetic homeostasis. Paradoxically, bMAT levels increase during both obesity and caloric restriction (CR); however, it is unclear whether the qualitative phenotype of bMAT differs under these conditions. **PURPOSE:** To identify obesity- and CR-induced alterations in bMAT lipid composition, transcriptional profile, and metabolic signature. **METHODS:** Male 6-week-old genetically obese ob/ob mice (leptin deficient) were housed at 32°C (thermoneutral) for 10 weeks. One group of mice was fed ad libitum (AL; N=9) for the study duration, while a second group was calorically restricted (CR; N=9) to ~50% of the AL group to prevent excess weight gain. Femora and tibiae were collected for lipid composition (gas chromatography), gene expression analysis (qRT-PCR), and *in situ* metabolic phenotyping (MPLSM-FLIM). Blood was collected for assessment of circulating analytes. **RESULTS:** CR mice had lower body mass and blood glucose, and higher blood corticosterone compared to AL mice. CR increased femur adipocyte density and adipocyte size compared to AL. Tibia lipid composition differed between AL and CR mice (AL>CR C16:0, C:18:1n-9, C:18:1n-7, C20:4n-6; CR >AL C14:0, C16:1n-7, and C18:2n-6). CR upregulated the expression of adipokines (e.g., *Adipoq*, *CFD*), which occurred co-incidentally with elevated levels of serum adiponectin and adipsin. Transcriptional profiling revealed differential expression of genes involved in adipogenesis, lipid metabolism, mitochondrial activity, and antioxidant response

(e.g., CR>AL *SCD1*, *FASN*, *LIPE*, *LPL*, *KLF15*, *PPARGC1a*, *PPARa*, and *SOD1*). MPLSM-FLIM revealed highly heterogenic metabolic phenotypes among cells within the bone marrow cavity. **CONCLUSION:** CR induces functional changes in bMAT that occur independent of leptin. bMAT lies at the interface of metabolic and inflammatory signaling mechanisms, and is a potential mediator of systemic metabolic and inflammatory homeostasis during health and disease.

3873 Board #190 May 30 9:00 AM - 10:30 AM
Regulation Of CD36/LKB1/AMPK On Fatty Acid Oxidative Metabolism Under High-fat Diet Conditions

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Activation of AMP-activated kinase (AMPK) in skeletal muscle increases FA oxidation by inducing Acetyl-CoA Carboxylase (ACC) deactivation. However, the upstream signal molecules that activate AMPK/ACC signaling remains unclear. It is expected that Fatty Acid Translocase (FAT/CD36) will become another potential target for diabetic therapy after AMPK.

PURPOSE: To explore the role of CD36, as a signal molecule, in regulating the upstream signaling pathway of AMPK/ACC in skeletal muscle under HFD conditions. **METHODS:** First, siRNA interference was used to knock down CD36 gene in C2C12 cells to investigate the effect of CD36 deficiency on the phosphorylation of AMPK/ACC signaling in skeletal muscle cells. Then, twelve 8-week-old C57BL/6 male mice were randomly divided into two groups: control group (CON; $n = 6$), and high-fat diet group (HFD; $n = 6$). The expression levels of CD36 protein and phosphorylation of AMPK/ACC signaling under HFD conditions were detected by Western blotting method; the translocation of Liver kinase B1 (LKB1) in nucleus was detected by immunofluorescence method; the ultrastructural changes of skeletal muscle were detected by transmission electron microscopy; and the activity of mitochondrial respiratory chain enzyme was detected by colorimetry. **RESULTS:** CD36 deficiency activated AMPK (0.129 ± 0.009 vs. 0.417 ± 0.055 , $p < 0.05$), ACC (0.044 ± 0.008 vs. 0.081 ± 0.010 , $p < 0.05$) signaling in skeletal muscle cells. Compared with the CON group, the expression levels of CD36 protein in HFD group were significantly increased (0.225 ± 0.041 vs. 0.506 ± 0.022 , $p < 0.01$), the phosphorylation levels of AMPK (0.142 ± 0.020 vs. 0.079 ± 0.010 , $p < 0.05$) and ACC (0.229 ± 0.023 vs. 0.119 ± 0.028 , $p < 0.05$) were significantly decreased, and induced LKB1 translocation from cytoplasm to nucleus. In addition, electron microscopic results showed that HFD intervention damaged the mitochondrial structure of skeletal muscle to a certain extent, and significantly decreased CS activity (411.32 ± 22.15 vs. 310.20 ± 44.09 , $p < 0.01$). **CONCLUSION:** CD36, as a signaling molecule, promotes LKB1 to translocate from cytoplasm to nucleus, which inhibits AMPK/ACC signaling activation, thereby regulating FA oxidation under HFD condition.

Supported by the National Natural Science Foundation of China (No. 31600966).

3874 Board #191 May 30 9:00 AM - 10:30 AM
Insulin Action And Body Composition In Aged C57bl/6 Mice: A New Model For Obesity

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(No relevant relationships reported)

The prevalence of obesity in the United States has increased dramatically over the last three decades resulting in a major public health crisis. Feeding mice a high fat diet is a pervasively used model to study mechanisms of human obesity. However, the rapid weight gain that occurs in high fat fed mice and the extremely high fat content of commercially available experimental rodent diets pose serious limitations of this approach. A more appropriate model to study human obesity might be the aged male C57BL/6 mice. **PURPOSE:** To determine body composition and insulin action in young (YG, 6 months), aged (AG, 18 months), and very old (VO, 28 months) male C57BL/6 mice. **METHODS:** Body composition was assessed by an LF50 Body Composition Analyzer (Bruker, Inc). Insulin action was determined by conducting insulin tolerance (IT), glucose tolerance (GT), and 5-aminoimidazole-4-carboxamide ribonucleoside (AICAR) tolerance (AT) tests. Data was analyzed by using a 1 x 3 analysis of variance and least significant difference post-hoc test. Statistical significance was set at $P \leq 0.05$. **RESULTS:** Body mass (YG: 30.7 ± 1.1 vs AG: 46.3 ± 1.7 vs VO: 39.1 ± 1.6 g) and fat mass (YG: 5.8 ± 1.0 vs AG: 21.6 ± 1.6 vs VO: 10.2 ± 1.8 g) were significantly higher in AG mice compared to VO and YG mice. Lean mass was significantly higher in VO mice compared to AG and YG mice (YG: 20.4 ± 0.4 vs AG: 19.6 ± 0.6 vs VO: 23.4 ± 0.5 g). The area under the curve (AUC) for the GT test was significantly lower in VO mice compared to YG and AG mice (YG: 59030 ± 2817 vs AG: 54835 ± 3423 vs VO: 33378 ± 2286). The AUC for the IT test curve was similar in YG, AG and VO mice (YG: 11320 ± 214 vs AG: 11804 ± 343 vs VO: 11138 ± 968). Although the AUC for the AT test was similar, the decline in glucose following AICAR injections was significantly less in VO mice compared to

AG and YG mice, indicating an impairment in AMPK activity. These data suggest that adiposity increases substantially in 18 month old male C57BL/6 mice, a process that appears to be reversed by 28 months. Further, aging does not appear to cause a deterioration in insulin sensitivity when assessed by an IT test. The lower glucose values observed during the GT test in VO mice is likely due to enhanced insulin secretion. Overall our findings indicate that male C57BL/6 mice may be a valuable model to examine mechanisms of obesity when studied at approximately 18 months of age.

3875 Board #192 May 30 9:00 AM - 10:30 AM
Effects Of Different Exercise On Liver Lipid Metabolism In Lean And Obese Rats And Its Relationship With FGF21

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PURPOSE: This study aimed to investigate the effects of different exercise training: High Intensity Interval Training (HIIT) and Continuous Training (CT) on body mass gain, hepatic lipid accumulation and the correlation of the level of FGF21 in serum and liver tissues in lean and obese rats.

METHOD: Male Sprague-Dawley rats at 4 weeks of age were randomly divided into normal diet group (N) and obesity model group (H) after 1 week of adaptive feeding. Rats in the obesity model group were fed with 45% high-fat Diet for about 8 weeks, and 20% weight increase compared with normal rats was considered as obesity. Then, rats were given weight-bearing swimming training intervention for 8 weeks. The rats were divided into normal control group (NC), normal HIIT group (NHI), normal CT group (NCT), High fat diet-induced obesity control group (HC), obese HIIT group (HHI), and obese CT group (HCT).

RESULTS: (1) 8 weeks of HIIT (716.00 ± 15.98 vs 596.21 ± 14.27 g, $p < 0.05$) and CT exercise (716.00 ± 15.98 vs 629.62 ± 12.31 g, $p < 0.05$) result in the body weight of obesity animals significantly reduced. (2) Liver triglyceride content of obese rats were decreased by 21.8% and 7.7% respectively with 8-week HIIT and CT intervention. (3) The activity of LPL enzyme was only increased with CT in normal animals and FAT/CD36 activity was upregulated by CT both in normal and obese groups. HIIT significantly increased the mitochondrial CPT1- α and β -HAD enzyme activities in obese rats. (4) The serum FGF21 level in obese rats was significantly higher than that in normal rats (8.40 ± 1.14 vs 22.20 ± 3.59 pg/ml, $p < 0.05$), and further improved by CT. HIIT and CT increased the FGF21 expression in normal rats, but reduced its expression in obese rats.

CONCLUSION: Both types of exercise can affect the level of fat metabolism in the liver, but showed different mechanisms. HIIT significantly increased the activity of mitochondrial fat oxidase and had a significant effect on the alleviation of lipid deposition in the liver of obese rats, although this process was less correlated with changes in FGF21 levels. However, CT improve the activity of enzymes involved in fatty acid uptake, accelerate the utilization of fatty acids in the liver by regulating FGF21 levels in serum and liver tissues.

3876 Board #193 May 30 9:00 AM - 10:30 AM
FOUR WEEK DETRAINING PROMOTES FAT GAIN BUT NOT INFLAMMATION ON ADIPOSE TISSUE OF OBESE RATS

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Obesity caused by high-fat diet can lead to metabolic impairment in adipocytes as well as in other tissues. Resistance training can promote alterations to improve metabolic damages, which is likely reversed by detraining.

PURPOSE: To determine the effects of resistance training (RT) and detraining on the expression of TNF α , PPAR γ and HIF-1 α proteins of the adipose tissue of obese rats. **METHODS:** Wistar rats were divided into groups: Control (C), Trained (RT), High-fat diet (HFD), Trained/High-fat diet (HFD-T) and Detrained/High-fat diet (HFD-D). Control received standard chow; HFD received high-fat diet during 12 weeks. Trained performed RT (jump squat) for 12 weeks, 3x/week, 3 sets of 12 repetitions per session. The HFD-D interrupted the training at 8th week, characterizing detraining during 4 weeks. Adipose tissue was removed under anesthesia, weighed, and used in protein and genes expression analysis. **RESULTS:** HFD presented higher body weight gain and fat mass compared to the C and T groups ($P < 0.05$), which was reduced with RT (HFD-T vs HFD, $P < 0.001$). Among the HFD groups, HFD-T rats presented the lowest body weight ($P < 0.0002$), weight gain ($P < 0.0006$), and fat mass ($P < 0.0001$). HFD presented elevated TNF α protein and gene expression in adipose tissue compared

to C and T (50% higher), and HFD-T (40% higher) groups ($P<0.05$). HFD-T group presented higher levels of PPAR γ protein and gene compared to C (60%-higher), T (50%-higher) and HFD (50%-higher) groups ($P<0.05$). HIF-1 α mRNA expression was reduced in HFD-T rats compared with HFD ($P<0.05$). Detraining caused increase on the weight gain (50% higher) and fat mass (44% higher) compared to HFD-T ($P<0.05$). HFD-D maintained protein expression of TNF α and PPAR γ elevated compared to HFD and reduced HIF-1 α mRNA expression compared to HFD ($P<0.05$). **CONCLUSION:** Therefore, RTr can attenuate HIF-1 α and TNF α gene expression, and prevent reduction of PPAR γ independent on the ingestion of a high-fat diet. Additionally, TNF α expression remained lower, and PPAR γ expression remained increased in detrained rats, even with increased fat mass. These results suggest that four-week detraining can accelerate the gain of fat mass, without eliciting an inflammatory response in the adipose tissue. Supported by CAPES – Finance code 001.

3877 Board #194 May 30 9:00 AM - 10:30 AM
An Enzymatically Driven Hydrogen Peroxide Exposure To Human Hepatocytes And Its Effects On Iron Homeostatic Proteins

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(No relevant relationships reported)

Previous data in our lab has shown that high concentration (200 μ M) H₂O₂ exposure induces iron dysregulation in muscle cells. It is known that following strenuous exercise, oxidative stress is induced in tissues, leading to iron dysregulation, and generation of reactive oxygen species. Due to the unstable nature of H₂O₂ in solution and the critical role of the liver in iron homeostasis, we sought to see how human hepatocytes would respond to a 12-hour low-dose H₂O₂ exposure that mimics the concentration of neutrophils during the inflammatory response using glucose oxidase (GOX) and Catalase (CAT)

PURPOSE

To determine the effects of a low-concentration, H₂O₂ exposure on the iron regulatory proteins such as TfR, and Ferritin Light-Chain (FLC) in HepG2 cells.

METHODS

When HepG2 cells reached 80% confluency, iron treatments of 10, 50, and 100 μ M were imposed for 24 hours using an FeCl₃ solution diluted in media. Groups that received both iron and H₂O₂ treatments were exposed to 12 hours of iron, followed by 12-hour incubation with media that included both iron and a GOX-CAT cocktail. Western blots were carried out to measure protein content relative to controls. Cell viability was assessed using an MTT assay.

RESULTS

MTT assays for both FeCl₃ and FeCl₃ + H₂O₂ groups did not show any significant cell death. Treatment with FeCl₃ alone resulted in a significant decrease in TfR for all three groups when compared against controls ($C=1\pm 0.1$ SEM vs. 0.71 ± 1 ; $p<0.01$; $n=12$). We observed a significant increase in FTL, but only in the 10 μ M group ($C=1\pm 0.1$ vs. 1.6 ± 0.2 ; $p<0.01$; $n=11$). We saw no significant change in FTL at 50 and 100 μ M. H₂O₂ treatments driven by GOX and CAT produced concentrations of 5-10 μ M, mimicking neutrophils during inflammatory response. The addition of a low concentration H₂O₂ stress resulted in a 9-fold increase of FTL content at all iron exposure concentrations ($C=1\pm 0.3$ vs 9.3 ± 0.9 10 μ M; $p<0.01$; $n=4$). Groups of 50 and 100 μ M also showed similar results, with an increasing trend.

CONCLUSION

A low concentration exposure of H₂O₂ and iron to human hepatocytes results in a significant increase in FTL when compared to iron exposure alone. This suggests that liver cells have a robust defense against iron-dysregulation induced by oxidative stress. We are still evaluating changes that occur in other iron regulatory proteins.

G-37 Free Communication/Poster - Energy Metabolism, Obesity, and Weight Control

Saturday, May 30, 2020, 8:00 AM - 10:30 AM

Room: CC-Exhibit Hall

3878 Board #195 May 30 9:00 AM - 10:30 AM
Circulating Klotho Response To A Behavioral Weight Loss Intervention In Adults With Overweight Or Obesity

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Klotho, a biomarker of aging, is associated with a slower aging process. Klotho concentration is lower among adults with obesity compared to normal-weight adults, and exercise may independently increase levels of Klotho. Whether Klotho is altered by weight loss and whether there is an added effect of exercise are not understood.

Purpose: This study examined changes in Klotho concentration in response to a behavioral weight loss intervention among adults with overweight or obesity.

Methods: A subset of 152 adults (age: 45.4 ± 8.0 years; BMI: 32.1 ± 3.7 kg/m²) who participated in a 12-month weight loss intervention were classified as an intervention "responder" (achieved $\geq 10\%$ weight loss at both 6- and 12 months) or "non-responder" (achieved $<5\%$ weight loss at both 6- and 12 months). Intervention conditions included: 1) diet only (1200-1800 kcal/day), 2) diet plus 150 min/wk of moderate-to-vigorous intensity physical activity (MVPA) per week, 3) or diet plus 250 min/wk of unsupervised MVPA per week. Measures of height, weight, body composition, cardiorespiratory fitness, and Klotho were completed at baseline, 6-, and 12 months. Klotho was analyzed using solid-phase sandwich ELISA kits.

Results: There were significant ($p<0.0001$) changes in weight (-12.5 ± 9.1 kg), percent body fat ($-7.1\pm 5.5\%$), lean body mass (-1.7 ± 2.0 kg), and cardiorespiratory fitness ($+3.3\pm 4.1$ ml/kg/min) from baseline to 12-months. Klotho significantly ($p=0.009$) changed across the 12 months (baseline: 933 ± 381 pg/mL; 6 months: 985 ± 450 pg/mL; 12 months: 940 ± 423 pg/mL), with no difference by intervention group or weight loss response. Participants who performed physical activity had non-significantly greater changes in Klotho. Klotho was consistently associated with lean body mass at baseline ($r=-0.19$), 6 ($r=-0.23$), and 12 months ($r=-0.19$) ($p<0.05$). Klotho was not predictive of change in weight, body composition, or fitness.

Conclusion: Klotho significantly, but modestly, increases with weight loss; however, the increase in Klotho was not sustained throughout the intervention. There may be an influence of physical activity on change in Klotho with weight loss, but this warrants further investigation. Further investigation to examine how weight loss and physical activity may alter biomarkers of aging in adults with obesity may be warranted.

3879 Board #196 May 30 9:00 AM - 10:30 AM
Effects Of Beetroot Juice Components On Exercise Tolerance And Cardiometabolic Health In Individuals With Obesity

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Routine exercise training is known to improve health outcomes in individuals with obesity (IO); however it remains challenging for IO to adhere to exercise programs. Thus, it is critical to identify novel strategies that can improve exercise capacity (EC) and lead to greater adherence in IO. Beetroot juice (BRJ), high in inorganic dietary nitrate, has been shown to consistently improve exercise performance in athletes, individuals with cardiopulmonary diseases, and non-obese lean individuals. These improvements may be explained by reduced oxygen uptake (VO₂) during exercise, enhanced blood flow, and greater mitochondrial efficiency. To date, we are aware of no studies that have compared the effects of BRJ, sodium nitrate (NaNO₃), denitrified BRJ (PLA), and control (CON) conditions for improving EC and cardiometabolic health in IO. **PURPOSE:** to determine if BRJ improves EC, exercise efficiency (EE) and cardiometabolic health in IO and identify possible mechanisms of action. **METHODS:** Vascular health (blood pressure and arterial elasticity), VO₂ on a cycle ergometer during submaximal- and maximal- exercise, and time to exhaustion (TTE) were assessed in 16 sedentary IO in a crossover design for the following 4 conditions: 1) consumption of BRJ, 2) NaNO₃, 3) PLA, or 4) CON. Study visits were at least 72 hours apart. **RESULTS:** A significant treatment effect was observed for submaximal exercise VO₂ ($p=0.003$), and TTE (seconds) ($p=0.035$). Post hoc analyses demonstrated a lower VO₂ during submaximal exercise in BRJ compared to PLA ($P=0.009$) NaNO₃

($P=0.042$) and CON (0.009). TTE was greater between BRJ and CON ($P=0.029$) with no other differences observed between conditions. No other significant changes were observed for other exercise or vascular health measures. In this analysis of 16 IO, consumption of BRJ improved EE during submaximal cycling exercise by 5.28% compared to PLA, 5.91% compared to the NaNO₂, and 4.22% compared to CON. Finally, BRJ resulted in a 19% improvement in TTE compared to CON condition. **CONCLUSION:** These results suggest that consumption of BRJ may improve cycling efficiency and exercise capacity in IO.

3880 Board #197 May 30 9:00 AM - 10:30 AM
Associations Among Measures Of Abdominal Fat And Metabolic Health In Normoglycemic Women

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Central adiposity, and particularly visceral fat, is tightly associated with metabolic health. Gold standard measures for visceral fat, MRI and CT, are impractical for widespread use. Ultrasound, DXA, and bioimpedance are useful alternatives, though their associations with metabolism are less understood.

OBJECTIVE: To test associations of abdominal adipose by ultrasound (US), DXA, and bioimpedance (BIA) with insulin sensitivity (IS), β -cell responsiveness, physical activity, and adiponectin (AdipN), an adipokine tightly associated with visceral fat.

METHODS: After overnight fast, 41 normoglycemic young women (Age 20.9 ± 2.7 ; BMI 27.8 ± 3.5) completed iDXA (GE Lunar) and BIA (InBody 770) for VAT and %BF; US for visceral (VAT-US) and subcutaneous adipose thicknesses (SAT-US) measured 1cm superior to umbilicus; circumferences; 2-hr OGTT (75g); and 5-day accelerometry (Steps; ActiGraph GT3x). Plasma insulin, c-peptide, and AdipN were determined by ELISA. IS was calculated using Matsuda Index from insulin and glucose at 0 and 120 min. First phase β -cell responsiveness (β Cell) was estimated as ΔC -peptide/ Δ glucose from 0 to 30 min.

RESULTS: VAT-DXA correlated strongly with VAT-BIA ($r=.80$), SAT-US ($r=.78$), Waist ($r=.81$; $p<.01$ for all), and weakly with VAT-US ($r=.35$) and Steps ($r=-.38$; $p<.05$ for all), but not AdipN ($r=-.31$, $p=ns$). VAT-US correlated with AdipN ($r=-.52$), VAT-DXA ($r=.35$), Waist ($r=.50$; $p<.05$ for all), but not SAT-US ($r=-.02$) or VAT-BIA ($r=.31$; $p=ns$ for both). IS was associated with VAT-US ($r=-.42$), VAT-DXA ($r=-.44$), and AdipN ($r=.46$; $p<.05$ for all), controlled for age and race, and these persisted when further controlling for BMI. Only SAT-US was associated with β -cell ($r=.38$, $p<.05$), controlled for age and race, but attenuated when controlling for BMI. Steps correlated with SAT ($r=-.36$), VAT-DX ($r=-.38$), and VAT-BIA ($r=-.39$; $p<.05$ for all), but not IS, β Cell, VAT-US, or AdipN ($p=ns$ for all). In multiple regression analysis with VAT-DX, and BMI included in the model, VAT-US was the only independent predictor of IS (Std. $\beta=-.36$, $p<.05$).

CONCLUSION: VAT by DXA and BIA are strongly related to SAT and overall adiposity, and less to VAT by US and AdipN. While VAT by DXA and ultrasound were both predictors of poor metabolic health in this population, VAT by ultrasound was the strongest independent predictor of IS.

3881 Board #198 May 30 9:00 AM - 10:30 AM
Longitudinal Characterization Of RMR Ratio In Ovulatory Exercising Women Across 12 Months

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Resting metabolic rate (RMR) ratio has been shown to be an indicator of energetic status as indicated by significant correlations with total triiodothyronine (TT₃) concentrations in exercising women. However, it is unknown whether the relationship between RMR ratio and TT₃ remains constant over time. **PURPOSE:** To examine the relationship between RMR ratio and TT₃ in exercising, ovulatory, weight-stable women for a 12-month observational period. **METHODS:** We performed a 12-month longitudinal analysis of data from exercising women ($n=14$). Dual-energy X-ray absorptiometry (DXA) and indirect calorimetry provided data on anthropometrics and energy expenditure. Harris-Benedict DXA, and Cunningham (1980 and 1991) equations estimated RMR and RMR ratio. Repeated-measures analysis assessed changes over time (ANOVA and Friedman). Intraclass correlation coefficient (ICC) and Cronbach's Alpha measure agreement over 12-months for RMR ratio and energy availability (EA). Generalized linear modeling tested whether RMR ratio predicted TT₃ to be above or below two thresholds (TT₃>73.2ng/mL and TT₃>80ng/mL) over 12-months. **RESULTS:** Women were 25.9 ± 5.4 yr, and at baseline, weighed 59.6 ± 5.2 kg with BMI 22.3 ± 1.4 kg/m², which remained unchanged during the study (weight: $p=0.52$; BMI: $p=0.51$). Over 12-months, RMR ($p=0.88$), TT₃ ($p=0.89$), EA

($p=0.21$), and RMR ratio (Harris-Benedict: $p=0.85$; DXA: $p=0.60$; Cunningham₁₉₈₀: $p=0.75$; Cunningham₁₉₉₁: $p=0.73$) remained consistent for 12-months. Each RMR ratio produced ICC and Cronbach's alpha greater than 0.90, indicating excellent reliability of repeated measures, while ICC of energy availability of 0.75 and Cronbach's alpha of 0.73, indicated moderate reliability. When TT₃>73.2ng/dL, each RMR ratio threshold (Harris-Benedict: $p=0.021$; DXA: $p=0.019$; Cunningham₁₉₈₀: $p=0.019$; Cunningham₁₉₉₁: $p=0.016$) significantly predicted participants as energy replete; however, when using a more lenient clinical TT₃ threshold of >80ng/dL, only the DXA ratio threshold yielded a significant model

(<0.001). **CONCLUSIONS:** The relationship between RMR ratio and TT₃ remains constant over time with excellent reliability helping to validate the use of RMR ratio for the longitudinal characterization of energetic status in exercising women (i.e. prospective serial monitoring).

3882 Board #199 May 30 9:00 AM - 10:30 AM
Sex Characteristics Of Fat Distribution In Chinese Adolescent: Based On Magnetic Resonance Imaging

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(No relevant relationships reported)

PURPOSE: To find out the characteristics of accurate fat distribution of healthy adolescent in China and compare the differences between different genders.

METHODS: We recruited 36 Chinese healthy adolescents without obesity or malnutrition. (12-17 years old, 3 men and 3 women of each age; height: 155.24 ± 15.66 cm; mass: 48.60 ± 14.41 kg). Scanning the whole body by MRI (1 cm apart). The visceral fat, subcutaneous fat and intramuscular fat of trunk, upper and lower limbs were calculated by gray area. The derivative index of the above indicators is obtained by dividing by the square of height. SPSS 22.0 was used to analyze the data by t-test.

RESULTS: 1) Fat mass. The visceral fat, the intramuscular fat of trunk and the subcutaneous fat of upper and lower limbs were higher in women than in men. But there was no significant difference in fat quality between men and women ($p>0.05$). 2) Fat mass index. There was a significant difference between the female and the male in the subcutaneous fat index of the upper extremity ($m:0.53 \pm 0.14$; $f:0.63 \pm 0.16$; $p=0.048$), and a significant difference between the female and the male in the subcutaneous fat index of the lower extremity ($m:1.94 \pm 0.61$; $f:2.55 \pm 0.51$; $p=0.002$). There was no gender difference in muscle fat between upper and lower limbs ($P>0.05$). The visceral fat index of female was higher than that of male ($m:0.43 \pm 0.12$; $f:0.53 \pm 0.17$; $p=0.042$). 3) The trunk fat mass of male accounted for 38.89% of the total fat mass, which was lower than that of female (41.77%), but there was no significant difference. ($p>0.05$). The visceral fat mass of male accounted for 10.10% of the total fat mass, which was higher than that of female (9.11%). The upper limb fat mass of male accounted for 12.17% of the total fat mass, which was significantly higher than that of female (10.72%) ($p=0.048$). There was no significant difference between male (47.93%) and female (47.50) in the proportion of lower limb fat mass. ($p>0.05$) **CONCLUSIONS:** There was no gender difference in fat mass of different parts of adolescent. The subcutaneous fat index and visceral fat index of women were higher than that of men, but there was no gender difference in muscle fat index. The centripetal accumulation of puberty male fat was not obvious, but the proportion of upper limb fat was relatively high.

3883 Board #200 May 30 9:00 AM - 10:30 AM
Habitual Physical Activity And Muscle Mass Changes With Weight Loss

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As with any weight loss program, losing fat while maintaining muscle is a desirable outcome. We sought to determine how different types of habitual activity influenced the retention of muscle mass with a decrease in body fat.

PURPOSE: As a preliminary analysis to guide future research, the purpose of this study was to determine whether self-reported frequency of aerobic, strength, and stretching exercise (days per week) associates with body composition changes in response to weight loss in overweight and obese adults. **METHODS:** Adults ($n=23$), 18-70 years old with a minimum waist circumference of 35 inches for women and 40 inches for men participated in an 8-week study diet intervention. Participants were asked to maintain habitual physical activity during the intervention. All participants reported their habitual exercise frequency for aerobic, strength, and stretching activities within a typical 7-day period. Body composition was assessed using bioelectrical impedance analysis (mBCA). After post testing, correlations (nonparametric, Spearman) between days reported for each activity and changes in body mass, percent body fat, visceral adipose tissue (VAT) and muscle mass were determined in participants who had a reduction in body mass during the intervention. **RESULTS:** The

average number of days per week reported for each activity was 4.3 for aerobic, 1.8 for strength, and 3.3 for stretching. Change in body mass pre to post intervention was from 94.6 + 22.3 kg to 92.9 + 21.4 kg. The range in change for muscle mass was from -2.31 kg to +1.1 kg. There was a correlation ($r = 0.603$, $p = 0.029$) between days per week of aerobic activity and change in muscle mass. **CONCLUSIONS:** While all individuals of the analysis lost some weight during the intervention, some of them lost and some of them gained muscle mass. Individuals who reported more days of aerobic activity per week as their habitual activity level were more likely to retain muscle mass. Supported by the USA Dry Pea & Lentil Council

3884 Board #201 May 30 9:00 AM - 10:30 AM
Body Shape And Basal Metabolism Characteristics Of Female College Students With Normal Weight Obesity
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 (No relevant relationships reported)

PURPOSE: Female college students become a high-risk group of normal weight obesity (NWO) because of their lifestyle and psychological status. NWO can have an impact on the health of students. We analyze the characteristics of the body's physical form and basal metabolism to add a new basis for the evaluation of female college students' physical condition.

METHODS: A stratified cluster sampling method was used to extract 2000 samples from the two universities. Excluding those who did not meet the test conditions, eventually included 1,937 female college students. The subject's body mass index (BMI), body fat percentage (BF%), skeletal muscle percentage (SM%), waist-to-hip fat ratio, basal metabolic rate, waist circumference (WC), hip circumference (HC), and thigh circumference (TC) were measured. One-way ANOVA was used to compare the differences in body shape indicators between NWO and normal weight lean (NWL) female college students. Compare the incidence of central obesity among NWO and NWL female college students.

RESULTS: 1) Among female college students, the incidence of NWO was 33.3%, accounting for 66.02% of female college students with excessive body fat. Among NWO female college students, 4.19% belong to the group with BMI <18.5(kg/m²). 2) Compared with NWL, NWO had higher BF% and lower SM% (33.32±2.59 vs 26.49±2.70%; 35.79±1.53 vs 39.79±1.69%, $p < 0.01$); NWO had higher waist-to-hip fat ratio (0.83±0.02 vs 0.81±0.02, $p < 0.01$); NWO had lower basal metabolic rate (1192.09±75.99 vs 1240.71±77.93 kcal/d, $p < 0.01$). 3) In the circumference index, compared with NWL, WC, HC and TC of NWO were larger (69.38±4.62 vs 67.07±4.95cm, $p < 0.01$; 94.16±5.10 vs 92.09±4.48cm, $p < 0.01$; 55.97±3.14 vs 54.56±3.13cm, $p < 0.05$). 4) There are 19 central obese female college students, 68% of whom are from NWO population.

CONCLUSIONS: NWO female college students have a big difference in physical form compared with NWL. NWO has a larger circumference and its fat distribution is characterized by more fat accumulation in the waist and had lower basal metabolic rate. We need to pay attention to the status of female college students with NWO. Supported by Thirteenth Five-Year Plan for scientific research of Chinese society of Higher Education (17TZ006), Basic scientific research business fund project of Central University (2008XS030).

3885 Board #202 May 30 9:00 AM - 10:30 AM
High Versus Low Inflammation Phenotype And Fat Utilization During Exercise
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 (No relevant relationships reported)

Inflammatory markers are a well-known and reliable predictor of all-cause mortality in individuals as they are associated with disease-specific processes. It has also been established that individuals with higher adiposity tend to oxidize fat at a higher rate during exercise than lean individuals. It is currently not known whether there is any relationship between resting inflammatory markers and levels of fat oxidation during exercise.

PURPOSE: To examine the relationship between inflammatory phenotype and fat utilization in obese adults during a graded exercise test.

METHODS: Healthy overweight and obese (OW/OB) adults ($n=34$) were classified as either having or not having a low-grade inflammation phenotype according to at least four out of six elevated cytokines, obtained through a fasted blood draw. Selected inflammatory cytokines to be detected include IL-1 β , IL-6, TNF- α , granulocyte macrophage colony-stimulating factor (GM-CSF), IL-17A, and IL-23. Inclusion criteria also required that each participant achieve at least 80% $\dot{V}O_{2max}$ according to age-predicted heart rate max. Participants completed a modified Bruce protocol on a treadmill and carbohydrate and fat oxidation were compared at 35, 50, 65, and 80% of estimated $\dot{V}O_{2max}$.

RESULTS: All participants had similar anthropometric measurements with a mean BMI of 30.6 kg/m². Male participants with low-grade inflammation phenotype oxidized a higher ($p < 0.05$) percentage (mean \pm SD, 10.2 \pm 10.2% vs 30.7 \pm 14.1%) of fat and greater Kcal of fat per kg body mass at 65% of $\dot{V}O_{2max}$. However, exercise intensities at 35%, 50%, and 80% of $\dot{V}O_{2max}$ showed no difference between the two groups of males. Female participants showed no difference between inflammation phenotyping and utilization of fat during the graded exercise test.

CONCLUSIONS: It is understood that OW/OB individuals tend to oxidize a greater amount of fat than their lean counterparts, particularly during exercise. However, when observing OW/OB men who had been classified as having a low grade inflammation phenotype, were noted to utilize a greater amount of fat as exercise intensity increases. **FUNDING:** Montana State University Research Initiative 51040-MUSRI2015-03 and USDA-NIFA 2017-67018-26367.

3886 Board #203 May 30 9:00 AM - 10:30 AM
Weight Loss Strategies Used By Older Adults In A 6-month Weight Loss Intervention
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 (No relevant relationships reported)

Obesity in older adults places them at risk for increased mortality and comorbid health conditions. Older adults are also at risk for loss of muscle mass and related decreased functioning with diet being an important factor. Gaining a better understanding of perceptions of weight loss in older adults and identifying successful weight loss strategies that can assist in reducing obesity while protecting muscle mass is important to improve health outcomes. **PURPOSE:** To identify and examine the perceptions of weight loss and weight loss strategies used by older adults in a 6-month weight loss intervention. **METHODS:** Twelve overweight (94.0 kg \pm 13.2), older adults (65.7 years \pm 4.0) were enrolled in a 6-month weight loss intervention. Participants received a calorically reduced meal plan (500kcal/d) with 1.2g/kg protein to protect against muscle loss. Fourteen follow-up sessions were conducted. Body weight (BW) and skeletal muscle mass (SMM) were monitored utilizing InBody770. Post program interviews were audio-recorded, transcribed and analyzed using constant-comparative analysis. A 35-item weight loss strategy inventory was completed and analyzed utilizing descriptive statistics. **RESULTS:** Ninety-two percent ($n=11$) of participants lost weight, with mean weight loss of 6.8% \pm 4.4 of BW. Seventy-five percent of participants had weight loss of >5% of BW. Mean SMM loss was 0.009% \pm 0.031 of BW with 33.3% ($n=4$) of participants increasing or maintaining SMM. Participants used a mean 15 \pm 6 weight loss strategies four or more times/week. Themes for successful weight loss included using personal behavioral strategies such as measuring portion sizes, biochemical and anthropometric motivators, personalized support, and accountability feedback and monitoring. Barriers included consuming the additional protein in the diet and care-taking of others. **CONCLUSION:** Results of this study provide considerations for the development of strategies to achieve clinically significant weight loss (>5%) while maintaining SMM in older adults. The higher intake of protein to protect against muscle loss was reported to be difficult for participants. Both personal strategies, as well as external strategies provided through the counseling relationship, contributed to success.

3887 Board #204 May 30 9:00 AM - 10:30 AM
No Changes In Appetite Stimulating Hormones Following Swimming And Cycling Exercise Interventions
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Swimming is a favorable and ideal modality of exercise for individuals with obesity and arthritis as it encompasses a minimal weight-bearing stress and a reduced heat load. However, the available evidence indicates that regular swimming may not be effective in reducing body weight and body fatness. A current hypothesis is that exercise in cold water somehow stimulates appetite. **PURPOSE:** We determined the effect of swimming exercise training on fasting concentrations of ghrelin, insulin, leptin, and peptide YY in obese individuals with osteoarthritis. Cycling training was included as a non-weight bearing land-based comparison group. **METHODS:** Thirty-nine obese participants with osteoarthritis (age=59 \pm 1 years, BMI=33 \pm 1 kg/m²) were randomly assigned to 12 weeks of supervised swimming training (N=19) or cycling training (N=20). In the initial few weeks, participants exercised for 20-30 minutes/day, 3 days/week, at an exercise intensity of 40-50% of heart rate reserve (HRR). Subsequently, the intensity and duration of exercise were progressively increased to 40-45 minutes/day, 3 days/week, at an intensity of 60-70% of HRR. Fasting blood samples were analyzed for ghrelin, insulin, leptin, and peptide YY concentrations

using ELISAs. **RESULTS:** There were no group differences in body weight, BMI, or appetite stimulating hormones prior to the exercise interventions. Fasting plasma concentrations of ghrelin (37±8 vs. 42±11 pg/ml), insulin (1,176±424 vs. 1,179±442 pg/ml), leptin (20,200±2,891 vs. 16,617±2,734 pg/ml), and peptide YY (51±6 vs. 54±7 pg/ml) did not change with the swimming exercise intervention (all p>0.05). Similarly, cycling exercise had no effect on ghrelin (36±10 vs. 44±8 pg/ml), insulin (978±321 vs. 964±311 pg/ml), leptin (29,261±5,438 vs. 26,308±4,771 pg/ml), or peptide YY (58±15 vs. 63±16 pg/ml) concentrations (all p>0.05). **CONCLUSIONS:** Our present results indicate that fasting levels of appetite stimulating hormones did not change with 12 weeks of swimming exercise intervention in obese participants with osteoarthritis and that there were no group differences in changes in these hormones between swimming and cycling exercise interventions.

3888 Board #205 May 30 9:00 AM - 10:30 AM
Rapid Weight Loss Adversely Affects Muscle Damage Markers In Elite Judo Athletes

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 (No relevant relationships reported)

Rapid weight loss (RWL) is a phenomenon that is commonly detected amongst elite judo athletes. It is used to gain the advantage over their lighter opponents. **PURPOSE:** To evaluate the effects of 7-day RWL intervention on muscle damage markers in seven elite judokas during a pre-competition period.

METHODS: The participants voluntarily participated in this study. RWL was induced in accordance to personal preference previously practiced by judo athletes. Most frequently reported methods of RWL were increased exercise volume, fluid and caloric restriction and heated environment exposure.

RESULTS: RWL induced a significant drop in weight within all seven participants (93.07 ± 10.69 kg at baseline vs. 88.12 ± 10.30 kg at follow-up; P < 0.001). Regarding biochemical changes, myoglobin levels significantly increased on the last day of intervention (P < 0.01) (day 7). In addition, creatine kinase levels were also elevated on the 6th day of the intervention.

CONCLUSIONS: Based on the obtained results, RWL methods caused alterations in myoglobin and creatine kinase levels in elite judokas. This indicates that although RWL is perceived as helpful in achieving success in competition, it can produce muscle tissue damage that can further impact fitness profile of elite judokas. This project was partly supported by the Serbian Ministry of Education, Science and Technological Development (175037 and 179011), the Provincial Secretariat for Higher Education and Scientific Research (142-451-2473 and 114-451-710) and the Faculty of Sport and Physical Education, University of Novi Sad (2019 Annual Award).

3889 Board #206 May 30 9:00 AM - 10:30 AM
Baseline Characteristics Of Older Hispanics With Type 2 Diabetes Participating In An Intervention Study

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Type 2 Diabetes mellitus (DM2) affects 9.3% of the U.S. population. Health disparities are evident in DM2; twice as many Hispanics as non-Hispanic Whites have DM2.

PURPOSE: The goal of this study was to describe the baseline characteristics of older Hispanics with DM2 participating in a diet and exercise study in 3 senior centers. **METHODS:** Data from 38 older Hispanics with DM2 was collected. The variables included age, body mass, height, waist circumference, Hemoglobin A1C, glucose, blood pressure, chair stands in 30s, grip strength, balance, and preferred gait characteristics. **RESULTS:** The characteristics of the 38 participants (29 women, 9 men) that completed the baseline assessments to date were: age = 79±7 yrs (♀78±7; ♂80±7), body mass = 75±16 kg (♀73±13; ♂85±23), height = 157±10 cm (♀154±8; ♂168±6), body mass index = 31±6 kg/m² (♀30±5, ♂30±7), waist circumference = 103±13 cm (♀101±11; ♂109±19); A1C = 7±1% (♀7±1; ♂6±1), non-fasting blood glucose = 140±47 g/dL (♀135±5; ♂157±30), systolic = 140±19 mmHg (♀139±18; ♂145±20) and diastolic blood pressure = 78±10 mmHg (♀78±10; ♂78±10). Their physical characteristics presented in Table 1 indicate frailty (e.g. chair stands ≤8, grip strength ≤ 21, ♂32 kg, and gait velocity ≤ 80cm/s). **CONCLUSION:** The results indicate that at baseline the participants had high prevalence of obesity (abdominal and total), low levels of glycemic control, borderline high blood pressure, and have low levels of physical function that are indicative of frailty.

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Table 1. Characteristic of the physical function baseline characteristics of older Hispanics with DM2

	Variables	Total (n=38)	Women (n=29)	Men (n=9)
Muscle strength	Chair test (rep)	8±4	8±4	8±5
	Handgrip (kg)	21±6	19±5	29±5
Balance (Force plate)	A95 -EO (cm ²)	5.1±3.3	5.2±3.4	5.0±3.0
	A95 -EC (cm ²)	7.9±5.8	7.9±6.0	7.5±5.3
	VA-EO (cm/s)	3.9±0.8	3.8±0.7	4.0±1.1
	VA-EC (cm/s)	4.9±2.1	4.6±1.3	5.7±3.5
Gait (GaitRite®)	Velocity (cm/s)	81±22	78±24	89±15
	CP (steps/min)	99±12	99±13	100±10
	SL (cm)	48±9	47±10	53±5

Note: A95: Area 95 - Eyes Open and Closed; VA: Velocity Average - Eyes Open and Closed; CP: Cadence Preferred; SL: Step Length (mean right and left); Data are presented as mean±SD

3890 Board #207 May 30 9:00 AM - 10:30 AM
Substrate Utilization Differences Between Overweight And Obese Men And Women During Exercise

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 (No relevant relationships reported)

As exercise intensity and duration increase, substrate utilization typically shifts to carbohydrates over fats. However, individuals with higher levels of adiposity have been shown to rely more heavily on fat oxidation during higher intensity exercise than their lean counterparts. Currently, there is limited research on how carbohydrate and fat oxidation differ in men compared to women at different exercise intensities.

PURPOSE: To examine the difference in substrate utilization of fat and carbohydrate between men and women at different exercise intensities. **METHODS:** Participants (n=34) between 18-55 years old (Women: 35.9 +/- 11.3 years; Men: 36.1 +/- 7.7 years) with a BMI between 27-35 kg/m² (Women: 30.5 +/- 1.7 kg/m²; Men: 30.6 +/- 2.2 kg/m²) completed a modified Bruce protocol on a treadmill for measurement of an estimated VO2Max at their age-predicted heart rate max. To be included in the analysis these participants were required to reach 85% age predicted heart rate max.

RESULTS: Women utilized a higher (p≤0.05) percentage of fat at 65% (Women: 42.9 ± 16.9%; Men: 24.8 ± 17.7%), and 80% (Women: 14.7 ± 18.2%; Men: 2.7 ± 7.95%) of their VO2Max and greater (p≤0.05) usage of overall Kcal from fat per kg of body mass at 80% (Women: 0.02 ± 0.02kcalF/kg; Men: 0.01 ± 0.01 kcalF/kg) of VO2Max. Men relied more heavily (p≤0.05) than women on carbohydrates per kg of body mass at 50% (Women: 0.03 ± 0.02kcalC/kg; Men: 0.06 ± 0.03kcalC/kg), 65% (Women: 0.07 ± 0.03kcalC/kg; Men: 0.13 ± 0.06kcalC/kg) and 80% (Women: 0.16 ± 0.08kcalC/kg; Men: 0.26 ± 0.08kcalC/kg) of VO2max. **CONCLUSIONS:** Women oxidized more fat than men at 65% and 80% VO2Max, but not 35% and 50% VO2Max. As exercise intensity increased, the gap between women and men fat oxidation levels became larger. **Funding:** Montana State University Research Initiative 51040-MUSRI2015-03 and USDA-NIFA 2017-67018-26367.

3891 Board #208 May 30 9:00 AM - 10:30 AM
Whole-body Electromyostimulation Enhances Submaximal Performance And Leg Fatigue In Obese Women After Bariatric Surgery

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 (No relevant relationships reported)

Bariatric surgery (BS) is the most effective treatment for morbid obesity. Early rehabilitation strategies may be able to improve functional capacity (fc) and body composition that are impaired after the surgical procedure. In this sense, the whole-body electromyostimulation (WB-EMS) added to dynamic exercises may enhance the benefits for this population.

PURPOSE: To evaluate if WB-EMS would enhance dynamic exercises on fc, dyspnea and leg fatigue, and body composition

METHODS: Randomized double-blind controlled clinical trial. Twenty-six obese women (37±7years; BMI=37±4 kg/m²) were randomized after bariatric surgery into two groups (WB-EMSG, n=13; ShamG, n=13). Before and after training protocol, the patients performed body composition analysis (Inbody 720) and the two minutes step test (2MST) for functional capacity evaluation with portable ergospirometer (Oxycon Mobile®), with borg scale evaluation for effort perception. The WB-EMS (Miha

Bodytec) was applied at motor level (endurance training: 3x/week; frequency=85Hz, pulse duration=350 μ s, cycle on=6"; cycle off = 4"; strength training: 2x/week; frequency= 30Hz, pulse duration= 350 μ s, cycle on = 4"; cycle off = 10"), associated with dynamic exercises during 30 days, one week after BS. The ShamG performed the same exercises, but with the electric current turned off. After confirmation of normal data distribution (Shapiro-Wilk) a two-way ANOVA was performed ($p < 0.05$).

RESULTS: Weight loss was similar between groups after the intervention ($p < 0.002$), and higher values of up and down cycles were observed (WB-EMSG pre: 47, post: 57 vs ShamG pre: 44, post: 54; $p < 0.001$) and relative $\dot{V}O_2$ (WB-EMSG pre: 11.3, post: 14.1 vs ShamG pre: 10.3, post: 13.5; $p < 0.001$) (2MST) in both groups after the intervention. In addition, we observed lower values of ventilation per minute (pre: 37.1, post: 32.7, vs pre: 43.7, post: 45.4, $p = 0.002$) and leg fatigue (pre: 1.0, post: 0.79 vs pre: 1.9, post: 1.8, $p = 0.01$) at the 2MST peak in WB-EMSG compared to ShamG, respectively.

CONCLUSIONS: Early intervention composed of WB-EMS and dynamic exercises improved minute ventilation and leg fatigue in 2MST, which may reflect in a faster and quality recovery for these patients.

3892 Board #209 May 30 9:00 AM - 10:30 AM
PREDIABETES PHENOTYPE DOES NOT EXACERBATE MICROVASCULAR INSULIN SENSITIVITY IN METABOLIC SYNDROME

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Metabolic syndrome (MetS) and elevated glucose each promote microvascular dysfunction. Whether in combination these two conditions create increased dysfunction is not clear. Here, we tested whether glucose status worsens microvascular insulin sensitivity in MetS. Thirty-two sedentary, obese adults (54.2 \pm 1.2yrs; 35.9 \pm 1.3kg/m²; VO_{2max} : 19.9 \pm 1.3ml/kg/min) with MetS (≥ 3 ATP III criteria) were classified as normal glucose tolerant (NGT, n=8; 6F), impaired fasting glucose (IFG; n=10; 7F) or IFG+IGT (n=14; 11F) according to ADA criteria using a 75g OGTT. Capillary perfusion (microvascular blood volume, MBV), filling rate (microvascular flow velocity, MFV) and blood flow (MBF=MBV*MFV) were assessed as the change before and after a 2hr euglycemic-hyperinsulinemic clamp (90mg/dl, 40mU/m²/min) using contrast enhanced ultrasound. Glucose infusion rate (GIR) was used to determine metabolic insulin sensitivity while carbohydrate oxidation (CHO_{ox}) was measured before and after the clamp to understand nutrient utilization. T-tests, repeated measures ANOVAs and correlations were used when appropriate. Significance was accepted as $P \leq 0.05$. There were no differences in age, BMI, VO_{2max} or GIR (NGT: 2.26 \pm 0.48 vs. IFG: 2.66 \pm 0.46 vs. IFG+IGT: 1.91 \pm 0.37mg/kg/min, $P=0.44$) among groups. Insulin did not stimulate capillary perfusion (NGT: 0.16 \pm 0.19 vs. IFG: -0.02 \pm 0.14 vs. IFG+IGT: 0.08 \pm 0.12AI, $P=0.40$), filling rate (NGT: 0.006 \pm 0.005 vs. IFG: 0.003 \pm 0.004 vs. IFG+IGT: 0.004 \pm 0.004sec⁻¹, $P=0.11$) or blood flow (NGT: 0.02 \pm 0.02 vs. IFG: 0.01 \pm 0.01 vs. IFG+IGT: 0.01 \pm 0.01AI/sec, $P=0.21$). CHO_{ox} was likewise unresponsive to insulin ($P=0.34$). Although age, BMI, fasting and 2hr glucose concentrations did not relate to insulin effects on microvascular function, fasting triglycerides was related to insulin-stimulated MBF ($r=-0.39$, $P=0.03$). Prediabetes phenotype does not worsen microvascular insulin sensitivity in adults with MetS. Future work is warranted to examine the effects of different therapies (lifestyle, medication) on microvascular function.

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3893 Board #210 May 30 9:00 AM - 10:30 AM
Elevated Circulating Asprosin Impedes Low Intensity Exercise-induced Weight Loss In Obese Individuals

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(No relevant relationships reported)

PURPOSE: Circulating Asprosin is elevated in obese men and mice and mainly produced in white adipose tissue (WAT) to trigger hepatic glucose release into the bloodstream maintaining energy standards between meals, and hence has been suggested as pharmaceutical target to battle obesity and T2D. We hypothesized a mechanistic link to the empirical observation, why a predominant part of obese individuals mainly fail to lose depot-stored body fat despite their commitment to participate in aerobic exercise programs, and followed the research

question if stress induced secretion of Asprosin during aerobic exercise counteracts the metabolic consumption of body fat through stimulating insulin triggered refueling of WAT.

METHODS: After overnight fasting 7 obese men and women (age 59.7 \pm 5.6; BMI 40.2 \pm 8.4) and 7 age and sex matched lean counterparts (age 59.5 \pm 5.2; BMI 22.9 \pm 1.5) performed a treadmill protocol for 25 min at 90% of an individual's VT1 and RQ of ≤ 0.82 (controlled and adjusted if needed) to ensure that body fat as energy source was used. Venous blood samples (pre-, post-, +30 min post-, and +60 min post-exercise) were drawn to analyze Asprosin, Cortisol, Proinsulin, and acetylated Ghrelin using commercial ELISA kits.

RESULTS: Asprosin baseline data were significantly increased in obese compared to lean subjects ($p=0.013$) and further raised significantly during the course of the exercise trial only in obese. Stress marker Cortisol was comparable between groups at baseline ($p=0.38$) but significantly augmented in corpulent participants only, while it significantly decreased in lean subjects during the exercise test. Proinsulin increased significantly from baseline to +30 min post-exercise in obese ($p=0.013$) but remained unaffected in normal weight subjects ($p=0.99$) while their baseline data were comparable ($p=0.06$). Hunger hormone Ghrelin was already significantly increased at baseline in obese vs. lean subjects ($p=0.015$) but raised even significantly further in obese at +30 min post-exercise vs. baseline.

CONCLUSIONS: The stress induced aberrant hormone reaction of obese individuals counteracts the metabolic consumption of body fat through stimulating the refueling of WAT. This observation helps to explain the difficulty of obese persons to lose excess body fat when performing low intensity exercise.

3894 Board #211 May 30 9:00 AM - 10:30 AM
Associations Of Dietary Acid Load On Physical Function And Body Composition In Older Obese Adults

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Acid-base balance affects muscle quality in older adults leading to less muscle mass and strength. Individuals with knee osteoarthritis (OA) have less muscle mass and strength. It is unknown if OA's effect on function and strength is mediated by acid-base balance.

Purpose: This study examined associations between dietary acid production, physical function, muscle strength, and body composition in older obese adults with knee osteoarthritis. Higher acid load is hypothesized to be associated with lower physical function, strength and lean body mass (LBM).

Methods: Baseline data from the Intensive Diet and Exercise for Arthritis (IDEA) trial were used for this analysis. Measurements from IDEA included a 3-day food record to calculate daily potential renal acid load (PRAL) PRAL, 6-min walk distance, LBM via dual energy x-ray absorptiometry, and concentric knee extensor and flexor strength. Estimated potential renal acid load (PRAL in mEq H⁺ ions) = (0.49*mg protein) + (.037*mg phosphorus) - (.021*mg potassium) - (.026*mg magnesium) - (.013*mg calcium). Associations were determined by Pearson correlations.

Results: Data obtained from 388 participants (age=65.8 \pm 6.1 yrs; 70.4% female; body mass index=33.7 \pm 3.8 kg/m²) were used in the analysis. Mean values were: PRAL score (8.9 \pm 13.8 mEq/d); LBM (56.0 \pm 12.0 kg); 6-min walk distance (476.5 \pm 82.6 m); concentric knee extensor (60.2 \pm 26.0 Nm) and knee flexor (30.2 \pm 14.7 Nm) strength. PRAL showed significant positive associations with concentric knee extensor strength ($r=.19$; $p=.011$), knee flexor strength ($r=.19$; $p=.012$), and LBM ($r=.22$, $p<.001$).

Conclusion: The physiological importance of the statistical relationship observed for high PRAL (higher acid load) and high physical function and knee extensor and flexor strength, although minimal ($r \sim .2$), opposes our hypothesis. These discrepant findings may be from using an indirect measure acid production, presence of OA in this cohort, and the accuracy of self-reported dietary records.

3895 Board #212 May 30 9:00 AM - 10:30 AM
Obese Pediatric Youth Have A High Rate Of Adult Criminal Behavior And Low Rates Of Home Ownership That Is Not Linked To Pediatric Fitness

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Purpose: Pediatric obesity has been linked to negative social outcomes in childhood. Minimal information is known about social outcomes in adulthood for obese pediatric patients and if they are linked with pediatric fitness. **Methods:** A retrospective chart review was performed evaluating all pediatric (<18 year old) youth with obesity who presented to the HealthWorks! pediatric weight management program from 1999-2009 and had a formal cardiopulmonary exercise testing (CPET), which was a requirement for clinic enrollment. Demographic and public record collection including body habitus, death records, real estate transactions and criminal conviction history was collected with baseline data compared to published lifetime criminal prevalence (Shannon SKS, et al, *Demography* 2017) and home ownership rates (US Census). Statistical analysis was performed using JMP®, Version 14 with differences between groups assessed using an unpaired t-test where a p-value <0.05 was considered significant. **Results:** A total of 719 pediatric youths with obesity (12.2±2.9 years) performed exercise testing with all patients now adults (28.5±3.7 years). There was a 1.5% mortality rate (11/719), and mortality was not associated with body habitus or any CPET parameter. Only 28.6% (206/719) of patients were able to complete a maximal effort CPET. On review of the criminal records, 9.7% (70/720) of these young adult patients were convicted of a felony compared to ~6% lifetime prevalence in Ohio during this period of time (p=0.004). There was no difference between incarceration rates of these now adult pediatric youths with obesity and the reported lifetime prevalence in Ohio (3.6% vs 3%, p=0.5). In addition, 14.7% (106/719) of study patients purchased a home in adulthood compared to 56.8% of Midwest adults <35 years of age (p<0.0001). Inability to complete a maximal effort CPET was associated with age, weight and future home ownership. History of criminal conviction was not associated to any study parameter. **Conclusions:** Children with obesity have higher social risk than their peers in adulthood as evidenced by higher rates of criminal behavior and lower rates of home ownership. Pediatric patients with obesity have low rates of exercise test completion and pediatric exercise capacity is not associated with mortality or social outcomes.

3896 Board #213 May 30 9:00 AM - 10:30 AM
No Association Of Weight Gain Since Age 20 With Cardiorespiratory And Muscular Fitness

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Substantial exercise-induced weight loss is unachievable by many people. With no dietary modifications, a person of average size and fitness requires 60+ hours of moderate intensity exercise to lose 5 kg of fat. Individuals who are overweight or obese might not have the cardiorespiratory and muscle health necessary for successful exercise-induced weight loss, but it has yet to be determined if individuals with different patterns of weight gain (gradual vs fluctuation vs rapid) have different cardiorespiratory and muscle health levels.

PURPOSE: This pilot study's aim was to determine if weight gain since the age of 20 and recent weight history is related to current cardiorespiratory and muscular fitness. **METHODS:** A retrospective health and weight history questionnaire was completed by 23 overweight and obese, but otherwise healthy adults (47.42 ± 9.75 yrs, BMI 29.70 ± 3.36). Weight gain since age 20 and weight history (loss & gain) in the previous 5 years were self-reported. Total fat and lean mass, cardiorespiratory fitness, and skeletal muscle strength were determined through dual energy x-ray absorptiometry, metabolic gas analysis during a graded exercise test, and upper and lower body strength measurements. **RESULTS:** Participants had an average body fat of 39.2 ± 5.4% having gained 9.3 ± 4.4 kg since the age of 20 years. Maximal oxygen consumption was 2.18 ± 0.5 L/min. No relationship existed between percentage of weight gain since 20 (25.96 ± 11.10%) and current maximal oxygen consumption (r = -0.08). **CONCLUSIONS:** Based on this pilot data it does not appear that fitness determines weight gain after age 20. Future studies will determine if type of weight progression over time (e.g. gradual vs fluctuation) and weight loss history are related to cardiorespiratory and/or muscular fitness and if fitness can predict success in exercise-induced weight loss programs in overweight or obese individuals.

3897 Board #214 May 30 9:00 AM - 10:30 AM
Differences In Exercise Behaviors By Diabetes Status: Implications For Diabetic Americans

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Background:In Kansas, 10% of adults have type one or type two diabetes (T1D, T2D). Although Federal physical activity (PA) guidelines including aerobic and strength training exercises are recommended for T2D; guidelines lack for T1Ds. A better understanding of differences in exercise behaviors amongst between populations is needed. **Purpose:**This study compared exercise behaviors of T1D, T2D, and non-diabetics (ND). **Methods:**Male (n=68) and female (n=267) participants ages 18-64 were recruited via social media (e.g. Facebook, Instagram) and newsletters and indicated consent prior to participation in the online survey. Data were collected for demographics, anthropometrics, diabetes status, and exercise (PA) behaviors. One-way ANOVAs, with Games-Howell post hoc tests were used to determine differences in aerobic activity and strength training between T1D, T2D, and ND participants. **Results:**Participants included 48 T1Ds, 24 T2Ds, and 240 NDs. Statistically significant differences existed for moderate aerobic PA between groups, $f(2,304)=3.9$, $p=0.021$, where T2D reported fewer weekly minutes (109.2±88.8) than ND (215.7±186.5; $p=0.021$). T1D (179.0±171.7) were not significantly different. No significant vigorous PA differences were found ($p=0.242$; T1D=66.3±80; T2D=41.7±60.5; ND=73.8±94.8 min/week). Strength training days/week differed between groups, $f(2,314)=3.6$, $p=0.028$ with T1D (1.8±2.0) reporting significantly more than T2D (0.7±1.0; $p=0.024$); no significant differences for ND (1.5±1.7). **Conclusion:**Although statistically similar to T2D/ND, T1D's mean moderate activity was over the recommended 150 min/week. T1D did report significantly more strength training days/week than T2D approaching recommended 2 days/week. Participants' most popular PAs were walking (51%), and strength training (18%), thus Kansans should consider walking and strength training exercises.

3898 Board #215 May 30 9:00 AM - 10:30 AM
Montmorency Tart Cherries Influence The Urinary Metabolome But Not Vascular Function In Healthy Individuals

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There is accumulating evidence that Montmorency tart cherry (MC) polyphenols possess vasomodulatory properties and their intake has been shown to reduce a number of cardiovascular risk factors. Despite this our understanding of the overall mechanisms of action and compounds that exert these benefits has yet to be fully elucidated.

Purpose: The aim of this study was to characterise the effects of 4-week MC supplementation on vascular function in healthy adults and provide potential mechanistic evidence from urinary metabolite profiling. **Methods:** Twenty three healthy non-smoking individuals took part in a study in which they consumed either 30 mL of MC concentrate or an isocaloric placebo (PLA) bi-daily for 4 weeks. The study employed a randomised, double-blind, placebo-controlled, parallel design; mean ± SD age was 25 ± 4 years in the MC group (n = 12) and 22 ± 2 years in the PLA group (n = 11). Blood pressure, arterial stiffness (pulse wave velocity and digital volume pulse) were measured pre- and post- supplementation. Spot urine samples were also collected at the corresponding time points to determine the effect of the intervention on the urinary metabolite profiles. **Results:** There were no differences in blood pressure or arterial stiffness following the 4-week supplementation with MC compared to PLA. However, metabolite profiling highlighted changes to the urinary metabolome following MC consumption ($P < 0.001$ within and between groups). Several discriminatory metabolites of interest were putatively identified as metabolites of the tryptophan and histidine pathways. **Conclusions:** These findings suggest that bi-daily MC supplementation for 4-weeks has no influence on blood pressure or arterial stiffness in healthy individuals, but does exert distinct metabolic changes. Specifically, MC concentrate appears to influence amino acid metabolism which warrants further investigations.

3899 Board #216 May 30 9:00 AM - 10:30 AM

Traditional Intervention Versus Nutritional Coaching: Which Approach Was More Efficient In Health Promotion?Ana Paula Troccoli Noronha, Luciana Oquendo Pereira-Lancha, Danielle Kallas, Paula Helena Dayan-Kanas, Antônio Herbert Lancha Jr.. *Universidade de São Paulo, São Paulo, Brazil.**(No relevant relationships reported)***Traditional Intervention Versus Nutritional Coaching: Which Approach Was More Efficient In Health Promotion?**

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The worldwide prevalence of overweight and obesity has shown a rapid and progressive increase in the last decades, being characterized as a true world epidemic. In attempt to reduce it, a lot of new diets has been proposed in recent years as strategies for weight loss. However, studies report that 95% of overweight people fail in the maintenance of weight loss diets and then regain part of this weight later. In this context, new approaches such as nutritional coaching, oriented towards behavior change, assume an increasingly important role, specifically in its application to the nutrition sciences. **PURPOSE:** This study aimed to analyze the effectiveness of the use of coaching techniques in health parameters such as body weight, fat mass and waist circumference in physically active women, overweight, pre menopausal, compared to the traditional model of diet prescription. **METHODS:** 10 participants were assigned to the Nutritional Coaching group (NC; n=5), which received weekly care, or Traditional Group (TG; n=5), which received monthly care, for a 3 months intervention study. The physical activity protocol was composed by 40 minutes of resistance training and 20 minutes of treadmill. An individual diet plan was established to create an energy deficit of 750 kcal per day. **RESULTS:** The average of weight loss in NC group was 4.02 kg, in comparison to TG group (1.46 kg). The average of fat mass loss in the NC group was 4.02 kg in comparison to TG group (2.38 kg). Finally, the average of the reduction in waist circumference in the NC group was 4.5 cm in comparison to the TG group (2.0 cm). **CONCLUSION:** Nutritional Coaching was effective in promoting weight loss, improving body composition and reducing waist circumference. Nutritional coaching has effective tools that can be used by health professionals to help in promoting behavior change and, consequently, weight loss.

3900 Board #217 May 30 9:00 AM - 10:30 AM

Dietary Intake Is Associated With Ankle-brachial Index, Inflammation, And Ambulation In Peripheral Artery Disease PatientsPolly Montgomery¹, Ming Wang¹, Biyi Shen¹, Ana Casanegra², Federico Silva- Palacios³, Allen Knehans³, Andrew Gardner¹.¹Penn State COM, Hummelstown, PA. ²Mayo Clinic, Rochester, MN. ³OUHSC, Oklahoma City, OK.*(No relevant relationships reported)*

The aims of this study were (a) to determine whether the daily dietary intake of nutrients by patients (pts.) with peripheral artery disease (PAD) met recommended levels for adults 50 years or older, and (b) to determine whether meeting recommended levels of nutrients was associated with ankle-brachial index (ABI), inflammation, and ambulation of PAD pts. **Methods:** 48 pts. were assessed on their dietary intake of 20 nutrients during a three-day period. Pts. were also characterized on demographic variables, comorbid conditions, cardiovascular risk factors, ABI, 6-minute walk distance, and high-sensitivity C-reactive protein (hsCRP). **Results:** Few pts. met the daily recommended intakes for calcium (4%), fiber (6%), vitamin E (6%), trans fatty acids (13%), vitamin A (15%), total sugars (19%), potassium (23%), sodium (29%), saturated fat (29%), and vitamin C (31%), and none of the pts. met the daily recommended intake of vitamin D (0%). Overall, pts. met few of the 20 dietary recommendations. Only 17 of 48 pts. met more than 7 of the recommendations. The ABI regression model adjusted for age, sex, race, smoking, hypertension, dyslipidemia, body mass index, and percentage body fat, total sugars was the only significant predictor ($p < 0.001$) as pts. who did not meet the recommendation had lower ABI values. The hsCRP adjusted regression model, omega-3 polyunsaturated fatty acids ($p = 0.001$) was the strongest significant predictor, indicating that those who did not meet the recommendation had higher hsCRP values. Finally, the 6-minute walk distance adjusted regression model, folate ($p = 0.011$), and dietary score index ($p = 0.014$) were significant predictors, as those who did not meet the recommendation for folate and those who met five or fewer of the 20 recommendations had shorter 6-minute walk distances. **Conclusions:** PAD pts. consume a low nutrient dense diet that is deficient in many vitamins, calcium, fruits, and vegetables, and contains too much added sugar, saturated and trans fats, and processed foods. Additionally, more severe PAD, greater inflammation, and ambulatory dysfunction are independently associated with aspects

of a low nutrient dense diet, such as too much intake of added sugars, low intake of omega-3 polyunsaturated fatty acids and folate, and only meeting the recommended intakes of five or fewer nutrients.

3901 Board #218 May 30 9:00 AM - 10:30 AM

The Superoxide Scavenger And Antioxidant, L-Propionyl-carnitine, Is Metabolically Enhanced Following Exercise In HypoxiaGareth W. Davison¹, Maria Vinaxia², Rose McGovern¹, Anna Novials³, Xavier Correig², Conor McClean¹. ¹Ulster University, Belfast, United Kingdom. ²Rovira i Virgili University, Tarragona, Spain. ³Hospital Clinic de Barcelona, Barcelona, Spain.

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L-Propionyl-carnitine, a propionyl ester of L-carnitine, is known to scavenge the superoxide anion, inhibit lipid peroxidation, and protect against H₂O₂-induced DNA strand scission. While exogenous L-propionyl-carnitine supplementation modulates lipid peroxidation in humans, the endogenous metabolic response following exercise is currently unknown. **PURPOSE:** To investigate the metabolic profile of L-propionyl-carnitine following exercise in hypoxia. **METHODS:** Twenty-four ($n=24$) apparently healthy male participants were recruited (age 28 ± 5 years; mass 74 ± 8 kg; stature 177 ± 6 cm; $_{2max}$ hypoxia 45 ± 2 ml·kg⁻¹·min⁻¹; normoxia 60 ± 9 ml·kg⁻¹·min⁻¹), and completed 1 hr of exercise at a workload corresponding to 75% of pre-determined $_{2max}$ in hypoxia ($F_{iO_2} = 0.16\%$), and repeated in normoxia ($F_{iO_2} = 0.21\%$). Serum L-propionyl-carnitine was quantified using a LC ESI-qTOF-MS untargeted metabolomics approach at pre-, post-exercise and 3 h post-exercise (Recovery). **RESULTS:** Exercise performed in hypoxia and normoxia independently increased L-propionyl-carnitine metabolism ($p < 0.05$, pre vs. post-exercise), and hypoxia *per se* did not induce a selective metabolic change when compared to normoxia ($p > 0.05$). Recovery from exercise was similar for both hypoxia and normoxia ($p < 0.05$, post vs. 3 hrs post-exercise). There was a main effect for time observed for pooled hypoxia and normoxia values (pre vs. post-exercise vs. 3 hrs post-exercise, $p < 0.05$). **CONCLUSION:** This is the first data to show a metabolic response in L-propionyl-carnitine following exercise. As such, we propose the increased mobilisation of L-propionyl-carnitine may be beneficial to counteract deleterious free radical production and protect against vascular exercise-induced oxidative stress.

3902 Board #219 May 30 9:00 AM - 10:30 AM

Diets High In Fish And Sugar-sweetened Beverages Affect Energy Expenditure And Energy Balance.Cassie M. Mitchell, Paolo Piaggi, Jonathan Krakoff, Susanne B. Votruba. *National Institutes of Health, Phoenix, AZ.*

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BACKGROUND: Recent evidence indicates that dietary patterns, independent of macronutrient and total calorie consumption, alter body weight. This implies an effect of dietary pattern on 24-hour energy expenditure (24hrEE) and energy balance (EnBal). **PURPOSE:** To evaluate whether a 12-week weight maintaining, macronutrient stable dietary intervention that varies only by meat, fish or sugar sweetened beverages (SSBs) consumption alters 24hrEE and EnBal. **METHODS:** 32 healthy males were recruited to participate in a 12-week in-patient study and were randomized to a weight-maintaining dietary intervention that contained a varying combination of meat, fish or SSBs in a factorial design. Macronutrient composition across all dietary intervention groups was: 50% carbohydrate; 30% fat; and 20% protein. Twenty-four hour EE and EnBal were measured in a human metabolic chamber (e.g. room calorimeter). All measurements were performed at baseline and week 12. Descriptive statistics and analyses of co-variance were performed to characterize participants at baseline and quantify the changes in 24hrEE and EnBal over time. **RESULTS:** 28 males (age: 46.6 ± 10.4 years; body mass index 26.9 ± 4.1 kg/m²; predicted energy needs: 2311 ± 241 kilocalories/day [kcal/d]) completed all measurements. Fish consumption resulted in higher 24h EE by 127.4 ± 51.4 kcal/d compared to no fish consumption ($p = 0.0217$). SSB consumption had a 24hEE that was 136.3 ± 52.4 kcal lower ($p = 0.0166$). Approximately 85% of the decrease in 24hEE with SSB consumption was due to lower awake, inactive EE ($p = 0.0003$) and had greater 24hr EnBal when compared to groups without SSBs ($p = 0.0489$). **CONCLUSION:** Our data indicate that protein and carbohydrate quality (as reflected by fish versus SSB consumption), rather than % daily intake, influence 24hr EE and inactive EE, and thus EnBal. If so, this would imply a metabolic effect of SSB consumption independent of total calories or macronutrient composition that might contribute to overall increasing adiposity rates. Supported by intramural funding from NIDDK.

3903 Board #220 May 30 9:00 AM - 10:30 AM

Energy Balance During The Postpartum Period Is Associated With Metabolic Adaptation

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Previous studies have demonstrated that perturbations in body weight result in modified resting metabolic rate (i.e. metabolic adaption) that attempts to return the body to its customary weight (i.e. the set-point theory). How body weight changes during pregnancy impacts resting metabolic rate (RMR) and subsequently affects the ability to return to pre-pregnancy weight postpartum has not been investigated. **PURPOSE:** To examine if metabolic adaptation occurs during the postpartum period. **METHODS:** RMR and body composition were measured after an overnight fast in 26 women (mean age 34, range 26-40; mean BMI 28.1 ± 6.0 kg/m²) at 3, 6, 9 and 12 months postpartum. Energy balance over the postpartum period was calculated as the sum of the change in both fat mass (FM) and fat-free mass (FFM) multiplied by their respective energy densities. The ratio of RMR to FFM was used to assess the degree of metabolic adaptation. The degree of linearity between weight change and energy balance with metabolic adaptation was assessed using Pearson correlation. **RESULTS:** Weight loss (mean weight loss: -3.4 ± 3.6 kg) was positively associated ($\rho = 0.4$, $p = 0.03$) with metabolic adaptation (mean RMR/FFM: 31.8 ± 2.8 kcal/d/kg). Total energy balance (mean energy balance: -28719 ± 29546 kcal) was positively associated ($\rho = 0.5$, $p = 0.01$) with metabolic adaptation, indicating that a greater negative energy balance is associated with a lower resting metabolic rate relative to metabolically active fat-free mass (i.e. a greater metabolic efficiency). This relationship was independent of whether or not women had returned to their pre-pregnancy (i.e. set-point) body weight. **CONCLUSION:** The acute perturbation in body weight away from the set-point as a result of pregnancy contributes to the presence of metabolic adaptation during the postpartum period. The increase in metabolic efficiency in relation to greater weight loss during this time may contribute to difficulty in continuing to lose weight, or maintaining lost weight, after childbirth.

3904 Board #221 May 30 9:00 AM - 10:30 AM

Cardiovascular And Metabolic Responses Of US Army Soldiers During Heavy Military Rucksack Carriage

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Military leaders require accurate information on the physiological stress induced by modern equipment loads in order to optimize planning for dismounted operations. **PURPOSE:** Evaluate the effects of heavy rucksack loadings on physiological responses of Soldiers during incremental treadmill walking. **METHODS:** Six male US Army Soldiers (age, 20 ± 1 years; height, 176 ± 6 cm; body mass (BM), 74 ± 5 kg) performed incremental treadmill walking while unloaded and carrying three proportional rucksack loads (22, 44, and 66% of BM). Treadmill speed was initially set at 4.2 km/h for 3 min then increased by 0.3 km/h every 2 min. Tests were terminated if volunteers completed the highest treadmill speed (7.1 km/h), reached volitional fatigue, or if their respiratory exchange ratio (RER) exceeded 1. Volunteers wore a chest-strap heart rate monitor and breathed into a metabolic cart that measured oxygen consumption. **RESULTS:** Volunteers completed all walking speeds while unloaded (7.1 km/h). While speed did not decrease significantly when carrying 22% BM (6.9 ± 0.3 km/h; $p = 0.09$); volunteers finished at significantly slower speeds when carrying 44% BM (6.2 ± 0.5 km/h; $p = 0.01$) and 66% BM (5.5 ± 0.6 km/h; $p < 0.01$). Peak heart rate during the unloaded walk ($133 \pm$ bpm) was significantly lower than load carriage with 22% BM (157 ± 12 bpm; $p < 0.01$), 44% BM (162 ± 14 bpm; $p < 0.01$), and 66% BM (161 ± 16 bpm; $p < 0.01$). Peak oxygen consumption for the unloaded walk (1.85 ± 0.23 L/min) was significantly lower than when carrying 22% BM (2.25 ± 0.36 L/min; $p = 0.02$) but not 44% BM (2.27 ± 0.55 L/min; $p = 0.09$) or 66% BM (2.40 ± 0.65 L/min; $p = 0.06$). **CONCLUSION:** Heavy military rucksack loads severely impair marching pace and induce considerable cardiovascular and metabolic stress. Our results provide preliminary evidence that heart rate may be a superior work intensity indicator than oxygen consumption for Warfighter tasks. The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

3905 Board #222 May 30 9:00 AM - 10:30 AM

Measured And Estimated Energy Cost Of Sedentary And Active Activities

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Physical inactivity represents a public health problem in an endemic obesity scenario worldwide. Therefore, it is relevant to estimate the energy cost of daily activities for nutritional and physical activity assessment and guidance. **PURPOSE:** To measure the energy expenditure (EE) of sedentary (typing) and daily activities (organizing bookshelves, climbing up and down stairs and walking for pleasure and exercise) and to compare the results with the ones estimated from the Compendium of Physical Activities (CAF) and FAO/WHO tables. **METHODS:** Data are from 80 adult subjects (age ≥ 20 years) from a larger study measuring total daily EE by various methods (accelerometry and double-labeled water) participated in the study. EE was measured with a portable calorimeter during resting (MET), typing, standing, arranging books on a shelf, going up and down stairs (8 floors) and walking on the treadmill at three speeds (for pleasure, pleasure - 0.8 km/h, and exercise) on different visits to the laboratory. Basal metabolic rate (BMR) was also measured early in the morning with the subjects in the fasting state after 8hr sleep. BMR and MET values were used to estimate EE by CAF and FAO/WHO tables. Anthropometric and % body fat (%BF, DXA) assessment was also obtained. **RESULTS:** The mean (SD) age was 29.9 (10.4) years with a mean BMI of 23.8 (3.8) kg/m² and %BF of 30.0 (8.8). The EE (kcal/min) of typing was 1.41 (0.48) and it was the only nonsignificantly different value in comparison to either method of estimation. The EE of going up stairs was underestimated by 3.01 (1.69) kcal/min by both methods. **CONCLUSIONS:** Based on the measured values, it can be concluded that the values described in the CAF or FAO/WHO overestimate the EE, except for the sedentary activity of typing, even when BMR or MET are measured. Health professionals should be aware of the inaccuracy of their activity EE of daily activities. **FUNDING:** CNPq (310461-2016-20 and FAPERJ (E-26/202.514/2018; E-26/203.068/2017)

3906 Board #223 May 30 9:00 AM - 10:30 AM

Assessment Of Metabolic Responses To Exercise In Elite Professional Cyclists Using High-throughput Metabolomics

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The field of sports medicine and performance has benefited from the implementation of innovative strategies to study physiological responses to exercise in elite athletic populations. Over the last decade, the field of metabolomics has emerged as a powerful tool to precisely measure multiple metabolic pathways at the cellular level, fostering great strides in many fields. Therefore, the possibilities of deploying metabolomics to the field of sports medicine and performance offers tremendous opportunities to improve understanding of metabolic responses to exercise. **PURPOSE:** To evaluate the metabolic responses to exercise in elite professional cyclists using high-throughput mass spectrometry-based metabolomics. **METHODS:** 24 international-level World Tour professional cyclists (PS) performed a graded exercise test to exhaustion on a cycling ergometer. Both prior to and after exercise, 100 μ l of whole blood were collected for metabolomics analysis using high-throughput mass spectrometry-based methodologies developed by our group. Since blood lactate ([La⁻]) concentration is an accurate surrogate for metabolic efficiency (*San-Millan and Brooks, 2018*), cyclists were divided into two groups for multivariate analyses based on a whole blood [La⁻] above or below 5 mmol·L⁻¹ at an exercise intensity of 5 W·kg⁻¹. Group A consisted of 12 cyclists that were all able to pedal beyond this exercise intensity, whereas Group B (n=10) contained only one. **RESULTS:** We observed significant changes between baseline and maximal exercise in glycolytic intermediates, TCA cycle metabolites and amino acids ($p < 0.05$). Group A cyclists showed higher baseline levels of ketogenic amino acid in particular. In addition, this group possessed higher levels of succinate at rest ($p = 0.08$) and lower levels after exercise ($p = 0.06$) showing improved metabolic efficiency. Oxidized glutathione (GSSG) is higher both pre and post-exercise ($p < 0.0001$ and $p < 0.01$, respectively), suggesting increased basal activation of oxidative stress management pathways. **CONCLUSIONS:** High-throughput metabolomics offers an efficient methodology to assess metabolic changes during exercise, as well as the opportunity to identify metabolic parameters that can distinguish cyclists of different performance levels.

3907 Board #224 May 30 9:00 AM - 10:30 AM
Energy Expenditure And Body Composition In Mexican Female Recreational Dancers Of Latin, Zumba, And Twerk

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Caloric surplus has been associated with issues in body composition and weight management. In Mexico, 36% of women over 18 years of age reported performing some type of physical activity (PA). This troubling data are related to the overweight/obesity prevalence among female Mexican adults. Dance like, Latin, Zumba, and Twerk appears as an attractive form of PA for women. However, the effect they may have on energy expenditure and body composition remains unknown.

Purpose

To investigate energy expenditure and body composition in Mexican female recreational dancers of Latin, Zumba, and Twerk.

Method

77 women agreed to participate: Latin, 36, age 32.64 ± 13.16, BMI 24.41 ± 6.53, Zumba, 18, age 42.78 ± 16.55, BMI 26.63 ± 4.92, and Twerk, 23, age, 24.39 ± 5.38, BMI, 22.57 ± 1.45. Inclusion criteria included participation for more than 4 weeks and at least four times per week. Body fat percentage and fat-free mass were calculated bio impedance (BIA). Total Kcal spent during the session were measured with a pedometer. The BMI was calculated using weight and height. The analysis consisted of ANOVA.

Results Based on BMI standards, all (but the Zumba participants) were classified as normal. Body fat percentage: Latin 22.62 ± 7.65, Zumba 27.68 ± 7.86 and Twerk 23.59 ± 4.53 ($p = 0.043$). Fat-free mass: Latin 23.62 ± 7.65, Zumba 23.23 ± 3.92, and Twerk 28.63 ± 9.58 ($p = 0.031$). Total Kcal spent: Latin 62.84 ± 15.47, Zumba 67.22 ± 16.91, and Twerk 32.18 ± 7.90 ($p = 0.000$).

Conclusion

The overweight/obesity prevalence in Mexican women and its health implications have precipitated an increased awareness in the value of exercise prescription and adherence. These preliminary results show that Zumba generates greater energy expenditure. They also reveal that Zumba is more popular among older participants with higher BMI and fat percentage. Future studies should be longitudinal, investigate the effects of intensity of exercise and dietary habits on weight loss, and include participants of other weight classifications and dance fitness classes. Possible limitations include small sample size and unequal sample sizes.

3908 Board #225 May 30 9:00 AM - 10:30 AM
Fuel Use In Boys And Girls During Prolonged Submaximal Exercise

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 (No relevant relationships reported)

Some research has suggested that women may depend more on fat for energy during prolonged exercise compared to men. However, the extent to which this fuel use pattern exists in children is not as well understood. Specifically, the effect of sex on fuel use patterns in children during prolonged exercise is not well-understood. **PURPOSE:** This study examined fat and carbohydrate (CHO) metabolism during the latter half of a 40-minute bout of exercise in boys ($n=9$; 10.8±1.0 years, 148.5±6.7 cm, 46.6±17.2 kg) and girls ($n=10$; 10.6±1.2 years, 140.4±8.3 cm, 37.5±8.6 kg). It was hypothesized that there would be no difference between boys and girls with respect to fuel metabolism during exercise. **METHODS:** Participants reported to the laboratory for two separate visits. On the initial visit, body composition using dual x-ray absorptiometry and $\dot{V}O_{2max}$ were assessed. On the experimental visit, participants completed two 20-minute exercise bouts separated by a 10-minute rest. Bout 1 consisted of 10 minutes at 50% $\dot{V}O_{2max}$ and 10 minutes at 75% $\dot{V}O_{2max}$. Bout 2 consisted of 20 minutes at 50% $\dot{V}O_{2max}$. Fat oxidation rate (FOR) relative to fat-free mass [mg·kgFFM⁻¹·min⁻¹] and carbohydrate oxidation rate (COR) relative to fat-free mass [mg·kgFFM⁻¹·min⁻¹] were measured at 5, 10, 15, and 20 minutes of Bout 2 and averaged. **RESULTS:** There was no difference in $\dot{V}O_{2max}$ between the boys (38.9±8.7 ml·kg⁻¹·min⁻¹) and the girls (37.1±5.6 ml·kg⁻¹·min⁻¹) nor were there any differences in the relative intensity (% $\dot{V}O_{2max}$) during exercise. FOR relative to FFM was 5.3±0.9 mg·kgFFM⁻¹·min⁻¹ in boys and 5.5±1.2 mg·kgFFM⁻¹·min⁻¹ in girls ($p>0.05$). Proportional fat use was 35.9±7.7% in boys and 37.9±8.4% in girls ($p>0.05$). COR relative to FFM was 24.1±4.9 mg·kgFFM⁻¹·min⁻¹ in boys and 23.0±4.2 mg·kgFFM⁻¹·min⁻¹ in girls ($p>0.05$). Proportional CHO use was 64.1±7.7% in boys and 62.1±8.4% in girls ($p>0.05$). **CONCLUSION:** In this age range, boys and girls do not display differences in fat and CHO metabolism relative to FFM during the latter half of a prolonged bout of exercise. Future research should investigate the influence of physical maturity on potential sex differences in metabolism.

This study was supported by the Ball State University ASPIRE Graduate Student grant program.

3909 Board #226 May 30 9:00 AM - 10:30 AM
Serum MOTs-c Concentrations Are Higher In Older Females Compared To Older Males But Is Not Affected By Physical Activity Status Or Cardiorespiratory Fitness In Young And Older Adults

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 (No relevant relationships reported)

Recently, MOTs-c, a mitochondrial-derived peptide with effects on metabolic health, was identified. However, few data exist in humans including factors that affect circulating concentrations. **PURPOSE:** The aim of this study was to discern if serum MOTs-c concentrations were different between physically active and inactive young and older adults, or affected by cardiorespiratory fitness, body composition, hemoglobin A1c (HbA1c), and sex. **METHODS:** Forty-one healthy Young (18 – 30 yrs; $n=26$) and Older (55 – 70 yrs; $n=15$) adults participated in the study. Young and Older groups were further divided into Active and Inactive groups. Serum MOTs-c concentrations, maximum oxygen consumption ($\dot{V}O_{2max}$), body composition, and HbA1c were measured. Independent student's t-tests were performed to determine group mean differences in serum MOTs-c concentrations between: Young and Older groups, Active and Inactive Young, Active and Inactive Older, males and females, Young males and females, and Older males and females. An α -level of ≤ 0.05 was set a priori. Pearson's correlations were performed between MOTs-c concentrations and the following: $\dot{V}O_{2max}$, HbA1c, percent body fat, fat mass, and lean mass. **RESULTS:** There were no differences in serum MOTs-c concentrations between Young and Older subjects, between Active Young and Inactive Young or Active Older and Inactive Older subjects. Serum MOTs-c was also not correlated with $\dot{V}O_{2max}$, percent body fat, lean body mass, fat mass or HbA1c, which were in normal ranges. When sexes were analyzed separately, MOTs-c levels in Older females were significantly higher than Older males (419.9±43.3 vs 354.0±63.7 ng/mL, respectively; $p=0.03$). These findings suggest that circulating MOTs-c concentrations are not affected by physical activity status, cardiorespiratory fitness, body composition, or normal HbA1c in healthy young and older adults, however, vary between sexes in older adults.

3910 Board #227 May 30 9:00 AM - 10:30 AM
A Dietary Assessment Of Mid-Spectrum Chronic Kidney Disease

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BACKGROUND: Diets of adult individuals with mid-spectrum Chronic Kidney Disease (CKD) remain understudied. The 2015-2020 Dietary Guidelines for Americans food patterns based on the Recommended Dietary Allowances (RDA) in concert with the National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF KDOQI) guidelines are advised to individuals with CKD. Estimated glomerular filtration rate (eGFR) remains the best method for tracking CKD progression, yet relationships between self-reported dietary intake and eGFR are understudied. **PURPOSE:** To assess the self-reported dietary pattern in patients with stage 3 or 4 CKD in contrast to the RDA and NKF KDOQI dietary guidelines and to identify predictors of eGFR. **METHODS:** Twenty participants with stage 3 or 4 CKD [$n = 6$ male (M); $n = 14$ female (F)]; age 62.0 ± 9.9 years; weight 80.9 ± 16.2 kg; body fat 37.3 ± 8.5% of weight; eGFR 51.5 ± 6.82 mL/min/1.73m²) completed self-reported dietary assessments for an average of 5 days. Diet was assessed using the ESHA Food Processor Software, Version 11.1. Micro- and macronutrient analyses for males and females were compared to the RDA and NKF KDOQI guidelines to identify malnutrition, and stepwise multiple linear regression models were used to identify predictors of eGFR, p -values were considered significant at the $\alpha = 0.05$ level. **RESULTS:** On average, all subjects met the RDA and NKF KDOQI guidelines for caloric intake. Average consumption of saturated fat (F = 24.3 ± 10.8g, M = 34.1 ± 6.0g), sodium (F = 3780 ± 2510mg, M = 4210 ± 386mg) and protein (F = 65.0 ± 23.5g, M = 107.3 ± 27.3g) was high while the average consumption of fiber (F = 13.6 ± 4.1g, M = 14.8 ± 7.3g), calcium (F = 573 ± 325mg, M = 720 ± 224mg), potassium (F = 240 ± 1800mg, M = 940 ± 492mg) and phosphorous (F = 628 ± 1320mg, M = 425 ± 314mg) was low. Significant predictors of eGFR were age ($\beta = -0.29$, $p = 0.023$), calcium ($\beta = 0.02$, $p < 0.001$), body fat percentage (BF%) ($\beta = -1.47$, $p = 0.001$),

protein intake ($\beta = -1.20, p < 0.001$), weight ($\beta = 0.42, p = 0.033$), and daily caloric intake ($\beta = -0.36, p = 0.045$). **CONCLUSION:** When compared to the RDA and NKf KDOQI guidelines, CKD patients had poor nutritional quality. Increased protein intake and BF% were the strongest predictors of reduced eGFR. Future interventions in CKD patients should improve diet quality to concomitantly improve body composition and eGFR.

3911 Board #228 May 30 9:00 AM - 10:30 AM
RELATIONSHIP BETWEEN INSULIN RESISTANCE, BODY COMPOSITION, AND PHYSICAL ACTIVITY IN OLDER ADULTS

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(No relevant relationships reported)

There are 27 million adults in the U.S. with type II diabetes mellitus, a condition associated with significant morbidity and mortality. Existing therapies can be costly, have side effects and may not achieve adequate disease control. Therefore, it is useful to identify lifestyle factors such as physical activity (PA) that may mitigate insulin resistance. Key clinical indicators of insulin resistance include fasting blood glucose (FBG), hemoglobin A1c (HbA1c) percentage, and the homeostatic model assessment of insulin resistance (HOMA-IR). **PURPOSE:** To evaluate the relationships among insulin resistance indicators, body composition, and objective and subjective measures of habitual physical activity in older adults. **METHODS:** In 82 generally healthy nondiabetic adults (≥ 58 years, 23 m/59 f), body composition (bioelectrical impedance), fasting blood glucose (glucometer), serum insulin (enzyme-linked immunosorbent assay), HbA1c (HbA1c Analyzer), objective PA (7-day accelerometry), and subjective PA (Community Healthy Activities Model for Seniors (CHAMPS)) were measured. Controlling for age and body fat percentage, partial correlations between insulin resistance indicators and biometrics were determined (Significance was set as $\alpha < 0.05$). **RESULTS:** Mean values were (mean \pm sd): age (68.5 \pm 6.3 y), BMI (26.2 \pm 6.0 kg/m²), visceral fat (119.2 \pm 68.4 cm²), FBG (96.9 \pm 8.3 mg/dL), HOMA-IR (2.6 \pm 0.8), HbA1c (5.3 \pm 0.2%), and accelerometry (cts/min: 114.1 \pm 56.5; sedentary-to-moderate PA ratio: 12.8 \pm 6.1). FBG was significantly correlated with serum insulin ($r = 0.26$), visceral fat area ($r = 0.40$), cts/min ($r = -0.29$), and sedentary-to-moderate ratio ($r = 0.24$). HOMA-IR was significantly correlated with visceral fat ($r = 0.41$). No significant correlation was found between HbA1c and any measured variable. **CONCLUSIONS:** These preliminary data support previous findings that serum markers of insulin resistance are associated with physical activity and body composition. These findings suggest a potential role for using body composition and physical activity as clinical end points when managing patients with insulin resistance. Randomized controlled studies are needed to more rigorously assess the impact of physical activity on clinical indicators of diabetes mellitus in older adults.

3912 Board #229 May 30 9:00 AM - 10:30 AM
The Influence Of Heat On Appetite Regulating Hormones

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(No relevant relationships reported)

Leptin has been established as an energy-controlling hormone because of its role in activating the JAK-STAT3 pathway. Temperature has its own prominent role governing appetite regulation and thus, energy expenditure. Previous research has demonstrated consistent decreases in leptin while in a fasted state. Exercising in the heat (1-hour of cycling @60% VO_{2max} in 33°C) has also shown reductions in leptin. However, in order to elucidate the influence of environment, independent of exercise, a fasted resting investigation is needed.

PURPOSE: Determine the impact of environmental temperature (33 vs. 20°C) on adipose derived appetite-regulating hormones (leptin and adiponectin) and the impact on energy expenditure.

METHODS: 10 college-aged males (27.3 \pm 5 y, 86.7 \pm 13 kg, and 1.83 \pm 4.3 m; 25.8 \pm 0.9 kg/m²) completed two randomized, resting experimental trials in the Heat (HT, 33°C) and at Room Temperature (RT, 20°C) at 60% humidity. Blood draws were taken before intervention and after 3 hours for analysis of leptin and adiponectin. Oxygen consumption was measured at 1-, 2-, and 3-hr time-points.

RESULTS: HT trial temperatures were greater than RT for both core (mean \pm SEM; 37.17 \pm 0.08 vs. 36.89 \pm 0.08°C, $p = 0.002$) and skin (37.59 \pm 0.10 vs. 32.65 \pm 0.48°C; $p < 0.001$). Oxygen consumption in HT was greater than RT during the 2nd (4.37 \pm 0.14 vs. 4.13 \pm 0.15 ml/kg/min, $p = 0.037$) and 3rd hours (4.95 \pm 0.26 vs. 4.28 \pm 0.19 ml/kg/min, $p = 0.002$). Fasting leptin concentrations in RT decreased to a greater extent than

in HT (mean $\Delta \pm$ 95% CI; -2.05 \pm 1.72 vs. -0.89 \pm 1.67 ng/ml; $p = 0.036$, respectively); however, after adjustment for plasma volume shifts (-7.5%) the interactive effect dissipated (-1.79 \pm 1.72 vs. -0.89 \pm 1.6 ng/ml; $p = 0.068$).

CONCLUSIONS: The reduction of heat stress increased energy expenditure and attenuated the leptin reaction. These data may have implications for appetite control and weight management.

3913 Board #230 May 30 9:00 AM - 10:30 AM
Agricultural Activities Affect The State Of Body Characteristics In Peri-urban Kenya

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(No relevant relationships reported)

PURPOSE: The research aims to find out the relationships between agriculture and health state in peri-urban Kenya.

METHODS: We randomly selected 70 households who were former of vegetable and crop cultivation and mixed farming (vegetable and crop cultivation and husbandry) (male: 46 \pm 10 yrs, n=35, female: 41 \pm 9yrs, n=37) in Wangige region(peri-urban setting), Republic of Kenya. Participants Data on body characteristics, daily activity by wearable devices, food consumption by the 24-hour recall, and well-being were collected by trained enumerators. **RESULTS:** In the research, there were positive correlation between weight (M = 72.1 kg, SD = 14.8) and intaking of home garden foods in men (M = 37.2 % SD = 16.5), $r = .35, p < .05, n = 35$. And weight (M = 74.2 kg, SD = 14.8) and time of over of activity level 2 (M = 88.1 min, SD = 95.3) in women, $r = .34, p < .05, n = 37$, and And time of over of activity level 2 (M = 88.1 min, SD = 95.3) and number of agricultural fields (M = 1.3, SD = 0.6) in women, $r = .55, p < .001, n = 37$. There was negative correlation between weight (M = 74.2 kg, SD = 14.8) and intaking of home garden foods (M = 37.8 %, SD = 13.3), $r = .27, p < .05, n = 37$, and Body Mass Index(BMI) (M = 28, SD = 5) and intaking of home garden foods (M = 37.8 %, SD = 13.3), $r = .38, p < .05, n = 37$, in woman.

CONCLUSIONS: In the Peri-Urban setting in the Republic of Kenya, the cause of increasing weight and BMI suggested that affect the decreasing intaking of home garden foods and the number of agricultural fields in the female. Much of people works agriculture of main or side job in Kenya. Agricultural activity of role in peri-urban settings might affect daily activities and food consumption for the prevention of non-communicable diseases. The research was supported by academic cloud funding*Academist*, Doctor support fund in Tokyo University of Agriculture, Global readership training program at United Nations University, Research Fund, Resilience at Works.

3914 Board #231 May 30 9:00 AM - 10:30 AM
Effects Of Acute Exercise On Appetite Regulation And Energy Intake In Men And Women

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PURPOSE: Compare energy intake and appetite regulation responses between men and women following acute bouts of aerobic (AEx) and resistance exercise (REX).

METHODS: Men and women (n=12 each) with overweight/obesity matched on age (32.3 \pm 2 vs. 36.8 \pm 2 yrs, $p=0.14$) and BMI (28.1 \pm 1.2 vs 29.0 \pm 1.5 kg/m², $p=0.64$) completed 2 conditions; 1) AEx (65-70% of age-predicted maximum heart rate for 45 min) and 2) REX (1-set to failure on 12 exercises). Each condition was initiated in the post-prandial state (35 minutes post breakfast). Appetite (visual analog scale for hunger, satiety and prospective food consumption [PFC]) and hormones (ghrelin, PYY, and GLP-1) were measured before and every 30 minutes for 3 hours following consumption of a standardized breakfast. Post exercise *ad libitum* energy intake at the lunch meal was also measured.

RESULTS: There was no difference in relative *ad libitum* energy intake between men and women following either AEx (43.4 \pm 5 vs. 45.4 \pm 4% of total energy needs, $p=0.80$) or REX (48.3 \pm 3 vs. 46.6 \pm 3% of total energy needs, $p=0.81$). In the AEx condition there were no differences in area under the curve (AUC) for satiety or PFC between men and women, although men reported higher PFC vs women at the 30 (33.3 \pm 5 vs. 17.5 \pm 4mm, respectively, $p=0.03$) and 90 min (49.8 \pm 6 mm vs 30.2 \pm 6 mm, respectively, $p=0.03$) post-prandial time points. Additionally, in the AEx condition, a greater hunger AUC was detected in men vs women (7815 \pm 638 vs 5428 \pm 762 mm, respectively, $p=0.02$), which was driven by men reporting significantly greater hunger vs women at the 90 min post-prandial time point (42.7 \pm 5 vs. 16.6 \pm 4 mm, $p<0.001$). No differences

in AUC for ghrelin, PYY, and GLP-1 were noted between men and women following either AEx or REx (all $p > 0.05$). However, significantly higher ghrelin was observed in women vs. men at the 150 (807.6 \pm 37 vs. 652.2 \pm 41 pg/mL, respectively, $p = 0.01$) and 180 min (812.4 \pm 39 vs. 677.5 \pm 49 pg/mL, respectively, $p = 0.05$) post-prandial time points. **CONCLUSIONS:** The data suggest that men report greater hunger and PFC than women following acute AEx, and that women have higher ghrelin levels than men following acute REx. Future work is needed to examine if sex-based differences in appetite regulation and energy intake are present with chronic exercise of differing modalities.

3915 Board #232 May 30 9:00 AM - 10:30 AM
Reliability And Validity Of A Mobile Setup For Metabolic Syndrome Diagnosis Using Point-of-care Analyzers
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 (No relevant relationships reported)

The metabolic syndrome (MetS) is a worldwide public health concern and is characterized by having three or more of these risk factors: high blood glucose (Glc), increased waist circumference (WC), high blood pressure (BP), reduced serum high-density lipoprotein (HDL) and increased serum triglycerides (TG). As certain rural regions lack the required infrastructure for optimal medical care, mobile diagnostics using point-of-care analyzers could help by identifying people at risk for MetS.

PURPOSE: Test the reliability and validity of MetS risk factor analysis using point-of-care analyzers in a mobile examination unit.

METHODS: Fifty participants (18 test-retest; 52 \pm 7 y; 170 \pm 10 cm; 80 \pm 19 kg) were enrolled in the study. Agreement of Glc, HDL and TG of three point-of-care analyzers (A, B, C) against a reference lab (REF) were analyzed by Bland-Altman (bias, Limits of Agreement (LoA)) and McNemar's test (MN). Further, MetS diagnosis by the mobile setup was tested for inter-session reliability by Spearman's ρ and test-retest variability (TRV%).

RESULTS: The range of systematic bias was for Glc -21 to -8 mg/dl, for TG -90 to 3 mg/dl and for HDL -8 to 9 mg/dl. Device C was excluded from further analyses due to missing values. Device A was chosen for additional analysis based on smallest bias and LoA (Glc: -8 [LoA -27 to 11] mg/dl; TG: 3 [LoA -40 to 46] mg/dl; HDL: -3 [LoA -16 to 11] mg/dl) and best agreement of MetS diagnosis with REF (MN: A vs. REF: $p > .05$; B vs. REF: $p < .05$). Test-retest analysis for risk factor classification and MetS diagnosis was performed in a mobile examination unit using device A. No inter-session differences for risk factor and MetS diagnosis were shown (MN day 1 vs. 2: $p > .05$). Spearman's ρ and TRV for risk factors were: TG: $r = .734$ ($p < .05$); 3.3%; HDL: $r = .893$ ($p < .05$); 6.8%; Glc, $r = .076$; 1.9%; systolic BP: $r = .372$; 1.7%; diastolic BP: $r = .457$; 3.3% and WC: $r = .950$ ($p < .05$); 1.1%.

CONCLUSIONS: The mobile setup showed no inter-session difference in MetS diagnosis. TRV was low for all risk factors and test-retest reliability was acceptable for TG, good for HDL and excellent for WC. Inter-session variations in Glc and BP did not influence the overall risk factor classification and MetS diagnosis. A mobile setup using a point-of-care analyzer for blood analysis is a valid and reliable method for a near-to-home MetS screening.

3916 Board #233 May 30 9:00 AM - 10:30 AM
Abstract Withdrawn

3917 Board #234 May 30 9:00 AM - 10:30 AM
Nutritional Group Counseling Or Individualized Prescription? Anthropometric, Metabolic, Nutritional And Mental Health Responses: A Longitudinal Study
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PURPOSE: The aim of the present study was to investigate the effects of nutritional counseling in a group (NCG) or an individualized nutritional prescription (INP) on physical health (inferred from anthropometric, body composition and metabolic responses), nutritional and mental health of overweight or obese women. **METHODS:** Seventy-four women aged 40-59 years underwent pre-intervention evaluations. The women were randomized into NCG and INP. Twenty-seven women completed the 12-week interventions, 11 being in the NCG and 16 in the INP. The groups were submitted to the same concurrent exercise protocol. They were measured before and after for body weight (BW), body mass index (BMI), fat mass (FM), body fat percentage (BF), lean mass (LM), lipid profile, hemoglobin A1c (A1C), insulin and liver transaminases (AST and ALT). The dietary record was applied, and the following were calculated:

total caloric intake (TCI), carbohydrates (CHO), proteins (PTN), lipids (LIP), and saturated and polyunsaturated fats. For mental health, it was measured dissatisfaction with body image, anxiety levels, self-esteem and the presence of pathological eating attitudes.

RESULTS: After the intervention, reductions in BW, BMI, FM, BF, TCI, CHO, PTN, LIP, body dissatisfaction, anxiety, and saturated and polyunsaturated fats ($p < 0.05$) were identified. No differences were identified for LM, metabolic variables, self-esteem and pathological eating attitudes ($p > 0.05$).

CONCLUSIONS: Both nutritional interventions combined with concurrent exercise were effective in promoting improvements in anthropometrics, body composition, food intake and some mental health parameters. Therefore, the choice of the method of nutritional intervention should be based on the preference of the participants.

3918 Board #235 May 30 9:00 AM - 10:30 AM
Effects Of Nutritive And Nonnutritive Sweeteners And Exercise On Blood, Lipid, And Glucose Profiles
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 (No relevant relationships reported)

Nonnutritive sweeteners are widely used as low-calorie replacements for nutritive sweeteners. Despite widespread use, it is unclear how nonnutritive sweeteners, when combined with exercise, influence plasma lipids and glucose. **PURPOSE:** To investigate the effects of nutritive and nonnutritive sweeteners on plasma lipid profiles, complete blood counts, and glucose content following exercise.

METHODS: Ten healthy, college aged, individuals (4 females and 6 males) participated in the randomized, double-blinded, cross-over design study. Participants consumed 8 oz of sweetened drink, equivalent to three sodas worth of sweetener, containing either 445mg of stevia, 507mg of aspartame, 169mg of sucralose, or 110,000mg of sucrose in four separate occasions. After 30 minutes of each sweetened drink, participants completed a single bout of aerobic exercise on a cycle ergometer at 70% of HRmax for 45 minutes. Overnight fasting blood samples were collected at baseline, 30-min post-consumption of sweetened drink, and immediately post-exercise.

RESULTS: Sucrose resulted in significantly higher glucose content (115.8 \pm 6.14 mg/dL) than either sucralose (87.2 \pm 7.09 mg/dL, $p = .032$) or stevia (86.1 \pm 5.79 mg/dL, $p = .010$) at the 30-min post-consumption of the sweetened drink; however, this difference was no longer significant immediately post-exercise. Total cholesterol (TC), triglyceride (TG), and HDL-C were elevated following exercise (TC: 152.7 \pm 9.66 to 158.6 \pm 9.26 mg/dL, $p < .001$; TG: 69.5 \pm 5.78 to 76.8 \pm 5.83 mg/dL, $p = .002$; and HDL-C: 51.5 \pm 2.47 to 53.9 \pm 2.40 mg/dL, $p < .001$, respectively). Neutrophils increased (53.7 \pm 2.67 to 59.1 \pm 1.93%, $p = .012$) and lymphocytes decreased (36.8 \pm 2.56 to 31.3 \pm 1.56%, $p = .016$) from baseline to thirty minutes post-consumption.

CONCLUSIONS: The nonnutritive sweeteners did not change glucose content from baseline through exercise. However, a nutritive sweetener resulted in a spike in glucose 30-min post-consumption, which returned to baseline levels immediately after exercise, suggesting that glucose may be used as a substrate during exercise. Elevated neutrophils, paired with decreased lymphocytes, may be indicative of an acute immune response to exercise.

3919 Board #236 May 30 9:00 AM - 10:30 AM
Short- And Long-term Effects Of High Intensity Interval Training On Dietary Intake In Cardiac Rehabilitation
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 (No relevant relationships reported)

PURPOSE: The aim of this study was to investigate short- and long-term compensatory effects on dietary intake following high intensity interval training (HIIT) compared with usual care moderate intensity continuous training (MICT) during and following a cardiac rehabilitation (CR) program.

METHODS: Ninety-three patients with coronary artery disease enrolled in a 4-week CR program and were randomised to 1) 4x4-minute HIIT; or 2) 40-minutes of MICT (usual care). Patients were instructed to complete 3 weekly sessions (2 supervised, 1 home-based) for 4-weeks, and 3 weekly home-based sessions thereafter for 48-weeks. Only CR group-based dietary advice was provided. Dietary intake was measured by telephone-based 24-hour recall over two days at baseline, 4-weeks, 3-months, 6-months, and 12-months. The Three-Factor Eating Questionnaire was used to measure dietary behaviour, and fasting appetite was assessed by a 100mm visual analogue scale. Appetite hormones (ghrelin, PYY, leptin) were also analysed at baseline and 3-months. Data are mean change (95% confidence interval).

RESULTS: There was no change over the study period or differences between HIIT and MICT for daily energy intake at 4-weeks [-0.1(-0.8,0.5) vs -0.4(-1.0,0.2) MJ; $p = 0.549$] or 12-months [0.4(-0.6,1.3) vs 0.1(-0.9, 1.0) MJ; $p = 0.848$]. There were also no group differences for macronutrients, saturated fat, or fibre. Over 4-weeks, an increase in dietary restraint for both HIIT and MICT [7(-1,15) vs 6(-2,16); time effect: $p = 0.028$], coincided with an increase in hunger [6(1,10) vs 5(1,10)mm; time effect:

$p=0.001$], but this was not evident at 12-months. There was a time x group effect for leptin with a reduction for HIIT and increase for MICT [-0.9(-1.9,0.2) vs 0.7(-0.3, 1.7) ng/ml; $p=0.029$], but no changes over time or group differences for ghrelin [7(-10,23) vs 4(-12,20) pg/ml; $p=0.815$] or PYY [13(-4,30) vs 2(-14,18) pg/ml; $p=0.354$].

CONCLUSIONS: Compared to moderate intensity exercise, HIIT did not result in compensatory increases of energy intake or indicators of poor diet quality. Furthermore, HIIT reduced leptin without compensatory effects on ghrelin or dietary intake. HIIT can therefore be included in CR programs as an adjunct or alternative to MICT, without concern for any undesirable dietary compensation. **Funded by Wesley Medical Research**

3920 Board #237 May 30 9:00 AM - 10:30 AM

Change In Left Ventricular Mass In A 12-month Behavioral Weight Loss Program With Varying Doses Of Physical Activity: The Heart Health Study

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Greater left ventricular mass (LVM) has been associated with incidence of cardiovascular events in cohort studies. LVM has been shown to be associated with larger body mass index (BMI), which may partially explain the association between obesity and cardiovascular disease (CVD). Moderate-to-vigorous physical activity (MVPA) is recommended in lifestyle interventions for weight loss; however, few studies have examined how the dose of activity during weight loss contributes to changes in LVM.

PURPOSE: To examine the change in LVM in response to a behavioral weight loss intervention with varying doses of physical activity.

METHODS: Data were examined from sedentary adults (N=383; BMI: 32.1±3.8 kg/m²; age=46.2±7.7 years) enrolled in a behavioral program and randomized to a reduced calorie diet (DIET, N=127), diet plus a moderate dose of MVPA (MOD-PA, N=129), or diet plus a high dose of MVPA (HIGH-PA, N=127). All groups received weekly intervention sessions in months 1-6 followed by 2 group and 2 telephone contacts per month in months 7-12 and were prescribed a diet to reduce energy intake (1200-1800 kcal/day). MOD-PA was prescribed unsupervised MVPA that progressed to 150 min/wk, whereas HIGH-PA was progressed to 250 min/wk. Assessment of body weight and LVM using cardiac magnetic resonance imaging were assessed at both baseline and 12 months.

RESULTS: Weight (LS mean [95% CI]) significantly decreased from across time (0 months: 90.3 [89.0, 91.7] kg; 12 months: 81.2 [79.8, 82.6] kg) ($p<0.001$), with no difference between groups (Group: $p=0.29$; Group X Time: $p=0.50$). Overall baseline LVM was 42.5±7.4g/m². At 12 months, LVM decreased in DIET (-0.25±0.53g/m²), with increases in LVM in MOD-PA (1.35±0.54g/m²) and HIGH-PA (0.91±0.54g/m²). Post hoc changes in LVM showed a significant difference between DIET and MOD-PA ($p=0.0159$), with no differences between DIET and HIGH-PA ($p=0.5063$), or MOD-PA and HIGH-PA ($p=0.0799$).

CONCLUSIONS: Following a lifestyle weight loss intervention, LVM mass was reduced in the diet only condition; however, when physical activity was added, LVM appears to increase. Of interest, 150 min/wk of MVPA may be favorable compared to 250 min/wk for enhancing LVM during weight loss. The clinical implications of these results warrant further investigation. Support: NIH (R01 HL103646)

G-38 Free Communication/Poster - Fat Metabolism

Saturday, May 30, 2020, 8:00 AM - 10:30 AM

Room: CC-Exhibit Hall

3921 Board #238 May 30 9:00 AM - 10:30 AM

The Effects Of One-week Exogenous Ketone Consumption On Short Distance Time Trial Running Performance

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(No relevant relationships reported)

Currently, there is equivocal knowledge concerning the effects of ketone salt supplementation on short distance running time trial (TT) performance in well-trained subjects. **PURPOSE:** To determine the effects of one-week exogenous ketone salt supplementation on 800m running TT performance during non-fatigued and pre-exhaustive states in endurance-trained subjects. **METHODS:** In a randomized, double-blind, placebo-controlled study, endurance-trained male and female participants were allocated to one of the following treatment groups for 8 days following an initial familiarization visit: Ketone supplementation (KET) (n=16) or placebo control (CON) (n=16). Subjects underwent two consecutive 800m TT before and after the 8-day treatment period on a self-propelled, non-motorized treadmill. Time-to-completion of the first (TT1) and second (TT2) TTs, the average time-to-completion across both TTs, and blood lactate response during the TTs were measured pre- and post-treatment. A mixed factorial ANOVA was used for data analysis. **RESULTS:** KET alone exhibited a significant increase in blood β -hydroxybutyrate from pre-post-treatment ($p<0.05$). A group x time interaction was only detected for TT2 performance ($p<0.05$) but not TT1. There was no pre- to post-treatment change in TT1 performance in either group. CON demonstrated no change in TT2 performance from pre- to post-treatment; however, KET improved TT2 performance as reflected by a 3.7% faster time-to-completion from pre- to post-treatment ($p<0.05$). When examining the average time-to-completion across both TTs, there was a significant group x time interaction ($p=0.04$). CON showed no change while KET demonstrated a faster average time-to-completion from pre- to post-treatment ($p<0.05$). Blood lactate response to TTs decreased ($p<0.05$) in KET but not CON. **CONCLUSIONS:** In endurance-trained subjects, ketone salt supplementation does not appear to affect short-distance running TT performance in a non-fatigued state reflective of competition scenarios. However, ergogenic effects may be observed in high-intensity exercise when some level of exhaustion or energy substrate depletion is experienced prior, such as during training or prolonged, intermittently high-intensity sporting bouts.

3922 Board #239 May 30 9:00 AM - 10:30 AM

Effect Of L-carnitine And Exercise On Fat-rich Dietmice PPAR α And LPL In Liver

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(No relevant relationships reported)

Effect Of L-carnitine And Exercise On Fat-rich Dietmice PPAR α And LPL In Liver

Abstract:Objective: To investigate the effects of L-carnitine and exercise on lipid metabolism in the liver. Methods: To establish fat-rich diet model by feeding high-fat diets to mice. Fat-rich diet mice were divided into 4 random groups, the high-fat control group(HC group),the high-fat L-carnitine group (HL group), the high-fat exercise group(HE group)and the high-fat exercise combined with L-carnitine group(HEL group).Six weeks later, PPAR α ,LPL,FFA, TG, TC in liver and TG,TC in blood serum were tested. Results: Compared with control group, TG,TC in blood serum and TG,TC,FFA in liver was significantly low in the HE and HEL groups, at the same time, LPL and PPAR α was increased significantly in the HE and HEL groups. Compared with HE group, TC in blood serum and FFA in liver was decreased in HEL group, PPAR α significantly up-regulated in HEL group. Conclusion: 1) Long-term aerobic exercise up-regulated expression of PPAR α and LPL in liver, promoted FFA oxidative utilization. 2) In addition to PPAR α , regulation of L-carnitine supplement to LPL may be affected by other factors. 3) L-carnitine can increase the expression of PPAR α and decrease the content of FFA on athletic mice, to play its role in adjusting lipids.

Key words: L-Carnitine; exercise; lipid metabolism

3923 Board #240 May 30 9:00 AM - 10:30 AM
Effects Of Extra-Virgin Olive Oil And Exercise Training On Inflammation In Rats Fed A High-fat Atherogenic Diet

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Extra-virgin olive oil (EVOO), commonly seen in Mediterranean diet, has been shown to exert anti-inflammatory effect in chronic disease prevention. Long-term high-fat diet increases chronic inflammation, which leads to cardiovascular diseases and metabolic syndrome. **PURPOSE:** The purpose of the study is to evaluate the effects of 12-week EVOO supplementation and exercise training on circulatory inflammatory markers in rats fed a high-fat diet. **METHODS:** Female Sprague-Dawley rats (age 4 week, n=36) were randomly divided into 3 groups. One group was fed a basal diet (C, N=12) with added cholesterol (1.25%) and cholic acid (0.5%) for 12 wks. While on the basal diet, two groups were supplemented with 20% EVOO, half group being trained (T, N=12) on treadmill for 12 wks (25m/min, 10% grade for 60 min/day, 5 days/wk), and the other half being sedentary (S, N=12). Plasma inflammatory cytokines were measured by Multiplex immunoassays on Luminex 200. Data were analyzed using two-way ANOVA. **RESULTS:** EVOO supplementation elevated 1.91-fold on macrophage colony stimulating factor (M-CSF) level ($P<0.05$), but this effect was decreased 3.34-fold by T ($P<0.05$). A significant increase in granulocyte-macrophage colony stimulating factor (GM-CSF) was found in EVOO vs. C (5.9-fold, $P<0.05$). Monocyte chemoattractant protein-1 (MCP-1) level in plasma was decreased 1.46-fold in EVOO/T vs. C ($P<0.05$). Plasma interleukin-1 β (IL-1 β) and tumor necrosis factor- α (TNF- α) levels did not change in EVOO ($P>0.05$), but TNF- α was decreased 1.46-fold in EVOO/T vs. C ($P=0.077$). **CONCLUSION:** Dietary supplementation of EVOO resulted in an augmentation of plasma inflammatory cytokines levels in the sedentary rats fed a high-fat atherogenic diet, but these adverse effects were significantly reversed by chronic exercise training.

3924 Board #241 May 30 9:00 AM - 10:30 AM
Unique Medium Chain Triglyceride Product Rapidly Enhances Brain Function: A Pilot Investigational Study

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PURPOSE: Medium Chain Triglyceride (MCT) compounds are purported to increase brain energy based upon the relationship between MCT products and ketone production, especially for older individuals or those on low-carbohydrate diets. Little evidence exists that MCT products positively affect brain function, short-term. In this pilot study, Intervention Group (IG) subjects were tested prior to ingestion of a proprietary MCT product, and then 90 minutes later using the same electroencephalographic (EEG) device and compared to a control group (CG). **METHODS:** Eight (8) IG volunteers, aged 49-68 years old, (male = 5, female = 3) were compared to three (3) CG volunteers, aged 48 to 68 years old, (male = 3). Study subjects completed standard EEG testing prior to ingestion of the compound, and 90 minutes after consuming the compound or placebo. Testing consisted of a P300 audio reaction time test and two visual decision making/reaction tests. **RESULTS:** The IG increased brain function as measured with evoke potentials, time to task and graphic representations compared to the control group. The decrease for the IG in the audio reaction time test was 340 milliseconds to 314 milliseconds. In addition, the tens of millivolt (μ V) activation during the auditory reaction time test increased from 7.5 μ V to 12.9 μ V, indicating increased brain functional activity. The CG showed essentially no voltage changes. The IG decreased times in the first trail making test from 94 to 57 seconds, and decreased time to complete the second trail making test from 113 to 93 seconds. Descriptive statistics revealed the measures for the IG had statistical significance ($P<0.5$) for the second trail making test and strong positive trends for all other parameters. Topographic brain maps from the test revealed a representative picture of the changes from taking the supplement. **CONCLUSIONS:** In this pilot study, consumption of a proprietary MCT combination produced marked enhancement in brain activity 90 minutes after ingestion with significant increases in relation to topographical brain maps. Further investigation is warranted to determine optimal ingestion conditions and time to effect for this and similar products across various populations. EEG measurements show promise as assessment biomarkers for the effects of nutritional supplements on brain function.

3925 Board #242 May 30 9:00 AM - 10:30 AM
Exercise Priming: Effect Of Morning Exercise On Fat Oxidation During Afternoon Walking

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Reduced fat oxidation is emerging as a predictor for obesity-related diseases; therefore, interventions that increase fat oxidation may have clinically important health benefits. Previous research suggests that exercise priming may provide a novel solution by augmenting fat oxidation during subsequent exercise. **PURPOSE:** To investigate the effects of morning Reduced-Exertion High-intensity Interval Training (REHIT) on fat oxidation during afternoon Low-intensity Steady State (LISS) walking. **METHODS:** Twelve sedentary or recreationally active university students (7 male, 5 female) participated in 2 randomly assigned morning interventions, REHIT (two 20-second sprints on a cycle ergometer separated by 4-minutes of active recovery) or rest, on two separate days. On both occasions, participants returned to the lab in the afternoon (4 hours later) to complete a 45-minute treadmill walk at 5.6 km/h. Participants remained fasted for both morning and afternoon trials. Blood and gas samples were collected pre-, during, and post-LISS exercise. **RESULTS:** After 45 minutes of LISS walking, plasma non-esterified fatty acids (NEFA) was greater in the REHIT trial compared to control (REHIT, 1.03 ± 0.39 mmol/L; Control, 0.75 ± 0.43 mmol/L; $p = 0.03$; Cohen's $d = 0.67$). However, lipid oxidation was not concomitantly elevated ($p = 0.35$). Furthermore, plasma glucose, carbohydrate oxidation, respiratory exchange ratio (RER) and energy expenditure remained consistent between the trials across all time points ($p = 0.40$; $p = 0.98$; $p = 0.92$; $p = 0.81$, respectively). **CONCLUSION:** Exercise priming may not influence fat oxidation during subsequent bouts of LISS exercise; however, plasma NEFA may be greater suggesting changes in substrate availability. Relatively long rest intervals between the morning and afternoon trials and insufficient exercise workload could explain similarities in substrate oxidation. Isotopic research is required to understand the metabolic fate of the elevated substrate concentrations.

3926 Board #243 May 30 9:00 AM - 10:30 AM
PREPRANDIALEXERCISE DOES NOT MODIFY HIGH FAT MEAL INDUCED INFLAMMATION IN YOUNG AND OLD ADULTS

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 (No relevant relationships reported)

An up-regulation of pro-inflammatory cytokines (i.e. IL-6, TNF α , IL-1 β , IL-8) and lower anti-inflammatory cytokines (IL-10) are associated with development of cardiovascular disease. While a single high-fat meal (HFM) can transiently increase systemic postprandial inflammation (PPI) in young adults (YA), the effect of a HFM or acute exercise on PPI in older adults (OA) is not clear. **PURPOSE:** To determine if preprandial exercise attenuates PPI in YA and OA. **METHODS:** 12 YA (23.3 ± 3.9 years, $n = 5$ M/7 F) and 12 OA (67.7 ± 6 years, $n = 8$ M/4 F) completed an incremental exercise test to determine VO_{2peak} and then two HFM challenges (HFM alone or acute exercise prior to a HFM (EX+HFM)) in a randomized order. Prior to the HFM (12 kcal/kg body weight: 57% fat, 39% CHO, 4% PRO), participants abstained from strenuous physical activity for 48 hours and adhered to a 12 hour overnight fast. Inflammatory cytokines were measured at baseline, 3, and 6 hours during the HFM. In EX+HFM, participants completed an exercise session on a cycle ergometer 12 hours prior to the HFM at 65% VO_{2peak} until caloric expenditure matched 75% of the caloric content of the HFM. **RESULTS:** There was a significant main effect of time as a quadratic function for IL-6 and IL-8, which decreased by 28% and 8% (respectively) at three hours post-HFM, and then increased near baseline levels at six hours post-HFM ($p < 0.05$). TNF α , IL-10, and IL-1 β exhibited significant decreases over time from baseline to six hours ($p < 0.05$). Specifically, TNF α decreased by 12%, IL-10 decreased by 7%, and IL-1 β decreased by 14% ($p < 0.05$). TNF α was greater in OA at baseline compared to YA ($p = 0.036$), however there was no difference post-HFM at either three or six hours ($p > 0.05$). There was no difference in inflammation between HFM and EX+HFM at any time point for any inflammatory marker ($p > 0.05$). **CONCLUSION:** Contrary to our hypotheses, a HFM did not elicit PPI in YA or OA. Additionally, acute exercise did not impact inflammation at any timepoint. Future work should be performed to elucidate the mechanism by which a HFM raises cardiovascular disease risk.
 Supported by 4-VA grant

3927 Board #244 May 30 9:00 AM - 10:30 AM
A Short Bout Of Moderate- Or High-intensity Cycling Can Influence Postprandial Triglyceride Metabolism
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 (No relevant relationships reported)

PURPOSE: Examine the effects of high-intensity interval cycling (HIIC) and moderate-intensity continuous cycling (MICC) on postprandial glucose, insulin, and triglyceride (TG) concentration. **METHODS:** Each male subject ($n = 12$; age = 21.9 ± 1.8 yrs; body mass = 90.1 ± 16.8 kg) completed 1) REST, 2) MICC, and 3) HIIC in a randomized order. Each bout was separated by 1 week. Rest involved sitting quietly. MICC required continuous cycling at 60% maximal work rate (WR_{max}). HIIC involved 15-second cycling sprints (@ 120% WR_{max}) followed with 45 seconds of passive cycling. Each bout was performed for 20 minutes on the afternoon of Day 1. A mixed meal (50% carbohydrate (CHO) and 35% fat) was provided 30 minutes (Day 1) and 16 hours (Day 2) following the completion of each bout. Blood samples on Day 1, following a 4-hour fast, were acquired just prior to each bout and at 0, 0.5, 1, and 2 hours post-meal. Blood samples on Day 2, following a 10-hour fast, were acquired at 0, 2, and 4 hours post-meal. Blood samples were analyzed for glucose, insulin, and TG concentration. Postprandial (PP) responses were quantified via the total (AUC_T) and incremental area under the curve (AUC_I) using the trapezoidal method. Significant differences ($p < .05$) between the bouts were determined using a one-way, repeated measures ANOVA and Bonferroni post-hoc test. **RESULTS:** Average work (Watts) was similar between MICC (122.5 ± 25.4) and HIIC (110.3 ± 14.7) ($p = .091$, $ES = .51$). On Day 1, there was no significant difference in the PP glucose, insulin, or TG response between the 3 bouts. On Day 2, MICC reduced the TG AUC_T ($442.9 \pm 76.4 \text{ mg} \cdot \text{dl}^{-1} \cdot 4\text{hr}^{-1}$) when compared to rest ($487.4 \pm 104.4 \text{ mg} \cdot \text{dl}^{-1} \cdot 4\text{hr}^{-1}$) ($p = .02$, $ES = .43$). HIIC elicited a non-significant reduction the TG AUC_T ($454.8 \pm 72.3 \text{ mg} \cdot \text{dl}^{-1} \cdot 4\text{hr}^{-1}$), however the reduction was trending towards significance ($p = .076$, $ES = .31$). **CONCLUSION:** A brief bout of MICC and HIIC does not influence the PP response when completed just prior to a mixed meal. There may be a delayed response to exercise as MICC and (to a lesser degree) HIIC appear to reduce the PPTG response when completed 16 hours prior to a mixed meal. The lack of change in the PP glucose and insulin response might be explained by a wide inter-individual variance as half of the participants appeared to have responded to the exercise bouts based on their PP glucose and insulin concentration.

3928 Board #245 May 30 9:00 AM - 10:30 AM
Metabolic Flexibility During Exercise In Overweight/ obese Children Vs. Lean Children
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 (No relevant relationships reported)

Metabolic flexibility (MF) is the ability of the body to alter its reliance on fat or carbohydrate for energy purposes in response to a stimulus. The inverse, metabolic inflexibility, has been associated with type II diabetes and obesity. Given the prevalence of these disorders, assessing and improving MF is important. However, MF during exercise, particularly with respect to fat metabolism, in children remains poorly understood. **PURPOSE:** This study examined MF with respect to fat metabolism during exercise in lean ($n=11$; 10.9 ± 0.9 years) and overweight/obese (OW/OB; $n=8$; 10.4 ± 1.2 years) children. It was hypothesized that MF with respect to fat metabolism during exercise would be impaired in the OW/OB group as indicated by reduced use of fat as an energy source. **METHODS:** Participants were grouped based on BMI percentiles for age and sex (Lean $< 85^{\text{th}}$ percentile, OW/OB $\geq 85^{\text{th}}$ percentile). On the experimental visit, participants completed two 20-minute exercise bouts separated by a 10-minute rest. Bout 1 consisted of 10 minutes at 50% VO_{2max} and 10 minutes at 75% VO_{2max} . Bout 2 consisted of 20 minutes at 50% VO_{2max} . Absolute fat oxidation rate (FOR; [$\text{mg} \cdot \text{min}^{-1}$], FOR relative to body mass [$\text{mg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$], FOR relative to fat-free mass [$\text{mg} \cdot \text{kgFFM}^{-1} \cdot \text{min}^{-1}$], and proportional fat use (% Fat) were measured at 10 minutes of Bout 1 and at 5, 10, 15, and 20 minutes of Bout 2. **RESULTS:** There was a main effect for time for % Fat and for each expression of FOR, with fat oxidation values generally higher during the second bout, suggesting that exercise can be used to assess MF in children. Absolute FOR was higher in the OW/OB group (range: 121.6 ± 57.6 to $213.7 \pm 45.7 \text{ mg} \cdot \text{min}^{-1}$) than in the Lean group (81.1 ± 32.2 to $152.2 \pm 38.2 \text{ mg} \cdot \text{min}^{-1}$), however there were no main effects for group or interactions for % Fat (OW/OB: 29.0 ± 14.4 to $51.1 \pm 8.5\%$; Lean: 23.9 ± 10.9 to $41.8 \pm 6.5\%$), FOR relative to body mass (OW/OB: 2.4 ± 1.3 to $4.1 \pm 0.7 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$; Lean: 2.5 ± 1.0 to $4.5 \pm 1.0 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$), or FOR relative to FFM (OW/OB: 4.15 ± 1.97 to $7.12 \pm 1.17 \text{ mg} \cdot \text{kgFFM}^{-1} \cdot \text{min}^{-1}$; Lean: 3.49 ± 1.54 to $6.29 \pm 1.13 \text{ mg} \cdot \text{kgFFM}^{-1} \cdot \text{min}^{-1}$). **CONCLUSION:** OW/OB children in this age range do not display impaired MF with respect to fat metabolism during exercise. Future research should examine a broader range of children as well as the effects of different exercise characteristics (e.g. intensity) on MF.

3929 Board #246 May 30 9:00 AM - 10:30 AM
Different Exercise Models Affect White Adipose Browning Through Mechanism Of Irisin Molecular Pathway
 Yao Liu, Bing Zhang, Yingzhe Xiong. *Tsinghua University, Beijing, China.*
 (No relevant relationships reported)

Background: The white adipose browning can improve fat burning and accelerate fat consumption. Irisin which is cleaved by Fibronectin Type III Domain-Containing protein 5 (FNDC5) derived from muscle can act on white adipose tissue to promote the expression of Uncoupling Protein 1 (UCP1). However, it is unclear which exercise models is better to contribute to produce Irisin. **Purpose:** To discuss whether High-Intensity Intermittent Exercise (HIIT) is better than Medium-Intensity Continuous Exercise (MICT) on the effect of improving white fat production of UCP1 and the mechanism of molecular biology. **Methods:** Thirty-two 4-week-old C57BL/6J mice were fed with high-fat diet (D12492) for 8 weeks and randomly divided into three groups: control group (GC, $n=8$), MICT group (GM, $n=8$), and HIIT group (GH, $n=8$). Then, GM got an 8-weeks MICT training (10min warm-up, 45min 60% VO_{2max} speed, 6 times/week) and GH had an 8-weeks HIIT training (10min warm-up, 1set=1min 90% VO_{2max} speed + 2min 60% VO_{2max} speed, 12sets). 24 hours after the last training, anesthesia was dissected. Muscle tissue contained PGC-1 α mRNA, FNDC5mRNA, and Irisin. It was also taken by blood index. Irisin and UCP1mRNA were measured by subcutaneous white adipose tissue. The data were compared by using one-way analysis of variance. **Results and Discussions:** (1) Muscle: Comparing with GC, GM and GH both have a higher expression of PGC-1 α mRNA but there is no significant difference, yet FNDC5mRNA of GM is more than GC (7.53 ± 5.36 vs. 1.00 ± 1.13 , $p < 0.01$) and GH (7.53 ± 5.36 vs. 1.01 ± 1.16 , $p < 0.01$). Irisin of GM (32.22 ± 2.88 vs. $25.99 \pm 4.50 \text{ pg/mg}$, $p < 0.05$) and GH (32.10 ± 4.04 vs. $25.99 \pm 4.50 \text{ pg/mg}$, $p < 0.05$) are more than GC. (2) Serum: The Irisin level of GH is very significantly higher than GM (55.41 ± 1.19 vs. $51.83 \pm 2.47 \text{ pg/ml}$, $p < 0.01$). (3) Subcutaneous white adipose tissue: In respect of Irisin, GH is more than GM (37.68 ± 3.55 vs. $29.77 \pm 2.89 \text{ pg/mg}$, $p < 0.01$); UCP1mRNA, GH is more than GM (16.67 ± 6.65 vs. 0.69 ± 0.42 , $p < 0.01$). **Conclusion:** (1) Exercise can promote the production of Irisin upstream regulated factor, PGC-1 α and FNDC5. (2) HIIT compared with MICT has a greater effect on improving the white adipose tissue browning through the molecular pathway of PGC-1 α -FNDC5-Irisin-UCP1.

3930 Board #247 May 30 9:00 AM - 10:30 AM
Exercise Duration Affects Maximal Fat Oxidation In Post- Menopausal Women: Implications For Exercise Prescription
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 (No relevant relationships reported)

The relative exercise intensity at maximal fat oxidation (FAT_{max} , % VO_{2max}) is used for exercise prescription for weight loss and metabolic health. In young men, FAT_{max} is affected by exercise duration, with more prolonged testing protocols leading to higher values. **PURPOSE:** Since no data exist on post-menopausal women, we determined the effect of exercise duration on FAT_{max} in this population. **METHOD:** 18 non-obese women (54 ± 4 years; 4 ± 3 years from menopause; 22 ± 3 BMI) performed on a cycle ergometer a ramp test and 30-min steady-state trials at 40, 50, 60, 70 and 80% of the pre-determined VO_{2max} . Based on VO_2 and respiratory exchange ratio we calculated and compared (2-way RM ANOVA) absolute fat oxidation (FO , $\text{g} \cdot \text{min}^{-1}$) across intensities and duration. We compared FAT_{max} derived from ramp ($FAT_{max,ramp}$), 5 ($FAT_{max,5}$) and 30-min data ($FAT_{max,30}$) (1-way RM ANOVA). We estimated FAT_{max} using exercise duration (1, 5 and 30 min) and $FAT_{max,ramp}$ as explanatory variables. **RESULTS:** FO was significantly affected by exercise duration, intensity and their interaction (for all $p < 0.001$). Any exercise between 40 and 70% VO_{2max} , > 30 min, lead to an identical MFO (overall $0.21 \pm 0.09 \text{ g} \cdot \text{min}^{-1}$). $FAT_{max,30}$ occurred at a significantly higher % VO_{2max} ($57 \pm 10\%$) than $FAT_{max,ramp}$ and $FAT_{max,5}$ (44 ± 6 and $49 \pm 9\%$, not different). FAT_{max} can be predicted from the linear combination of exercise duration ($p < 0.001$) and $FAT_{max,ramp}$ ($p = 0.01$) as independent explanatory variables ($r = 0.69$, $SEE = 8.8\%$). **CONCLUSIONS:** In post-menopausal women exercises at 40-80% VO_{2max} of longer durations are associated with higher FAT_{max} compared to ramp or short, steady-state sessions. Moreover, any intensity greater than $FAT_{max,ramp}$ will maximize fat oxidation for exercises > 30 min. Finally, the intensity that maximizes fat oxidation can be predicted by exercise duration and $FAT_{max,ramp}$. This approach offers a valid approach for individualized exercise intensity prescription for weight loss and metabolic health in postmenopausal women.

3931 Board #248 May 30 9:00 AM - 10:30 AM
Wild Blueberries Increase Fat Oxidation Rate During Moderate Intensity Exercise

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 (No relevant relationships reported)

Fruits high in anthocyanins, such as wild blueberries (WBs), have been documented to decrease oxidative stress in active and sedentary populations and has more recently demonstrated the ability to influence lipolytic enzymes and increase the rate of fatty acid oxidation (FA-ox) during rest. To date, changes in FA-ox during exercise has only been examined with blackcurrants. **PURPOSE:** To examine the effect of freeze dried WBs on the rate of FA-ox and lipid peroxidation during moderate intensity exercise. **METHODS:** 11 healthy, aerobically trained males (26.6 ± 7.9 yrs, 74.7 ± 8.2 kg, 10.2 ± 3.4% BF) completed an incremental cycle test to determine $\dot{V}O_{2peak}$ (54.4 ± 7.9 ml/kg/min) followed by a 2-wk washout avoiding foods high in anthocyanins. Participants completed a control (C) exercise protocol of cycling at 65% of $\dot{V}O_{2peak}$ for 40 min. Urinary F2-isoprostanes (~ 50 mL) and capillary blood FA, glycerol, creatinine and free/total carnitine (~ 250 µL) were collected pre and post sessions. Ventilation, RER, lactate, HR, power output, RPM and RPE were collected before and at 10 min increments. Next, participants consumed 12.5 g freeze dried WB powder, 2x/day (25 g total) for 2-wks, then repeated the exercise protocol. Repeated measures ANOVAs were used to determine differences between conditions. **RESULTS:** WBs reduced lactate at 20 (C: 3.0 ± 1.1 mmol vs WB: 2.6 ± 1.0 mmol; p=0.005), 30 (C: 2.9 ± 1.0 mmol vs WB: 2.2 ± 0.9 mmol; p=0.005) and 40 min (C: 2.5 mmol ± 0.9 vs WB: 1.9 ± 0.8 mmol; p=0.013) and carbohydrate oxidation by 10.1% at 20 (C: 2.17 ± 0.46 g/min vs WB: 1.95 ± 0.42 g/min; p=0.024), 19.2% at 30 (C: 2.24 ± 0.52 g/min vs WB: 1.82 ± 0.48 g/min; p=0.014) and 14.8% at 40 min (C: 2.10 ± 0.54 g/min vs WB: 1.79 ± 0.45 g/min; p=0.045) while resulting in higher FA-ox by 19.7% at 20 (C: 0.45 ± 0.16 g/min vs WB: 0.53 ± 0.13 g/min; p=0.049), 43.2% at 30 (C: 0.41 ± 0.14 g/min vs WB: 0.58 ± 0.15 g/min; p=0.010) and 31.1% at 40 min (C: 0.45 ± 0.17 g/min vs WB: 0.59 ± 0.13 g/min; p=0.012). No differences were found between C and WB trials for all other variables. **CONCLUSION:** Results indicate that WBs may increase the rate of FA-ox during moderate intensity activity in healthy, active males. Potential complications with blood sample preparation may have led to unreliable results. Further, the exercise intensity may have been too low to see significant changes in urinary F2-isoprostanes.

3932 Board #249 May 30 9:00 AM - 10:30 AM
Exercise Training Adaptations In Metabolic Syndrome Individuals On Chronic Statin Treatment

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Statins reduce atherogenic dyslipidemia and cardiovascular disease (CVD) risk in metabolic syndrome individuals (MetS). Exercise-training could also contribute to reduce CVD by improving cardiorespiratory fitness (i.e., $\dot{V}O_{2MAX}$) and fat oxidation. However, some reports sustain that statin use could interfere with training adaptations. **PURPOSE:** To determine the therapeutic impact of an exercise-training program on fat metabolism and cardiorespiratory fitness (CRF) in a group of MetS individuals chronically medicated with statins in comparison to a well-matched control group statin-naïve. **METHODS:** One hundred and six MetS were divided into statin users (STATIN group, n=46) and statin-naïve (CONTROL group, n=60). Groups were matched by age, weight, and MetS components. All subjects completed 16 weeks of high intensity interval training (HIIT). Before and after HIIT, muscle biopsies were collected to assess mitochondrial content (citrate synthase (CS) activity) and the activity of the rate limiting β oxidation enzyme (3-hydroxyacyl-CoA-dehydrogenase (HAD)). Fasting plasma glucose, insulin, TG, HDL-c and LDL-c concentrations were measured. Exercise maximal fat oxidation (FO_{MAX}) and oxygen uptake ($\dot{V}O_{2PEAK}$) were determined. **RESULTS:** Training improved MetS components similarly in both groups (MetS Z-score -0.26±0.38 vs -0.22±0.31; P<0.001 for time and P=0.60 for time x group). Before training, STATIN had reduced muscle HAD activity and whole body FO_{MAX} compared to CONTROL (P=0.038 and P=0.002 for group, respectively). However, 16-weeks of HIIT increased HAD and FO_{MAX} in both groups (32% and 20% in STATIN and 3% and 10% in CONTROL; both P<0.03 for time and P>0.05 for time x group, respectively). $\dot{V}O_{2PEAK}$ improved less in STATIN than in CONTROL group (12% vs 19%; P=0.013 for time x group). Conversely STATIN did not prevent the increases in CS with HIIT (38%; P<0.001 for time, P=0.199 for time x group). **CONCLUSIONS:** Our findings suggest that chronic statin use in MetS does not interfere with exercise training improvements in fat oxidation and neither with the

muscle enzyme mediators of these responses (i.e., CS and HAD). However, STATIN attenuated the improvements in $\dot{V}O_{2PEAK}$ with training. ClinicalTrials.gov identifier: NCT03019796

3933 Board #250 May 30 9:00 AM - 10:30 AM
Effect Of Aerobic Exercise On The Proteins Of Ubiquitin System In Different Adipose Tissues Of Obese Rats

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PURPOSE: To observe character of the different adipose tissue ubiquitin system in obese rats and explore the role of ubiquitin system in regulation of 8-week moderate intensity aerobic exercise on the autophagy of different adipose tissue of obese rats. **METHODS:** After 8 weeks high fat feeding (D12451) and standard feeding (D12450B), 20 obesity 11weeks SD were randomly assigned to sedentary (OS, n=10) and exercise (OE, n=10) groups; 20 normal weighty also were randomly assigned to sedentary (CS, n=10) and exercise (CE (n=10) group. During the following 8 weeks, CS and OS groups were CE and OE groups did the 60%-70% $\dot{V}O_{2max}$ treadmill training (5 days/week, 1 hour/day). The $\dot{V}O_{2max}$ of exercise groups were remeasured every two weeks. The protein expressions of LC3II, LC3I, ATG7, ATG5, ATG12 and ATG12-ATG5 in white adipose tissue of groin and brown adipose tissue of scapular were measured by Western blotting. **RESULTS:** (1) In the white adipose tissues, the protein expressions of ATG7, ATG5, ATG12, ATG12-ATG5 (p<0.05) and LC3II/I (p<0.01) in OS group were significantly increased than CS group, but the protein expressions of ATG7, ATG5, ATG5-ATG12 and LC3II/I in OE group were significantly decreased (p<0.05) than OS group. (2) In the brown adipose tissues, compared with CS group, the protein expressions of ATG5, ATG12, ATG5-ATG12 in CE group increased significantly (p<0.05), but the LC3II/I (p<0.01) and ATG5-ATG12 (p<0.05) in OS group decreased significantly. The ATG7, ATG12, ATG5-ATG12 and LC3II/I of OE group were significantly higher than OS group (p<0.05). **CONCLUSIONS:** There was tissue specificity of adipose tissue autophagy in obese rats. The ubiquitin system of ATG5-ATG12 involved in activation of white fat autophagy. 8 weeks moderate intensity aerobic exercise can inhibit the autophagy of subcutaneous white fat and strengthen the autophagy of scapular brown fat.

3934 Board #251 May 30 9:00 AM - 10:30 AM
Magnesium Supplementation Combined With Hypoxic Training In Improving Hepatic Lipid Metabolism In Obese Mice

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PURPOSE: To explore the effect of hypoxic training on magnesium level, investigate the mechanism of magnesium supplementation combined with hypoxia training on hepatic lipid metabolism in obese mice. **METHODS:** Forty high-fat diet induced C57BL/6J mice were assigned into four groups (n=10 each): Diet-induced obesity (DIO); hypoxia training (HT), living and training in normobaric hypoxic conditions; magnesium supplementation (Mg), the 100mg/kg/d dose of magnesium chloride added to drinking water; hypoxia training+magnesium supplementation (HT+Mg). And set up a chow diet control group (CON). The intervention lasted for 4 weeks. All comparisons were made using two-way ANOVA analysis. **RESULTS:** 1) Serum magnesium in HT group (63.17±0.86 ppm vs 71.85±3.06 ppm) was decreased; femur magnesium in Mg group (2287.71±88.48 ppm vs 2106.89±41.68 ppm) were significant increased after 4 weeks intervention. And the femur magnesium was significantly negatively correlated with body weight (p<0.01, r=-0.645). 2) Compared with DIO group (1.80±0.32 g), liver weight of HT group (1.32±0.17 g), HT+Mg group (1.38±0.23 g) were significantly decreased; 3) Compared with DIO group (19.10±1.82 ng/ml, 8.58±0.41 U/L), serum ATGL level in Mg group (25.43±1.71 ng/ml), HT+Mg group (31.56±2.46 ng/ml) and serum CPT-1 level in HT+Mg group (17.46±1.56 U/L vs) were significantly increased. 4) Compared with DIO group (1.01±0.19), liver PPARα mRNA expression in HT group (1.30±0.28), HT+Mg group (2.32±0.75) were significantly increased; liver ATGL (3.68±2.20 vs 1.04±0.31), LPL (7.72±3.14 vs 1.02±0.21), CPT-1 (6.85±3.89 vs 1.03±0.30) mRNA expression in HT+Mg group were significantly higher than DIO group. Moreover, the PPARα, CPT-1 mRNA expression level was significantly higher than HT group (1.43±0.46). **CONCLUSIONS:** 1) Hypoxic training can significantly reduce femur magnesium, increase the loss of magnesium while effectively losing weight. 2) 4 weeks of hypoxic training combined with magnesium supplementation intervention can effectively reduce the liver weight and hepatic free fatty acid in obese mice; 3)

Hypoxic training combined with magnesium supplementation may promote liver lipolysis and fatty acid beta oxidation by activating liver PPAR α and its downstream factors, improve liver lipid metabolism in obese mice.

3935 Board #252 May 30 9:00 AM - 10:30 AM
Does Varying The Fatty Acid Composition Of A High-fat Meal Modify Postprandial Lipemia?

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(No relevant relationships reported)

PURPOSE: The western diet is typically high in saturated fats (SF) or omega-6 polyunsaturated fatty acids (O6) with insufficient amounts of omega-3 polyunsaturated fatty acids (O3). When chronic, this diet has been associated with an increased risk of cardiovascular, metabolic, and respiratory diseases. The purpose of this study was to examine the effect of varying the fatty acid composition of an acute High-Fat Meal (HFM) on postprandial lipemia.

METHODS: Fifteen individuals [6 M, 9 F; body mass index (BMI) = 25.3 \pm 6.6 kg/m²] consumed three HFM smoothies separated by a minimum of 48 hours. The three smoothies were high in SF [63% total fat, <0.02% from O3 and O6], O6 [15:1 O6 to O3], and O3 [15:1 O3 to O6]. All were standardized to 12 kcal/kg body weight, 63% total fat, and 0.72 g/kg sugar. Blood triglycerides (TG) were collected at baseline, 2 hr and 4 hr postprandially.

RESULTS: There was a significant main effect of time for SF HFM and O3 HFM in TG from baseline to 4 hr (P=0.001 and 0.006), and a quadratic effect in TG from baseline to 4 hours in O6 HFM, where TG increased from baseline to 2 hr and returned near baseline values at 4 hr (P<0.001). There was an interaction effect between condition and time effect for TG (P<0.05) and no difference between O3 and O6 TG concentrations at any time point (P>0.05). The TG concentrations were significantly lower from 2 hr to 4 hr postprandially in the high O6 (P=0.005) and high O3 HFMs (P=0.033) compared to the SF HFM, which was increased from 2 to 4h.

CONCLUSIONS: O6 and O3 HFMs led to a more accelerated peak in postprandial TG and trended towards baseline by 4 hr. The SF HFM resulted in a sustained elevation in TG with significantly higher concentrations at 4 hr than at baseline. These findings suggest that varying types of fatty acids can lead to markedly different metabolic responses and that diets high in SF could have prolonged exposure to high blood triglycerides, increasing the risk of atherosclerosis and other chronic diseases.

3936 Board #253 May 30 9:00 AM - 10:30 AM

Association Of Leptin And RMR In Obese Elderly Adults With Different Levels Of Physical Activity

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PURPOSE: The aims of this study were 1) to examine potential sex-related differences in leptin, resting metabolic rate (RMR) and metabolic markers 2) to assess differences in leptin, RMR and metabolic markers between low MVPA group and high MVPA group 3) to assess whether being physically active may play a role in the associations between leptin, RMR and physical activity.

METHODS: The subjects were 73 women (age=64.1 \pm 6.1 years, percent body fat=39.1 \pm 4.8%) and 37 men (age=66.3 \pm 5.6 years, percent body fat=29.7 \pm 4.7%). RMR was measured by indirect calorimetry (Metamax 3B-R2 Metabolic Measurement system, German) and body composition by the DXA (GE Lunar Prodigy, USA). Serum leptin and lipid and glucose metabolism makers' levels were determined by radioimmunoassay. Waist-mounted triaxial accelerometer Actigraph GT3X-BT was used to make objective 7-day recordings of physical activity. Based on the mean of the minutes spent in MVPA (180 min/week), subjects were divided into low MVPA group (n=50, percent body fat=37.1 \pm 7.0%) and high MVPA group (n=56, percent body fat=34.5 \pm 6.1%).

RESULTS: Leptin and HDL cholesterol levels were higher in women than men (both p<0.01), while men presented higher fat free mass and RMR (both p<0.01) than women. Leptin, insulin, HOMA-IR, percent body fat were higher in low MVPA than high MVPA group (all p<0.05), RMR and metabolic markers, however, were not found significant differences (all p>0.05). Leptin levels was associated with RMR negatively and PBF positively (r=-0.36, p=0.013; r=0.645, p=0.0001) in low MVPA group, leptin levels was associated with RMR negatively and PBF positively (r=-0.511, p=0.0001; r=0.631, p=0.0001) in high MVPA group. The negative association of RMR with proportion of sedentary (r=-0.304, p=0.027) and the negative association of leptin with proportion of MVPA (r=-0.303, p=0.023) were only found in high MVPA group.

CONCLUSIONS: Leptin may play a role in energy metabolism in overweight and obese elderly adults. Obesity is associated with energy metabolism and metabolic markers both in women and men. The relationship of leptin with energy

metabolism and insulin resistance might be moderated by levels of physical activity.

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3937 Board #254 May 30 9:00 AM - 10:30 AM
Cyclooxygenase 2 Regulates Isoprenaline Induced Adipolysis In Brown Adipocytes

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(No relevant relationships reported)

PURPOSE: By converting fat into heat, brown adipocytes (BAC) play as an energy expenditure in mammalian. Cyclooxygenase 2 (COX2) is a key factor of Uncoupling protein 1 (UCP1) synthesis which is essential for dissipates energy into heat via adipolysis. Isoprenaline (ISO) can induce adipolysis in brown adipocytes (BAC); however, whether COX2 takes part in ISO induced adipolysis remains unclear.

METHODS: C₃H₁₀T_{1/2} cells were differentiated into brown adipocytes. BACs were treated with 10 μ M ISO or 10 μ M ISO and 100 μ M NS-398 (COX2 inhibitor) for 0 (as control), 1, 3, 6, 12 or 24 hours. For lipid droplet (LP) size analysis, cells were fixed and stained with Oil Red O. Images were captured with a Leica CTR 4000 microscope with 10x objectives. All images were thresholded for LPs signal and watershed for individual LP size analysis using Image J. Data were loaded into GraphPad Prism 8 for LP size analysis and size frequency distribution. BACs were collected for UCP1 expression detection after 6-hour-incubation (beta tubulin as loading control). All results are presented as means \pm std. error of mean. Statistics were performed in SPSS using Student's t test.

RESULTS: Average LP size decreased as ISO incubation time prolonged (113.67 \pm 2.40, 115.69 \pm 2.21, 83.61 \pm 1.69, 35.00 \pm 0.88, 31.60 \pm 0.69, 34.28 \pm 0.77 μ m² after 0, 1, 3, 6, 12, 24 hours incubation, respectively). Incubation of ISO and NS-398 slowed down the rate of LP size reduction (95.08 \pm 1.65, 107.73 \pm 2.26, 85.22 \pm 1.87, 56.97 \pm 1.49, 41.32 \pm 0.87, 37.43 \pm 0.65 μ m² after 0, 1, 3, 6, 12, 24 hours incubation, respectively; slope (-53.04 \pm 1.21 vs. -65.45 \pm 1.33) LP size frequency distribution showed a shift of LP size towards smaller LPs following incubation with ISO. Inhibition of COX2 activity can delay the occurrence of left shift (became smaller) of LP size frequency distribution (12h vs. 3h). UCP1 expression were lower following ISO and NS-398 incubation than those treated with ISO only (0.74 \pm 0.08 vs. 1.00 \pm 0.00, p<0.05).

CONCLUSION: COX2 inhibition can repress ISO induced adipolysis in BACs and may related to a decrease in UCP1 expression.

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3938 Board #255 May 30 9:00 AM - 10:30 AM
Correspondence Between Indexes Of Maximal Fat Oxidation From Ramp Vs Steady-state Protocols In Postmenopausal Women

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Maximal fat oxidation (MFO, in g^l·min⁻¹) is an index of metabolic flexibility and the relative exercise intensity at MFO (FAT_{max} as % maximum oxygen consumption (VO_{2max})) is used for exercise prescription for weight loss and metabolic health. The time-consuming, steady-state protocol required for MFO/FAT_{max} determination hinders the extensive use of these indexes. Alternative, ramp testing has been validated for MFO/FAT_{max} determination in healthy, young males only. **PURPOSE:** to validate ramp testing for MFO/FAT_{max} measure in post-menopausal women.

METHODS: 18 sedentary, postmenopausal women (54 \pm 4 years; 4 \pm 3 years from menopause; 22 \pm 3 BMI) performed on a cycle ergometer: *i*) a ramp incremental test; *ii*) steady-state trials at 40, 50, 60, 70 and 80% of the VO_{2max} as determined by the incremental test. We measured VO₂, respiratory exchange ratio (R) and heart rate (HR). Based on VO₂ and R from the ramp test (breath-by breath data) and steady-state protocol (5th minute of each trial) we measured absolute fat oxidation (FO, in g^l·min⁻¹); then, we determined MFO in absolute units (in g^l·min⁻¹) and the relative intensity corresponding to MFO, i.e. FAT_{max}, that was expressed relative to VO_{2max} and directly determined maximal HR (HR_{max}). MFO and FAT_{max} from the ramp (MFO_{ramp} and FAT_{max,ramp}) were compared to the values from the steady-state protocol (MFO_{ss} and FAT_{max,ss}) by paired t-Test.

RESULTS: The MFO was significantly lower than MFO (0.39 \pm 0.13 vs 0.19 \pm 0.07 g·min⁻¹ p<0.001). On the contrary, the FAT_{max} and FAT_{max} occurred at an identical %VO_{2max} (45 \pm 6 vs 47 \pm 7% VO_{2max} p=0.17) and %HR_{max} (61 \pm 6 vs 62 \pm 6% HR_{max} p=0.54).

CONCLUSIONS: In agreement with previous studies conducted in young males, our data confirm that only steady-state protocols allow accurate MFO quantification. On the contrary, accurate measures of FAT_{max} can be obtained indifferently from both ramp and steady-state protocols in post-menopausal women. Therefore, ramp testing offers a valid alternative to more time-consuming steady-state protocols for the identification of

optimal exercise intensity for weight loss and metabolic health. Time-efficient testing strategies have a high practical value for longitudinal/large-scale evaluation of fat metabolism in postmenopausal women offering the means for individualized exercise prescription.

3939 Board #256 May 30 9:00 AM - 10:30 AM
The Effects Of Exercise, Estrogens, And Diet On Hepatic Protein Expression In Type 2 Diabetes

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Exercise can ameliorate Type 2 Diabetes (T2D), and studies also show that estrogens may prevent the onset of T2D. Thus, postmenopausal women may be at a greater risk for T2D. While the effects exercise, estrogens, and diet on whole body risk factors for T2D are established, little is known about the cellular changes in the liver that account for these whole body beneficial effects. **PURPOSE:** To examine the effects of exercise, estrogens and diet on hepatic protein expression. **METHODS:** Female Wistar rats were fed a standard diet (SD) or a high-fat diet (HFD) for 10 weeks. A subset of the rats had their ovaries removed via ovariectomy (OVX). The rats were given treatment of treadmill exercise (25 minutes/day at 40 cm/s for 5 days/week (Ex)) or estradiol replacement (E₂; 1.4 µg/day). At the end of the study, the liver was removed and homogenized in cell extraction buffer, and the protein was isolated. Western blot analyses were performed to measure the expression of the following proteins involved in lipid metabolism and mitochondrial function: acetyl-coA carboxylase (ACC), fatty acid synthase (FAS), hormone sensitive lipase (HSL), lipoprotein lipase (LPL), citrate synthase, and cytochrome c oxidase (COX) IV. **RESULTS:** The HFD decreased the ACC expression compared to the SD (0.59 vs. 0.93 AU, p<0.05), and E₂ treatment restored these values (0.81 AU, p<0.05). Similarly, the HFD decreased the FAS expression compared to the SD (0.44 vs. 1.58 AU, p<0.05), and E₂ treatment restored these values (0.75 AU, p<0.05). The HFD increased the LPL expression compared to the SD (1.58 vs. 1.15, p<0.05), and E₂ treatment decreased the LPL expression (1.32 AU, p<0.05). There was no effect of Ex on the ACC, FAS, or LPL expression. The expression of HSL, citrate synthase, and COX IV did not change with diet, E₂ replacement, or Ex. **CONCLUSION:** Two proteins that stimulate de novo fatty acid synthesis (ACC and FAS) decreased with the HFD, likely due to the exogenous intake of fats. Notably, E₂ replacement increased the ACC and FAS expression, even though the HFD was still being consumed. LPL is a protein that stimulates fat storage. Consumption of the HFD increased the LPL expression to increase fat storage, and E₂ replacement decreased the LPL expression. Thus, E₂ may provide benefits by decreasing fat storage. Supported by NIH Grant P20GM103443 and NSF Grant IIA-1355423.

3940 Board #257 May 30 9:00 AM - 10:30 AM
Ethnicity Mediates Change In Fat Oxidation In Response To High Intensity Interval Training (hiit)
Ethnicity Mediates The Magnitude Of Change In Fat Oxidation In Response To High Intensity Interval Training (hiit)

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Ethnicity Mediates The Magnitude Of Change In Fat Oxidation In Response To High Intensity Interval Training (HIIT)

One response to high intensity interval training (HIIT) is increased fat oxidation (FOx) (Astorino et al. 2017) which is due to enhanced oxidative capacity and activity of β-HAD (Talanian et al. 2007). In the U. S., Hispanic adults have a higher rate of obesity than Caucasians (Hales et al. 2017), and have twofold higher rate of diabetes (CDC 2018). It is unknown if ethnicity alters FOx responses to HIIT. **PURPOSE:** To assess the role of ethnicity in mediating FOx changes with HIIT. **METHODS:** Eleven inactive Caucasian (C) and 7 Hispanic women (H) (age = 25 ± 6 yr) participated in the study. Initially, VO₂max and peak power output (PPO) were determined. On two separate days after a minimum 6 h fast, they completed five stages of progressive exercise at 10 - 50 %PPO during which gas exchange data were acquired to calculate RER, FOx, and carbohydrate oxidation (CHOOx). Fingertip blood samples were used to measure blood lactate concentration (BLA). HIIT consisted of 9 sessions of cycling at 85 %PPO separated by 75 s recovery. **RESULTS:** HIIT increased VO₂max by 10 and 8 % in C and H with no effect of ethnicity (p = 0.69). RER increased during exercise (p < 0.001) and timeXtraining (p = 0.001) and timeXtrainingXgroup

interactions (p = 0.012) were shown. Fat oxidation differed during exercise (p = 0.001) and there was a timeXtrainingXgroup interaction (p = 0.03). Post hoc analyses showed significantly higher FOx post-HIIT at 10 (0.19 ± 0.04 g/min vs. 0.16 ± 0.04 g/min) and 20 %PPO (0.17 ± 0.03 g/min vs. 0.14 ± 0.04 g/min) versus baseline in H. Data showed a 10 - 35 % reduction in CHO oxidation (p = 0.01) after HIIT and a timeXtraining interaction (p = 0.01), but no timeXtrainingXgroup interaction (p = 0.32) was shown. BLA increased during progressive exercise (p < 0.001) and there was a reduction in BLA during exercise in response to training (p = 0.002) that was similar in C and H (p = 0.28). **CONCLUSION:** These preliminary data obtained in inactive women suggest that ethnicity may alter changes in energy metabolism observed in response to short-term interval training. Further work is needed to examine the mechanisms underpinning this potential effect of ethnicity on adaptation to training.
 This work was funded by a Research and Scholarly Activity Grant

3941 Board #258 May 30 9:00 AM - 10:30 AM
Dietary Fat Retention In Cortical Bone In Rats Fed High Fat Diet

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Excess adiposity during childhood and adolescence are associated with poorer bone quality and increased risk of fracture. A high fat diet (HFD) may promote marrow adipogenesis at the expense of osteogenesis and may also promote excess lipid accumulation in osteoblasts and osteocytes. Exercise is prescribed for bone health primarily because of its mechanical loading attributes, but little is known about how obesity or exercise training status affects nutrient trafficking and retention in bone. **PURPOSE:** To determine the effects of obesity and exercise on fat retention in bone. **METHODS:** Female Wistar rats, 5 weeks in age (n=18), were fed a high fat diet (HFD) for 20 weeks and designated as obese (OB) or lean (LN) based on weight gain. OB and LN rats performed treadmill running (EX) (5 d/w, 1h/d, 15 m/min) or sedentary control (SED) for 10 weeks. In a 24-hour tracer study, rats were given ad libitum access to 14C oleate and 14C palmitate blended in food. Marrow was removed from hind limb bones and lipid was extracted from the remaining cortical bone. Data are mean ± SEM. **RESULTS:** Fat intake was not different between groups. Obesity status had no significant effect on fat retention in cortical bone. Lipid in hindlimb cortical bone was higher in EX compared to SED (EX: 6.66 ± 1.64 vs SED: 1.50 ± 1.47 mg, p<0.05). LNEX had the highest dietary fat retention in cortical bone lipid compared to other groups (LNEX: 0.69 ± 0.14, OBEX: 0.24 ± 0.14, LNSED: 0.27 ± 0.13, OBSED: 0.41 ± 0.13 mg, interaction p<0.05). The proportion of the meal retained, and the magnitude of lipid turnover did not differ between groups. Dietary fat retention in bone was positively (p<0.05) associated with fat intake, bone mineral density and bone mineral content (BMC; r=0.51-0.64). BMC in bone was associated (r=0.54, p<0.05) with total energy expenditure. **CONCLUSION:** Although cortical bone constitutes a minor fraction of overall dietary fat retention, we demonstrate that fat is trafficked to and retained in cortical bone in proportion to meal size and bone size. Future work is needed to test whether fat accumulation influences the ability to adapt to mechanical loading.

G-39 Free Communication/Poster - Ketogenics

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3942 Board #259 May 30 9:00 AM - 10:30 AM
Effect Of A 21-day Well-formulated Ketogenic Diet On Women's Metabolic Health: Glow Pilot Trial

Catherine Saenz. Jacksonville University, Jacksonville, FL.
 (Sponsor: Carena Winters, FACSM)
 (No relevant relationships reported)

Cardiovascular disease (CVD) is a pandemic that is the leading cause of death for women in the United States. This is particularly alarming as the primary etiologies for CVD are lifestyle related Nutrition interventions, such as well-formulated ketogenic diets (WKFD), improve metabolic health and reduce risk factors associated with CVD but it is unknown if these improvements in health can be observed within the first three weeks of carbohydrate restriction. **Purpose:** The purpose of this study was to examine the effectiveness of a WKFD on women's metabolic health. **Methods:** Twenty-two women (Age (yr.) 42.2 ± 8.1, Ht. (cm) 164.2 ± 5.9, BMI 27.3 ± 6.0) participated in a 21-day, eucaloric diet study. Anthropometrics, body composition (InBody 570), fasted capillary-blood ketones, glucose (BG), and cholesterol panel, and diet records were

collected before (PRE) and after (POST) intervention. **Results:** Women maintained calories (PRE: 1938kcal vs POST: 1836kcal) and protein levels (PRE: 17% vs POST: 20%) but decreased dietary carbohydrate (PRE: 36% vs POST: 13%) and increased dietary fat (PRE: 45% vs POST: 65%) PRE to POST ($p \leq 0.05$). Weight (PRE: 73.9kg vs POST: 72.3kg) and body fat (PRE: 56.9kg vs POST: 54.0kg) significantly decreased but there were no differences in lean body mass PRE to POST ($p \leq 0.05$). BG (PRE: 94.0mmol/L vs POST: 89.9mmol/L) decreased significantly, with 73% of women decreasing BG from PRE to POST ($p \leq 0.05$). Ketones increased significantly and 58% of women reached nutritional ketosis by POST testing ($p \leq 0.05$). There were no differences in cholesterol panel except for LDL, which increased from PRE (111.1mg/dL) to POST (124.2mg/dL) ($p \leq 0.05$). **Conclusion:** Women's metabolic health is an immediate concern for the silent killer known as CVD in this population. Finding safe, systemic interventions to this pandemic are imperative. WFKD improved some, but not all, metabolic markers within 21 days. This highlights the initial shifts in metabolic health related to WFKD nutritional interventions and calls for additional research to help better understand the underlying mechanisms of WFKD on metabolic health, especially as it relates to cholesterol metabolism, and the timeline of these events.

3943 Board #260 May 30 9:00 AM - 10:30 AM
Effects Of Ketogenic Diet Containing Medium-chain Triglyceride And Endurance Training On Metabolic Enzyme Adaptations.

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Purpose:

Long-term intake of very low-carbohydrate, high-fat (ketogenic) diets enhance production and utilization of ketone bodies, which are more energy-efficient fuels for skeletal muscle. However, adaptation to the extremely low-carbohydrate diet has been shown to upregulate pyruvate dehydrogenase kinase 4 (PDK4) content in skeletal muscle, which is a negative regulator of glycolytic flux, resulting in the impaired high-intensity exercise capacity. Because medium-chain triglyceride (MCT) can produce more ketone bodies than long-chain triglyceride (LCT), incorporating MCT into the diet may allow more carbohydrates yet preserving ketosis and exert less inhibitory effect on muscle glucose metabolism. The purpose of this study was therefore to examine the effects of long-term feeding of ketogenic diet containing MCT on the endurance training-induced adaptations in metabolic enzymes of rat skeletal muscle.

Methods:

Male Sprague-Dawley rats (7-week-old) were placed on a standard diet (PFC ratio = 21:16:63), LCT-containing ketogenic diet (LKD, PFC ratio = 12:87:1) or MCT-containing ketogenic diet (MKD, PFC ratio = 16:66:18) for 8 wks. Half the rats in each group performed 2-h swimming exercise, 5 days a week for 8 wks. After the 8-wk intervention, protein expressions of 3-oxoacid CoA transferase 1 (OXCT, a ketolytic enzyme) and PDK4 in epitrochlearis muscle were measured.

Results:

Despite the lower lipid content in the diet, plasma β hydroxybutyrate concentration in the MKD-fed rats increased to a level similar to that attained in the rats fed the LKD (85 ± 7 vs. 83 ± 8 mmol/L day, $p = 0.99$). Endurance training significantly increased OXCT protein content in epitrochlearis muscle and moreover, intake of the MKD additively enhanced the endurance training-induced increase in OXCT protein content. PDK4 protein level in skeletal muscle was substantially increased after the LKD consumption. However, such increase in the PDK4 was not observed in the MKD-fed rats regardless of endurance training status.

Conclusion:

Long-term intake of ketogenic diet containing MCT may additively enhance endurance training-induced ketone bodies utilization capacity in skeletal muscle without exerting inhibitory effects on glucose metabolism.

3944 Board #261 May 30 9:00 AM - 10:30 AM
Beta-hydroxybutyrate (bhb) Ketone Salt Supplement Alters Energy Metabolism, Blood Glucose And Ketone Levels

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 (No relevant relationships reported)

Ketone supplements were found to produce acute nutritional ketosis (defined as having a blood ketone level of 0.5-3.0 mM), suppress appetite, lower plasma ghrelin levels and perceived hunger. **PURPOSE:** To determine the acute effect of beta-hydroxybutyrate (BHB) ketone salt (KS) on appetite profile, energy metabolism, blood glucose and ketone levels and subsequent energy intake. **METHODS:** Twenty-two healthy females (age: 26 ± 7 y, BF%: 28.6 ± 8.2 , BMI: 26.1 ± 8.6 kg/m²) were recruited to participate in a single-blind crossover study design. Participants were randomly assigned to consume either 0.25g/kg of KS or flavor matched placebo (PL).

During each visit, participants completed an appetite profile survey using a visual analogue scale (VAS) before, at 0, 30, 60 and 90 minutes. Indirect calorimetry using ventilated hood technique was used to measure thermic effect of a supplement at 30-45 and 75-90 minutes. Blood glucose, ketone levels and affect were measured before, at 0, 45 and 90 minutes. Energy intake following an ad libitum breakfast was recorded. A repeated measures ANOVA was used for analysis with significance accepted at $p < 0.05$. **RESULTS:** A significant difference over time ($p < 0.001$) but not between supplements ($p > 0.05$) was observed for appetite profile. A significant interaction supplement over time was observed for VO₂ ($p = 0.007$) but not RQ ($p = 0.28$). A significant supplement effect was observed for blood glucose (KS: 83 ± 10 , 84 ± 8 , 82 ± 8 mg/dL and PL: 88 ± 10 , 89 ± 8 , 86 ± 9 mg/dL, $p = 0.04$) and ketone levels (KS: 0.3 ± 0.2 , 0.5 ± 0.2 , 0.4 ± 0.2 mM and PL: 0.3 ± 0.3 , 0.2 ± 0.2 , 0.2 ± 0.2 mM, $p < 0.001$) at 0, 45 and 90 min, respectively. However, no significant difference in energy intake at breakfast ($p = 0.94$) was observed between KS: 200 ± 116 kcal and PL: 203 ± 107 kcal. **CONCLUSIONS:** Ketone salt supplement caused modest elevation in blood ketone levels and reduced glucose, suggesting improved glycemic control, however, did not have an effect on perceived satiety or energy intake.

3945 Board #262 May 30 9:00 AM - 10:30 AM
Combined Effects Of 5-week Ketogenic Diet With Different Exercise Interventions On Lipid Metabolism In Skeletal Muscle Of Obese Mice

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PURPOSE: To determine the effect of ketogenic diet with exercise on the expression of lipid metabolism related to proteins and genes in skeletal muscle of obese mice.

METHODS: 45 twelve-week obese male C57BL/6J mice were divided into ketogenic diet group (KD), ketogenic diet combined with HIIT group (KH) and ketogenic diet combined with MICT group (KM), 15 mice in each group. Exercise was performed on the treadmill without slope, 6 days a week, 1 hour a day. Both groups started with warm-up exercise, in KH group, followed by 10 rounds of 4-minute high-intensity treadmill exercise and 2-minute active rest between; In KM group, moderate intensity continuous running with the same distance as KH was performed. The energy composition of ketogenic diet was: protein 10%, fat 90%, carbohydrate 0%. Western blot was used to detect the protein contents of pAMPK α , AMPK α (Thr172), PGC-1 α , PPAR α and CPT-1 in skeletal muscle, and RT-PCR was used to detect the mRNA expression of Acadl and Acox1 genes. One-way ANOVA was used for the data analysis.

RESULTS: Compared with KD group, the expression of all protein and mRNA in KH group increased significantly ($P < .05$). Compared with KD group, the expression of pAMPK α /AMPK α ratio, PGC-1 α , CPT-1 protein and Acadl mRNA in KM group increased significantly ($P < .05$). Compared with KM group, the expression of pAMPK α /AMPK α ratio and PPAR α protein in KH group increased significantly ($P < .05$; see Table 1 for details:

Table 1. Statistical summary of relative expression of protein and gene in skeletal muscle of mice

Group	KD (M \pm SD)	KH (M \pm SD)	KM (M \pm SD)
pAMPK α /AMPK α	1 \pm 0.16	2.52 \pm 0.4 [#]	1.92 \pm 0.15 ^{###}
PGC-1 α	1 \pm 0.24	3.15 \pm 0.39 [#]	3.06 \pm 0.34 [#]
PPAR α	1 \pm 0.05	1.27 \pm 0.14 [#]	0.78 \pm 0.09 ^{**}
CPT-1	1 \pm 0.28	3.01 \pm 0.41 [#]	2.14 \pm 0.35 [#]
Acadl	1 \pm 0.40	1.57 \pm 0.21 [#]	1.48 \pm 0.19 [#]
Acox1	1 \pm 0.23	1.57 \pm 0.23 [#]	1.37 \pm 0.11

Note: Compared with KD group, [#] $P < .05$, ^{###} $P < .01$; Compared with KH group, * $P < .05$, ** $P < .01$.

CONCLUSION: Ketogenic diet combined with exercise was more effective than ketogenic diet alone in enhancing the lipid metabolism of skeletal muscle. Compared with KM, KH is more effective in enhancing the lipid metabolism level of skeletal muscle in mice, mainly through the enhancement of AMPK-PGC-1 α -PPAR α mediated lipid metabolism pathway.

3946 Board #263 May 30 9:00 AM - 10:30 AM
Extended Ketogenic Diet Is Necessary For Increases In Protein Acetylation

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Decline in mitochondrial function is associated with a decrease in lifespan. We have previously demonstrated that a long-term ketogenic diet (KD) improves mitochondrial function and longevity. However, a life-long KD is difficult to maintain and an intermittent KD might be more viable long term.

PURPOSE: Determine how long it takes before a ketogenic diet alters muscle metabolism so that intermittent diets can be developed.

METHODS:

Four C57BL/6 mice were fed a control diet or 1 or 7 days of continuous KD. At the time of sacrifice, livers, gastrocnemius, brain and kidneys were extracted and frozen in liquid nitrogen before being powdered and homogenized in sucrose lysis buffer and prepared for western blot analysis to determine total acetylated lysine content, total OXPHOS protein, or acetylated p300 content.

RESULTS: Following one day of KD, neither acetylated, nor mitochondrial proteins were different than control diet. By seven days of continuous KD diet, total acetylated proteins increased in the liver, kidney and gastrocnemius muscle. Specifically, acetylation of p300 was 3.4±0.89-fold greater following 7 days of KD. Unlike the other tissues the brain showed no difference in acetylated proteins by 7 days. An increase in mitochondrial mass was only seen in the liver at 7 days of KD.

CONCLUSIONS:

A short term ketogenic diet can be used to rapidly alter protein acetylation in the liver, kidney and muscle. These data suggest that an intermittent keto diet may be useful in promoting a biochemical change in muscle that promotes mitochondrial function and may benefit long-term muscle function.

G-40 Free Communication/Poster - Resting Energy Expenditure

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3947 Board #264 May 30 9:00 AM - 10:30 AM
Metabolic Rest Rate (mrr) Prediction By Linear Regression

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PURPOSE: The aim of this study is to evaluate the validity of the prediction equation of the Metabolic Rest Rate (MRR) prescribed in an indirect way. This measure would be very helpful in the nutritional counseling, because many people don't have access to indirect calorimetry tests (ICT).

METHODS: 143 volunteers were selected. They made the ICT using the Metacheck® calorimeter, equipped with the gas analyzer. The MRR was collected as well as the Body Weight (BW) - kg, Height (H) - cm, and Age (A) - years. We also calculated the Body Mass Index (BMI) - kg/m². These metrics were used considering the MRR as an independent variants and the others (BW, H, A, BMI) as dependent variables. A linear regression was made to obtain a prediction equation to estimate the MRR.

RESULTS: After made all the necessary verifications for using the multivariate data analysis, a linear regression was made using the Stepwise method. The final equation was $MRR = -690,55 + (12,65 \times BW) + (897,71 \times H) - (5,03 \times A)$. The "R" of the equation was 0.901 and the determinant coefficient was 0.812.

	Age	Weight	Height	BMI	MRR
Mean	36,74	74,62	1,65	27,23	1.551,18
Standard Deviation	11,23	17,78	0,91	5,42	301,26

CONCLUSIONS: This trial showed that is possible to estimate the MRR through equations, since the determinant coefficient is adequated. In this trial, we worked with a general equation, but it is possible to work with equations for specific populations, regarding the sex, age, gender and other aspects

3948 Board #265 May 30 9:00 AM - 10:30 AM
Evaluating The Accuracy Of Basal Metabolic Rate Prediction Equations For Masters Athletes

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Basal metabolic rate (BMR) is the energy required to perform basic metabolic functions at rest. Indirect calorimetry is one method of measuring BMR, but it can also be predicted using BMR prediction equations. Depending on the equation used, a prediction can take into account a combination of different factors (e.g., age, body weight, height, lean body mass, fat mass). These equations tend to overestimate BMR. However, most of the researchers relied on small sample sizes or specific populations.

PURPOSE: To determine the accuracy of BMR prediction equations for Masters Athletes. **METHODS:** Two hundred and eighty-five athletes (157 women, 128 men; ≥ 26 years of age) representing a number of sports and physical activities, who exercised at least twice a week and were non-smokers, participated in our cross-sectional study. Resting metabolic rate (RMR) was measured using indirect calorimetry. Prior to measuring RMR, participants fasted and refrained from caffeine for 12 hours, avoided alcohol and exercise for 24 hours, and rested in a recliner for 15 minutes prior to data collection. Body composition was determined using dual-energy X-ray absorptiometry (DXA). We compared the Mifflin-St. Jeor, Harris-Benedict, Cunningham, and Owen to indirect calorimetry using one-way analysis of variance (ANOVA) with repeated measures. **RESULTS:** We found that indirect calorimetry measured significantly lower ($p < 0.001$) kilocalories (kcal) compared to any of the four prediction equations. The Mifflin-St. Jeor equation was more closely aligned with indirect calorimetry for all participants combined and women (mean difference, percent accuracy: 115, 54.8%; 95, 57.2%, respectively) compared to indirect calorimetry. However, the Owen equation was more accurate for men (98, 61.3%). The Cunningham equation generated the highest mean difference and lowest percent accuracy for all participants combined, women, and men (234, 29.1%; 221, 23.6%; 250, 35.9%, respectively). **CONCLUSIONS:** We found that the four BMR prediction equations analyzed significantly over-predicted BMR compared to indirect calorimetry. Our results emphasize the need for a more appropriate BMR prediction equation for athletes. This study was not funded

3949 Board #266 May 30 9:00 AM - 10:30 AM
Comparison Between Measurement Of Resting Metabolic Rate By Indirect Calorimetry And Predictive Equation

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PURPOSE: The aim of this study is to evaluate the validity of the predictive equation of the Metabolic Rest Rate (MRR) with the utilization of a bioimpedance equipment in comparison with the results obtained with indirect calorimetry test (ICT).

METHODS: 27 subjects (17 female and 10 male), all volunteers, were selected. As the first step of the trial, the volunteers had their MRR calculated by a tetrapolar bioimpedance equipment (Biodynamics 310A®) - MRRbio. Afterwards, the volunteers undergone an ICT (Metacheck®) with a gas analyzer - MRRcal.

RESULTS: Differences were found in the measures of 12 of the 27 volunteers. The effect size was calculated between the measures and the result was 0.0083, demonstrating a very low value. However, this number is deceptive, as the variation in the results can be positive or negative. We had the impression of a small difference between the groups that is not true, and it can be verified when we work the variations in modules ($|\Delta\% \text{MRR}|$). The highest positive variation was 332,5 calories (a variation of 27,31% between the MRRcal and MRRbio) and the highest negative variation was 271,2 calories (negative variation of 18,46%).

	Age	Body Weight	Height	BMI	MRR (Cal)	MRR-cal-MR-Rbio	$|\Delta\% \text{MRR}|$
Mean	38,70	77,04	1,65	28,21	1.598,42	2,94	7,77%
SD	12,45	20,00	0,09	6,88	304,84	146,24	6,40%

CONCLUSIONS: This trial showed that the estimated MRR through equations can have a wide range of variability, with the possibility of significant errors in the clinic point of view. Because of this, the indirect calorimetry test with a gas analyzer is recommended whenever is possible to minimize errors in the measurements

3950 Board #267 May 30 9:00 AM - 10:30 AM
Resting Energy Expenditure In Crossfit® Practitioners: Indirect Calorimetry Versus Predictive Equations

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BACKGROUND: Indirect calorimetry (IC) is the gold standard method to assess individual resting energy expenditure (REE). However, due to its high cost and time demand, predictive equations are largely used to estimate energy requirements, which may vary according to different body compositions and health status. Crossfit® is a training program created by Greg Glessman in 1995 and consists of performing high intensity functional movements. Some studies have already reported increase of metabolic rates in this population.

PURPOSE: To measure REE in Crossfit® practitioners, using IC, and verify the most appropriate predictive equation to estimate this variable.

METHODS: 142 Crossfit® practitioners, 91 female (64.1%), aged between 16-59 years, underwent nutritional assessment, including weight, height, waist circumference (WC) and body mass index (BMI). Body composition was measured by a portable ultrasound. REE was measured by IC (mREE) and predicted by six different equations (pREE): Harris-Benedict, World Health Organization (WHO), Henry and Rees, Cunningham (1980), Cunningham (1991), and Mifflin-St.Jeor. Statistical analysis were carried out by Kolmogorov-Smirnov Test, Student's *t* test and Bland and Altman plots.

RESULTS: The mean age was 33.0 ± 6.3 years of age, without difference between men and women. The mean BMI was 24.7 ± 3.5 kg/m². The mean mREE was 1583.2 ± 404.4 kcal, and the pREE ranged from 1455.5 ± 230.9 kcal to 1711.3 ± 285.5. The best REE predictive equations for Crossfit® practitioners were the Cunningham (1991) (*P*=0.338), WHO equation (*P*=0.494) and Harris-Benedict (*P*=0.705). Harris-Benedict presented the smaller difference comparing with IC (12.9 ± 307.6 kcal), Cunningham (1991) showed better adequacy (102.5%) and WHO equation presented greater percentage of accuracy (59.9%). The same equations remained adequate when data were stratified by gender.

CONCLUSIONS: This study showed that Cunningham (1991), WHO (1985) and Harris-Benedict (1919) equations were the most appropriated REE equations for Crossfit® practitioners. Further studies should investigate more suitable methods to determine the energy requirements in Crossfit® and should, perhaps, create and propose a specific equation for this population.

3951 Board #268 May 30 9:00 AM - 10:30 AM
Comparison Of The Effects Of Sprint Interval Vs. Steady State Exercise On Resting Metabolic Rate

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(No relevant relationships reported)

Exercise is a modality that may result in an elevation of resting metabolic rate (RMR) due to homeostatic disruption. Sprint Interval Training (SIT) exercise is widely recognized as a time efficient, low-volume, high-intensity alternative to endurance training and, in acute phases, may elevate RMR for longer durations. **PURPOSE:** To compare the effects of an acute bout of SIT vs. steady state (SS) vs. control (CON) on 24-h RMR in recreationally active college-aged males. **METHODS:** In this randomized crossover design, 13 recreationally active males ages 18-30 yrs. (24.1 ± 2.3) participated in three exercise sessions using an electronically braked cycle ergometer: SIT (5, 30-sec. sprints, interspersed with 4-min. active recovery), SS (70% VO_{2 peak} for 30 min.) and CON. Exercise sessions were separated by one week. All sessions included 7 RMR measurements taken at the same times over a 24-h period (8am resting, 8:50am pre-ex, 10:10am post-ex, 12:10pm 2-h post-ex, 1:00pm 3-h post-ex, 4:00pm 6-h post-ex and 10:10am the following morning 24-h post-ex). RMR comparisons were made using two-way ANOVA with repeated measures. **RESULTS:** There was a significant main effect for group with regard to RMR (*F*=5.706; *p*=.043) with no effect of time (*F*= 5.351; *p*=.113) or group x time interaction (*F*=1.486; *p*=.066). There was a significant difference between SS (2116 kcal) and CON (1891 kcal) (*p*=.009) and SIT (2105 kcal) and CON (1891 kcal) (*p*=.012). SS (2116 kcal) and SIT (2105 kcal) were not different (*p*=.994). There was a significant effect for time between combined exercise (CE) condition vs. CON when comparing rest to pre (Δ CE = 582 kcal vs. Δ CON = 498 kcal) (*p*=.002), rest to post-ex (Δ CE = 628 kcal vs. Δ CON = 211 kcal) (*p*=.034), and rest to 6-h post (Δ CE = 716 kcal vs. Δ CON = 193) (*p*=.016). There was a significant group x time interaction for CE vs. CON (*p*= .034). Post-hoc analysis revealed statistical differences in measurements 2-h post (*p*= 0.018; 455 kcal), 3-h post (*p*= 0.002; 599 kcal) and a trend towards statistical significance at 6-h post (*p*=

.076; 340 kcal) and 24-h post (*p*=0.103; 313 kcal). **CONCLUSION:** A single bout of SIT may significantly elevate post-exercise RMR, and if repeated regularly, may confer longer-term benefits similar to that produced by 30 minutes of SS exercise.

3952 Board #269 May 30 9:00 AM - 10:30 AM
Effects Of Adiposity And Body Composition On Adjusted Resting Energy Expenditure In Women

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(Sponsor: Abbie Smith-Ryan, FACSM)

(No relevant relationships reported)

PURPOSE: To compare adjusted resting energy expenditure (REEa) and contributions of skeletal lean mass (SM) and fat mass (FM) to REEa in women at varying levels of adiposity.

METHODS: Resting energy expenditure (REE) was measured via indirect calorimetry (REEm). Body composition data was obtained from dual-energy X-ray absorptiometry in 182 female subjects (Mean ± SD; Age 24.2 ± 9.1 yrs, Ht 164.6 ± 6.0 cm, Wt 69.0 ± 22.5 kg, BMI 25.5 ± 8.3 kg·m⁻²). The sample was divided into tertiles by body fat percent (%fat); Tertile 1 (T1): %fat=18.5-28.4%; Tertile 2 (T2): %fat=28.5-33.8%; Tertile 3 (T3): %fat=34.0-61.0%. To normalize and compare groups, REE was predicted (REEp) to account for differences in FFM and age. Adjusted REE was then calculated from REEm, REEp, and mean REEm per tertile (REEt) using REEa=REEt+REEm-REEp. Contributions (mass × metabolic rate, kcal/kg/day) of FM and SM were calculated as percentages of REEa. One-way ANOVAS and a two-way ANOVA were conducted to analyze differences in body composition and differences between REEm and REEa [(REE (REEm vs REEa) × Group (T1 vs T2 vs T3)], respectively.

RESULTS: FM in T3 was significantly higher than T1 (Mean Difference (MD) ± SD; 22.6 ± 25.0 kg, *p*=0.001) and T2 (MD ± SD; 17.9 ± 25.0 kg, *p*=0.001). No differences occurred in SM (*p*>0.05). When evaluating REE and group, there was no significant interaction (*p*=0.191), or main effect for REE (REEm vs REEa) (*p*=0.995). There was a significant main effect for group (T1 vs T2 vs T3, *p*=0.001); REE was significantly higher in T3 versus T1 (MD ± SD; 281 ± 396 kcal/day, *p*=0.001) and T2 (MD ± SD; 215 ± 396 kcal/day, *p*=0.001). Expenditure attributed to SM in T1 was significantly higher than T3 (MD ± SD; 3.2 ± 8.6%, *p*=0.001). Difference in FM contribution between T1 and T2 lacked significance (*p*=0.210), but T3 had a significantly higher FM contribution than T1 (MD ± SD; 5.1 ± 7.0%, *p*=0.001) and T2 (MD ± SD; 3.9 ± 7.0%, *p*=0.001).

CONCLUSIONS: Despite similarities in SM, women with elevated %fat experienced lower SM contribution and higher FM contribution to REEa. As adiposity increases, REE increases; FM may explain more of the variance in REE between women of different levels of adiposity.

3953 Board #270 May 30 9:00 AM - 10:30 AM
Relationship Between Energy Availability And Basal Metabolic Rate In Free-living Competitive Girl Runners

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Decrease in energy availability (EA) theoretically reduce basal metabolic rate (BMR) with sacrificing reproduction or bone health. However, research in EA of Asians is scarce and there is no data of EA as a determinant of BMR in adolescent athletes.

PURPOSE: To reveal the relationship between BMR and EA in free-living Japanese competitive girl runners with a focus on female athlete triad.

METHODS: Consecutive 14 girl runners (16.6 ± 0.7 y/o, 161.0 ± 6.3 cm, 45.2 ± 5.4 kg) in the same competitive high school team were evaluated without control on food and exercise. Each runner was asked to report dietary records with photos and training logs for 7 days. Energy intake (EI) was assessed by registered nutritionists. The runners were tested on treadmill with indirect calorimeter to yield individual prediction equations for VO₂ by running velocity. Exercise energy expenditure (EEE) was calculated by the equations based on the training log. EA was calculated by subtracting EEE from EI for each day. The daily means of those variables were calculated. BMR was measured by whole room calorimeter in the early morning after overnight sleep at the night of the last day of the assessment inside the calorimeter. Body composition was measured by DXA. Bivariate correlation analyses and *t*-test were used to examine the relationships and the difference between variables and groups, respectively.

RESULTS: Percent body fat (%BF), fat free mass (FFM), and bone mineral density of TBLH (BMD) were 13.3 ± 4.5 %, 39.0 ± 3.5 kg, and 1.013 ± 0.04 g/cm², respectively. BMR, EI, EEE, and EA were 26.5 ± 2.4 kcal/kg·FFM/day, 2330 ± 479 kcal/day, 892 ± 245 kcal/day, and 37.4 ± 10.7 kcal/kg·FFM/day, respectively. EA was significantly

correlated with BMR ($r=0.60$, $p=0.02$). However, EA was not correlated with either %BF ($p=0.25$) or BMD ($p=0.16$) and did not differ between runners with oligo/amenorrhea ($n=7$; 40.8 ± 11.9) and eumenorrhea ($n=6$; 34.0 ± 9.8) ($p=0.29$).

CONCLUSIONS: The strong linear correlation between EA and BMR supports the theory that decrease in EA leads to compensatory adaptation in metabolism which may suppress reproduction or bone mineral accrual. However, arbitrarily evaluated EA in short-term was not related to the triad associated conditions. Those results were consistent with the evidences from adult Caucasian population.

G-41 Free Communication/Poster - Thermogenic Dietary Supplements

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
Room: CC-Exhibit Hall

3954 Board #271 May 30 9:00 AM - 10:30 AM The Effect Of Thermogenic Nutritional Supplementation On Resting Metabolism In College Females

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(No relevant relationships reported)

BACKGROUND: Global increases in the incidence of obesity and the ensuing clinical co-morbidities has increased interest in the use of thermogenic supplements formulated to increase resting metabolism to increase energy expenditure and fat utilization. **PURPOSE:** The purpose of this study was to assess the effect of new capsaicin-based thermogenic supplements on resting oxygen consumption (VO₂), carbon dioxide production (VCO₂) and respiratory quotient (RQ). **METHODS:** Twenty-two untrained females (21.1±4.2 years) visited the lab on six occasions for measurements of pre-supplementation (PRE) resting energy expenditure (REE) for 30-60 min followed by the ingestion of a placebo or supplement (Shred, Shred 2.0, Capsimax 50, Capsimax 100, Capsimax 200) with at least three days separating conditions. Resting VO₂, VCO₂, and RQ were re-assessed for 90-120 minutes post-supplementation (POST). Changes in metabolic markers between treatment groups and over time were assessed in 5-minute intervals over the course of the 90-minute assessment using a two-way repeated measures ANOVA. **RESULTS:** PRE VO₂ ($2.5 \pm 0.3 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$; $0.21 \pm 0.03 \text{ L}\cdot\text{min}^{-1}$), VCO₂ ($0.18 \pm 0.03 \text{ L}\cdot\text{min}^{-1}$), and RQ (0.85 ± 0.06) were lower than any given 5-minute interval POST ($p<0.05$). VO₂ ($\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) was elevated at 5 min POST ($2.99 \pm 0.5 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) compared to each subsequent 5 min interval ($p<0.05$) with no differences noted after 10 minutes ($2.7 \pm 0.4 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$). VCO₂ and VO₂ ($\text{L}\cdot\text{min}^{-1}$) were elevated at 5 min POST compared to subsequent 5-minute intervals until 80 min (VCO₂; 0.22 ± 0.04 to $0.19 \pm 0.03 \text{ L}\cdot\text{min}^{-1}$) and 70 min (VO₂; 0.25 ± 0.04 to $0.23 \pm 0.03 \text{ L}\cdot\text{min}^{-1}$; $p<0.05$). There were no changes in VCO₂ at 10 minutes ($0.19 \pm 0.03 \text{ L}\cdot\text{min}^{-1}$) compared to any other time point POST. VO₂ ($\text{L}\cdot\text{min}^{-1}$) briefly increased from 35-45 minutes POST ($0.23 \pm 0.04 \text{ L}\cdot\text{min}^{-1}$) compared to 20 min POST ($0.22 \pm 0.03 \text{ L}\cdot\text{min}^{-1}$; $p=0.002$); no further changes occurred after 45 minutes. There were no changes in RQ during POST. There were no interaction effects (time*treatment) or treatment differences in metabolic markers. **CONCLUSIONS:** Observed time effects are postulated as a result of the elevated REE caused by changes in subject position during supplement consumption, rather than supplementation. This study suggests that new thermogenic supplementation has no effect on metabolism.

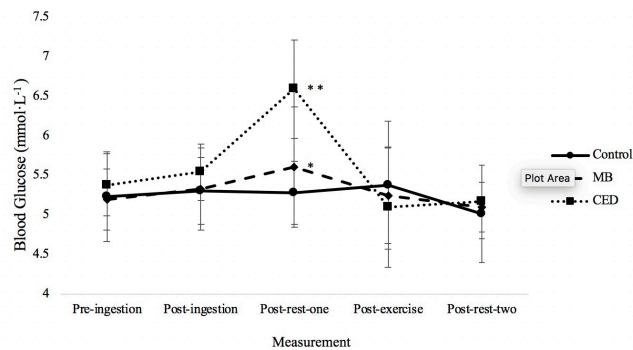
3955 Board #272 May 30 9:00 AM - 10:30 AM Effect Of Energy Drink Consumption On Heart Rate Variability And Blood Glucose In Relation To Exercise

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(No relevant relationships reported)

There is high prevalence of adverse events associated with caffeinated energy drink (CED) consumption. **PURPOSE:** This study aimed to examine the acute physiological effects of CED in apparently-healthy volunteers, pre-, during-, and post-exercise. **METHODS:** A randomized cross-over double-blind design with three experimental conditions was used: a CED condition, a matched caffeine-carbohydrate beverage condition (MB), and a control beverage condition (CB). Participants underwent blood glucose, heart rate variability (HRV), and heart rate measures pre- and post-exercise. During the exercise component, participants increased cycling intensity to a respiratory exchange ratio of 0.96 to 0.98 and maintained the workload for 20-minutes. Blood glucose, HRV, and heart rate measures were compared using two-way ANOVA, and

exercise measures were compared using one-way ANOVA. **RESULTS:** As seen in Figure 1, an effect of condition on blood glucose ($p < 0.001$), an effect of time on blood glucose ($p < 0.001$), and an effect of condition x time on blood glucose ($p < 0.001$) was observed. Specifically, pre-exercise there was an increase in blood glucose in the CED condition relative to the MB condition (6.59 ± 0.63 vs. $5.61 \pm 0.76 \text{ mmol}\cdot\text{L}^{-1}$, $p < 0.001$), and in the MB condition relative to the CB condition (5.61 ± 0.76 vs. $5.28 \pm 0.40 \text{ mmol}\cdot\text{L}^{-1}$, $p = 0.045$). There was no effect of condition on HRV, heart rate, or exercise measures. **CONCLUSION:** Given the increased blood glucose in the CED condition relative to the MB conditions it is concluded that an ingredient in commercial CED must stimulate the endogenous release of glucose into circulation.

Fig. 1. Mean condition blood glucose concentration values over time. Effect of condition and time ($p < 0.001$), effect of condition x time ($p < 0.001$). * indicates statistical significance between conditions ($p < 0.050$).



3956 Board #273 May 30 9:00 AM - 10:30 AM Effect Of 5-hour Energy Shot® On Physiological And Performance Responses To Simulated Car Racing

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(No relevant relationships reported)

The 5-Hour Energy Shot® continues to be one of the more popular energy drinks on the market. The maker claims that it improves work and/or exercise performance. **PURPOSE:** To determine if ingesting one 5-Hour Energy Shot® compared to a placebo causes measurable improvement in performance related to physiological variables during a simulated driving task (SDT). **METHODS:** Nineteen (11 males, 8 females), college-aged (21.8 ± 1.55 yrs; 1.7 ± 0.11 m in ht; 72.9 ± 13.83 kg in wt), volunteers participated in a double-blind, cross-over, placebo-based study. The participants were tested prior to and then at 5 consecutive 1-hour intervals after ingesting either a randomly assigned non-caffeinated placebo (PL) (59 ml; 5 kcal) or the 5-Hour Energy Shot® (SHES) (59 ml; 4 kcal). The SDT was a solo-timed road race (Forza Horizon game) on an Xbox 360 gaming system. During each of the 6 data collection trials, heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), ear temperature (ETemp), skin temperature (STemp), drive time (DT), and number of crashes (#C) were recorded. Subjects were also evaluated for alertness and drink effectiveness at each of same time points. A 2-way repeated measures ANOVA was utilized to determine differences between the PL and the 5-HES treatments across the six test periods of the driving task. Significance was established at $p < 0.05$. **summary of RESULTS:** There was no statistically significant difference between PL and 5-HES across the six time periods relative to HR, SBP, DBP, ETemp, or #C driving tasks. However, the 5-HES group had a significantly lower STemp than the PL group at each time interval; with a 5-hour post-ingestion STemp of $89.55 \pm 2.30^\circ\text{F}$ in the 5-HES group compared to $90.27 \pm 1.96^\circ\text{F}$ in the PL group. The 5-HES group had a faster DT compared to the PL group at each of the time intervals; with a 5-hour post-ingestion DT of 197.47 ± 50.39 sec in the 5-HES group compared to 201.09 ± 52.38 sec in the PL group. **CONCLUSIONS:** When compared to a placebo, 5-Hour Energy Shot® did significantly improve driving time, along with a concomitant reduced skin temperature in college-aged participants during a simulated driving task.

- 3957** Board #274 May 30 9:00 AM - 10:30 AM
Effects Of Esport Specific Supplementation On Esport Performance And Physiological Measurements
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 (No relevant relationships reported)

Esports, or competitive video gaming, requires persistent cognitive functioning, alertness, quick reaction time, and mental clarity. As Esports has gained attention, more research is justified to elucidate performance enhancing strategies. Interestingly, Esport supplements aimed to improve reaction time, focus, and energy levels have yet to be heavily investigated. **PURPOSE:** To examine the impact of an Esport specific supplement on Esports performance and physiological responses. **METHODS:** Fifteen males (age = 22.0 ± 1.1 yrs, ht = 181.7 ± 10.2 cm, wt = 83.6 ± 14.5 kg, gaming = 13.9 ± 6.6 hrs) participated in the study. After completion of a baseline familiarization session including an Esports aim trainer (AT), subjects completed 2 performance sessions in a counterbalanced crossover design. Participants were given an Esports supplement (SUP) [caffeine, L-Theanine, Ginkgo Biloba, Vitamin B6, D3, B12] or placebo (PLA) 30 minutes prior to starting AT. During AT sessions, 3 rounds of 3 tests were completed each session: classic (CLA), reflex (RE), simple (SIM), and 1 round of time trial (TT). During each test, score (SCO), accuracy (ACC), and time per hit (TPH) were recorded, as well as time to completion (TTC) during CLA and TT. Before and after AT, BP and 5min resting HR and HrV were assessed. Subjects were asked mental fatigue and alertness prior to and after AT, along with SRPE after AT. Paired samples t-tests with an alpha level at p ≤ 0.05 were used to compare measurements of HR, HrV, BP, peak ACC, peak SCO, peak TPH, and peak TTC between SUP and PLA. **RESULTS:** There were no significant differences between SUP or PLA in regard to ACC (CLA 91.3 ± 3.0 vs 90.3 ± 4.4 %, RE 40.7 ± 12.9 vs 39.2 ± 12.0 %, SIM 61.7 ± 14.1 vs 61.7 ± 17.8 %, TT 48.0 ± 14.9 vs 49.7 ± 14.2 %, p ≥ 0.05), SCO (CLA 116357.1 ± 60706.9 vs 113642.9 ± 51013.7, RE 45839.3 ± 29161.1 vs 42339.3 ± 27287.2, SIM 40964.3 ± 22276.6 vs 38892.9 ± 24041.8, TT 16714.3 ± 20364.7 vs 20000.0 ± 18630.0, p ≥ 0.05), TPH (CLA 0.6 ± 0.1 vs 0.6 ± 0.1 sec, SIM 1.9 ± 0.5 vs 1.9 ± 0.5 sec, TT 1.8 ± 0.5 vs 1.7 ± 0.5 sec, p ≥ 0.05), and TTC (CLA 85.9 ± 23.1 vs 90.7 ± 15.4 sec, TT 177.5 ± 59.7 vs 161.7 ± 53.1 sec, p ≥ 0.05). **CONCLUSION:** SUP did not improve Esports performance during AT compared to PLA. This could be due to dosage, AT used, and level of experience of participants.

- 3958** Board #275 May 30 9:00 AM - 10:30 AM
Effect Of Dynamine With And Without Theacrine Supplementation Over Four Weeks On Blood Biomarkers
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 (Sponsor: Yuri Feito, FACSM)
 (No relevant relationships reported)

Methylxerine (Dynamine; DYM) and theacrine (Teacrine; TCR) are purine alkaloids. Previous research on TCR reported increases in feelings of energy, focus, and concentration, and decreases in fatigue. Currently, there are no published human safety data on DYM. **PURPOSE:** The purpose of this study was to examine the effect of four weeks of DYM supplementation with and without TCR on blood biomarkers. **METHODS:** One-hundred twenty-five men (n = 60) and women (n = 65) were assigned to one of five groups: low dose DYM (100 mg), high dose DYM (150 mg), low dose DYM with TCR (100 mg + 50 mg), high dose DYM with TCR (150 mg + 25 mg), and 125 mg maltodextrin. Participants visited the laboratory fasted on two occasions (week 0 and week 4), separated by four weeks of supplementation, for a blood draw. Blood was analyzed by an independent third-party (i.e. LabCorp). **RESULTS:** Three-way repeated measures analyses of variance were performed for all blood biomarkers. Group × sex × time interactions (p < 0.05) with post-hoc analyses revealed differences for mean corpuscular hemoglobin (MCH) concentration with MCH being higher in men consuming the placebo than women consuming low dose DYM (p = 0.028) and high dose DYM with TCR (p = 0.011) at week 4. Group × time interactions (p < 0.05) revealed differences for platelets, blood urea nitrogen, total globulins, alanine transaminase, total proteins, triglycerides, and high-density lipoproteins. However, post-hoc analyses showed specific increases for blood urea nitrogen in groups consuming low dose DYM with TCR compared to low dose DYM participants, and an increase in high-density lipoproteins in the group consuming high dose DYM. Significant main effects for time were observed. Specifically, increases in mean corpuscular volume, MCH, basophils, absolute eosinophils, creatinine, and high-density lipoproteins from week 0 to week 4, while decreases in glomerular filtration rate, chloride, carbon dioxide, bilirubin, and alanine transaminase were seen.

CONCLUSIONS: While small changes were found in some biomarkers, in all cases values remained within normal clinical limits. This suggests that DYM alone or in combination with TCR consumed at the dosages used in this study does not appear to negatively impact blood biomarkers associated with health.
 Compound Solutions, Inc. grant

G-42 Free Communication/Poster - Vitamin D

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

- 3959** Board #276 May 30 9:00 AM - 10:30 AM
Low-dose Vitamin D Supplementation Does Not Prevent 25(OH) Vitamin D Decline In College Students
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 (No relevant relationships reported)

Vitamin D deficiency is prevalent among active adults. Commonly, individuals opt to consume a multivitamin product to correct this deficiency. However, many multivitamins are often under-dosed compared to current evidenced-based recommendations. Furthermore, some companies offer a variety of vitamin formulations, with the claim of improving nutrient absorption. **PURPOSE:** To compare the effects of two different forms (liquid vs. capsule) of low-dose multivitamins on 25(OH) vitamin D status following 10-weeks of supplementation. **METHODS:** Thirty-two healthy males (n=15; 20.1y, 163cm, 71.7kg) and females (n=19; 22.1y, 153.4cm, 69.9kg) participated in this randomized, double-blind, placebo-controlled study. At the beginning of the 10-week intervention, participants provided a resting, fasted baseline blood sample and were randomly assigned to a liquid multivitamin supplement (LIQ; n=11), multivitamin capsule (CAP; n=11), or placebo group (PL; n=12). Participants took their respective supplement daily for 10 weeks. To maintain the double-blind study design, each participant consumed a combination of a liquid and capsule product. Placebo liquids and capsules were balanced so each group (LIQ, CAP, PL) consumed only their correct active (or placebo) treatment. The LIQ and CAP supplement both contained 268 IU of Vitamin D. Compliance was tracked by collecting empty supplement containers each week. After the 10-weeks, all participants reported back to the laboratory for a resting, fasted blood sample. Plasma samples were assayed for 25(OH) vitamin D concentrations. Data were analyzed using a 2-way repeated measures analysis of variance (ANOVA). **RESULTS:** There was a main effect for time (F=11.86, p=0.002, η²=0.227) with 25(OH) vitamin D concentrations significantly lower (Δ: -7.8±14.9ng/mL) at post-testing. Further, there were no significant differences between treatments (F=0.200, p=0.820, η²=0.013) in 25(OH) concentrations suggesting no benefit of LIQ or CAP supplementation over PL. **CONCLUSION:** It appears that a chronic low dose of vitamin D in liquid or capsule form is insufficient to maintain or elevate 25(OH)D concentrations in healthy, college-aged adults. Consumers should evaluate the dosing of their multivitamins compared to current evidence-based recommendations.

- 3960** Board #277 May 30 9:00 AM - 10:30 AM

EFFECTS OF ORAL VITAMIN D OR SIMULATED SUNLIGHT ON VITAMIN D METABOLISM DURING MILITARY TRAINING

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25-hydroxyvitamin D (25(OH)D) is hydroxylated in the liver to its *biologically active* form, 1,25 dihydroxyvitamin D (1,25(OH)₂D), and its *catabolic* form, 24,25 hydroxyvitamin D (24,25(OH)₂D). The effect of vitamin D supplementation on the production of 1,25(OH)₂D and 24,25(OH)₂D is unknown. **PURPOSE:** To examine the effect of oral vitamin D supplementation *versus* simulated sunlight on vitamin D metabolites and parathyroid hormone (PTH) during 13-weeks of military training. **METHODS:** Eighty male infantry recruits (mean ± SD, age 22 ± 3 years, height 1.78 ± 0.07 m, body mass 77.9 ± 10.7 kg) received oral vitamin D₃ (OD₃, 1,000 IU·D⁻¹ for 4 weeks and then 400 IU·d⁻¹ for 8 weeks, n = 21), an oral placebo (OP, n = 19), solar-simulated radiation (SSR-D, 1.3 × standard erythemal dose in T-shirt and shorts, 3 d·wk⁻¹ for 4 weeks and 1 d·wk⁻¹ for 8 weeks, n = 22), or placebo SSR (SSR-P, n =

18). A blood sample was drawn in weeks 1, 5 and 13, and analysed for 1,25(OH)₂D, 24,25(OH)₂D and PTH. **RESULTS:** There was a significant effect of time ($P = 0.001$) but no effect of supplementation on 1,25(OH)₂D (group \times time interaction, $P = 0.345$). 1,25(OH)₂D was not different between week 1 and 5 (104.8 ± 25.7 pmol·L⁻¹, 102.9 ± 26.2 pmol·L⁻¹), but increased by week 13 (112.4 ± 3.7 pmol·L⁻¹, $P = 0.009$). There was a significant group \times time interaction for 24,25(OH)₂D ($P < 0.001$). In OD₃ and SSR-D, 24,25(OH)₂D increased from week 1 (3.4 ± 2.3 and 2.9 ± 2.3 nmol·L⁻¹) to week 5 (5.5 ± 2.5 and 5.1 ± 1.5 nmol·L⁻¹, $P < 0.001$) and week 13 (5.3 ± 1.3 and 5.6 ± 1.4 nmol·L⁻¹, $P < 0.001$). In OP, 24,25(OH)₂D decreased from week 1 (3.5 ± 2.2 nmol·L⁻¹) to week 5 (2.7 ± 1.4 nmol·L⁻¹, $P < 0.001$) and returned to baseline by week 13 (3.6 ± 1.3 nmol·L⁻¹). In SSR-P, 24,25(OH)₂D increased from week 1 (2.4 ± 1.6 nmol·L⁻¹) and week 5 (2.6 ± 1.6 nmol·L⁻¹) to week 13 (4.0 ± 1.4 nmol·L⁻¹, $P \leq 0.027$). 24,25(OH)₂D was higher in the OD₃ and SSR-D than their respective placebo groups at week 5 and week 13 ($P < 0.001$). There was a significant effect of time ($P < 0.001$) but no effect of supplementation on PTH (group \times time interaction, $P = 0.059$). PTH decreased from week 1 (4.7 ± 1.3 pmol·L⁻¹) and week 5 (4.8 ± 1.4 pmol·L⁻¹) to week 13 (4.3 ± 1.2 pmol·L⁻¹, $P \leq 0.003$). **CONCLUSION:** Oral vitamin D supplementation or simulated sunlight have no effect on the *biologically active* 1,25(OH)₂D, but increase the production of the *catabolic* metabolite 24,25(OH)₂D.

3961 Board #278 May 30 9:00 AM - 10:30 AM
Conducting Vitamin D3 Supplementation To Observe Serum 25(OH)D Levels, Body Composition, And Depression In Athletes

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 (No relevant relationships reported)

Vitamin D insufficiency is linked with muscle weakness and adequate levels can improve muscle performance. Secondly, Vitamin D is stored in fat via fat sequestration and has ties to depression. Athletes in preseason use copious amounts of muscle potentially altering body composition. Indoor athletes in particular, would benefit from supplementation due to their specific population risk of limited access to sunlight and living in a seasonally changing climate; both of which are indicators for inadequate Serum Vitamin D (25(OH)D) and depression. **PURPOSE:** To first examine 25(OH)D levels in an indoor athletic population with daily supplementation of Vitamin D3 (D3) to observe any potential relationships between supplementation, 25(OH)D, body composition, and depression levels. **METHODS:** Men's Basketball players at a Division II school were recruited during preseason. Subjects with 25(OH)D levels <40ng/mL were admitted and started on 4000IU/day D3 supplementation for 8 weeks, Visit 1 (V1). Visit 2 (V2) and Visit 3 (V3), were 4 and 8 weeks after V1, respectively. Visit 4 (V4) was 4 weeks after V3 and D3 completion. 25(OH)D via blood draws, body composition (BodPod), anthropometrics such as height, weight, and waist circumference were measured at all visits. Depression (CES-D Scale) was measured at screen and V4. **RESULTS:** Five (19.4±1.3yo, 25.6±1.1kg/m² BMI, 23.0±9.2ng/dL 25(OH)D) subjects completed. 25(OH)D increased from V2-V3 (27.7 ± 5.9 - 38.7 ± 3.6 , $p=0.02$) but not from V1-V2 nor V1-V3. A trend was noted with falling 25(OH)D from V3-V4 (38.7 ± 3.6 - 32.3 ± 7.7 , $p=0.06$), 4 weeks post supplementation. No changes were seen in any body composition measures over time nor in comparison with parallel 25(OH)D levels. Screen 25(OH)D was not different than depression at pre study (4.4 ± 2.3 , $p=0.67$) but trended towards a difference compared to post study (2.3 ± 1.7 , $p=0.06$). **CONCLUSION:** 25(OH)D eventually increased in Division II basketball players with continual supplementation, possibly improving rates of depression. Further research is warranted with a larger active athletic population over a longer period of supplementation to perhaps see any definitive relationships in 25(OH)D and depression or in comparison to body composition, and to continue detecting levels after stopped supplementation.

3962 Board #279 May 30 9:00 AM - 10:30 AM

Modulation Of Acute Metabolic And Inflammatory Responses To Resistance Exercise By Vitamin D3 Injection In Vitamin D-deficient Males

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Vitamin D deficiency has been previously associated with impaired metabolic functions which may impact the acute effects of resistance exercise (RE) on insulin sensitivity, inflammation, and muscle damage. The effects of exogenous vitamin D on the metabolic, inflammatory, and muscle damage responses to an acute bout of RE in vitamin D deficient subjects have yet to be explored. **PURPOSE:** To evaluate the effects of a single vitamin D3 injection on the metabolic, inflammatory and muscle damage responses to an acute bout of RE in vitamin D-deficient resistance-trained males. **METHODS:** Blood samples from 14 vitamin D-deficient resistance-trained males were obtained during two separate trials: lower vitamin D (LVD, after saline injection) and higher vitamin D (HVD, after vitamin D3 injection). Metabolic, inflammatory, and muscle damage markers were evaluated at baseline and immediately then one hour after RE. Differences in mean values for each variable between trials were compared by repeated measures ANOVA followed by LSD test for pairwise comparisons. **RESULTS:** There were significant trial \times time interactions for serum insulin and Homeostatic Model Assessment (HOMA) of Insulin Resistance which were both lower ($p < 0.05$) at 1-hour post-RE in the HVD compared to LVD trial. There was a significant decrease ($p < 0.05$) for blood sugar and increase ($p < 0.05$) for creatine kinase, lactate dehydrogenase, and interleukin 6 1-hour post-RE across both trials with no interaction of time. There were no significant changes in other inflammatory and cardiovascular markers following either trials. A single injection of vitamin D3 demonstrated efficacy in reducing insulin resistance following RE in previously vitamin D-deficient resistance-trained males. Conversely, muscle damage and inflammatory response to acute RE were not altered. **CONCLUSION:** Intramuscular vitamin D replacement in vitamin D-deficient resistance-trained males may have key implications for the promotion of glucose metabolism and lowering the risk of diabetes in this population.

3963 Board #280 May 30 9:00 AM - 10:30 AM

Effects Of Vitamin D And Resistance Training On Insulin Sensitivity And Neuromuscular Health In Obesity

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 (No relevant relationships reported)

Vitamin D has been widely studied for its role in regulating calcium and bone metabolism. Increasing evidence shows that vitamin D has insulin-sensitizing and ergogenic properties, which are similar to the adaptations to resistance training (RT). **Purpose:** To evaluate the effects of a 10-week vitamin D administration with or without RT on systemic insulin sensitivity, inflammation and neuromuscular health in p62 deficient mice, a genetic obese animal model with reduced insulin sensitivity. **Method:** 24-week old p62 deficient male mice were assigned to the following groups (10/group) for 10-week interventions: control (p62C, no treatment), vitamin D (VD, 75 IU of vitamin D every 3 days), RT (ladder climbing 3x/wk), or combined treatment (VRT, VD + RT). Body weight and daily food intake were monitored biweekly. Body composition (Dual-energy X-ray absorptiometry), neuromuscular function (grip strength and sensorimotor function), and systemic glucose tolerance (2-hour oral glucose tolerance test) were measured pre- and post-intervention. Blood samples, the hindlimb muscles, and the spleen were collected post-intervention and analyzed for serum vitamin D levels, tissue wet weights, and myofiber cross-sectional area (CSA). **Results:** 10-week vitamin D administration significantly increased serum vitamin D levels in VD (+61.1%) and VRT (+34.0%, $p < 0.001$) compared to p62C. Total body mass significantly increased in three groups (p62C: +16.4%, VD: +13.5%, VRT: +8.6%, $p < 0.05$) except RT. Fat mass increased significantly in p62C (+33.0%, $p < 0.05$) but was not changed in the intervention groups. Lean mass was not affected by any intervention. Grip strength (-22.5%) and sensorimotor function (-12.8%) significantly decreased only in p62C ($p < 0.05$). RT preserved fasting blood glucose levels (BG). In addition, RT and VRT lowered 30-minute postprandial BG (RT: -40.9%, VRT:

-36.9%, $p < 0.05$), compared to p62C. The spleen mass was significantly lower in RT (-49.7%) and VRT (-45.1%, $p < 0.05$) compared to p62C. **Conclusion:** Vitamin D, RT, and when combined not only attenuated the progression of obesity but also preserved neuromuscular function in p62 deficient mice. However, only RT was effective in improving systemic insulin sensitivity and inflammation. Supported by Jiwon Co./FSU College of Human Sciences

G-43 Free Communication/Poster - Pedagogy Related to Exercise

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

**3964 Board #281 May 30 8:00 AM - 9:30 AM
 Community, Connectedness, And Learning In Exercise Science: Does Classroom Context Matter?**

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Exercise science programs require rigorous academic preparation often taught in traditional classroom and lab settings. However, situated learning theory views learning as action in a community of practice, where the elements of social interaction, connectedness, and authentic participation transform cognitive understanding into meaningful knowing. Situated learning can have a complex effect on exercise science students' connectedness, understanding, theory application, and professional skills. Additionally, social networks (like Facebook) can provide a modern educative community in which to increase engagement and connection in the classroom. **PURPOSE:** The purpose of this quantitative research was to examine the relationship between learning environment type (situated versus traditional) and the use of Facebook on undergraduate exercise science students' perceived sense of overall classroom community, connectedness, and learning. **METHODS:** 69 undergraduate exercise science students (age [yrs] = 22.5 ± 2.1 , males = 37.7%; females = 60.9%) who had participated in either a traditional course, traditional course with Facebook, a situated course, or a situated course with Facebook completed Rovai's (2002) Classroom Community Survey at the end of their course experience. Multiple Regression was performed to determine if there were any significant differences between the four groups ($\alpha = .05$). **RESULTS:** Results demonstrated a situated learning classroom and a situated learning classroom with Facebook were significant positive predictors of students' perception of overall classroom community ($R^2 = .181$, $F(3, 65) = 4.794$, $p = .004$), connectedness ($R^2 = .130$, $F(3, 65) = 3.232$, $p = .028$), and learning ($R^2 = .186$, $F(3, 65) = 4.965$, $p = .004$). **CONCLUSIONS:** This research supports situated learning as a best practice for increasing classroom community in undergraduate exercise science programs. Students perceived higher levels of overall classroom community, connectedness, and learning when participating in a situated classroom and to an even greater extent a situated classroom with Facebook. Incorporation of these types of learning environments and teaching strategies in exercise science degree programs may enhance professional skill development and successful employment within the field.

**3965 Board #282 May 30 8:00 AM - 9:30 AM
 Service-learning Or Internship: A Mixed-methods Evaluation Of Experiential Learning Pedagogies**

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Experiential learning pedagogies, including internship and service learning experiences, are becoming increasingly popular in higher education. An internship engages students with hands-on experiences that enhances their learning or skills within their fields of study while service-learning is as a type of experiential education in which students participate in service, typically within the community, and reflect on their involvement in such a way as to gain further understanding of course content and of the discipline as well as its relationship to societal needs. To date, no study has yet directly compared these teaching modalities. **PURPOSE:** To determine if a service learning experience or internship pose a more favorable effect on education-based self-efficacy. **METHODS:** The present study systematically evaluated a service learning experience against an internship experience using a mixed-methods model with the primary outcome being student self-efficacy. Sixteen students completed a community-based wellness internship with a subgroup (nine students) allocated to a service-learning component of internship which incorporated reflective assignments designed to improve self-efficacy. At the end of the semester, students completed a 15 item

online self-efficacy and satisfaction survey using a Likert scale. Three focus groups were conducted in which 3-4 participants responded to a series of nine questions which explored their internship experience. Qualitative data was analyzed via thematic analysis. **RESULTS:** Overall responses to the self-efficacy and satisfaction survey were favorable for both groups, but the internship group was more likely to agree or strongly agree with statements of self-efficacy. Focus groups found that the internship experience reinforced classroom learning, but the ability to work with different populations and ability levels was mentioned only by the service-learning group. Themes from reflective assignments, such as engaging with community members and professional exploration, were evident in the service-learning group responses only. **CONCLUSION:** When incorporating reflection assignments service learning experiences successfully connect the service experience to relevant course outcomes promoting student development and self-efficacy.

**3966 Board #283 May 30 8:00 AM - 9:30 AM
 Evaluation Of The Virtual Laboratory Of Exercise Physiology**

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Lab experience is one of the most important parts of Kinesiology courses; however, most California State University (CSU) campuses do not have the capacity for physical labs, adequate equipment, or funding to provide hands-on lab activities to their Kinesiology major students. **PURPOSE:** The purpose of this research was to compare student learning outcomes from Virtual Laboratory of Exercise Physiology (VLEP) with that from traditional exercise physiology laboratory activities. **METHODS:** 40 undergraduate Kinesiology students (mean±SD, age = 22 ± 3 , junior = 45%, senior = 55%) were randomly assigned to either experimental group 1 or group 2. Group 1 completed traditional laboratory activities, whereas group 2 completed the VLEP. Both groups then completed the same assessment to evaluate their understanding of aerobic (VO2max) and anaerobic (Wingate) power laboratory concepts. A one-way ANOVA was performed to determine if there were any significant differences between the two groups ($\alpha = .05$). The students were also asked to rate their experiences using a qualitative questionnaire. One of the relevant components of that questionnaire asked students to indicate which laboratory type they preferred. A second relevant component asked students to indicate how educational they thought the VLEP program was. **RESULTS:** Mean aerobic power lab activity assessment scores (%) were 81.5 ± 5.4 and 81.6 ± 6.6 and mean anaerobic power lab assessment scores were 82.5 ± 8.1 and 83.0 ± 6.5 for groups 1 and 2, respectively. There were no significant differences between the two groups in either aerobic power lab assessment scores or anaerobic power lab assessment scores. In this investigation, 47.5% of the students indicated a preference for the traditional laboratory activity, and the other 52.51% of the class either preferred the VLEP (27.5%) or did not prefer one laboratory type over another (25.0%). Students agreed that the VLEP was at least moderately educational (25.0%), and most students thought that the VLEP was very educational (75.0%). **CONCLUSIONS:** These findings support that VLEP instructs students as effectively as a traditional laboratory. We hope VLEP could remove enrollment bottleneck challenges and provide a lower cost, experiential, accessible alternative for Kinesiology major students in CSU.

**3967 Board #284 May 30 8:00 AM - 9:30 AM
 Classroom Teachers' Intentions To Provide Physical Activity Opportunities To Students: An Analysis Using Self-Determination Theory**

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PURPOSE: Providing opportunities for elementary school-aged children to be physically active during the school day is important for obesity prevention and overall health. Classroom physical activity (CPA) has been shown to be effective for increasing student PA, but is not widely practiced among teachers. This study examined teachers' perspectives on CPA, and intention to provide CPA, using a survey designed to measure constructs within the self-determination theory. **METHODS:** The constructs of Competence, Autonomy, Relatedness, and intention regarding CPA use were assessed using a survey of 173 elementary school teachers across 10 schools. The constructs were represented using the following subscales (each used a 6-point Likert-type scale from strongly disagree to strongly agree): Competence included three survey items ($\alpha = .94$), such as "I am capable of using activity breaks in my classroom;" Autonomy included three items ($\alpha = .83$), such as "I have a say in choosing whether to use activity breaks;" Relatedness included 4 items ($\alpha = .78$), such as "providing opportunities for children to be physically active in my classroom is consistent with my priorities as a teacher;" and intention to implement

CPA included 2 items ($\alpha = .77$): "I definitely plan to try using activity breaks in my classroom," and "I expect I will be able to use activity breaks regularly." Multiple linear regression was used to examine how the constructs of Competence, Autonomy, and Relatedness predicted intention to provide CPA to students.

RESULTS: Regression results indicated that the three predictors explained 44.1% of the variance ($R^2 = .44$, $F(3,173) = 44.74$, $p < .001$) in teacher intent to provide CPA. Competence ($B = .31$, $t(173) = 4.92$, $p < .001$) Autonomy ($B = .19$, $t(173) = 3.15$, $p = .002$) and Relatedness ($B = .18$, $t(173) = 3.40$, $p = .001$) each significantly predicted intention.

CONCLUSION: Competence was the strongest predictor of teachers' intent to provide CPA. However, feeling autonomous to implement CPA and viewing CPA as compatible with their teaching philosophy also predicted teachers' intention to provide CPA opportunities. Increasing teacher competence to provide CPA through professional development could be one effective method for increasing this practice. Supported by the Institute of Education Sciences grant R305A150277

3968 Board #285 May 30 8:00 AM - 9:30 AM
Effects Of Exercise On Plasma β -endorphin And Dsq In Methamphetamine Dependent Individuals

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PURPOSE: Methamphetamine is the main component of opioid drugs, which directly affects the central nervous system which leading to abnormal secretion of catecholamines. Physical exercise has been shown to benefit diverse medical and behavioral conditions. This study assesses the feasibility and efficacy of an 8-week aerobic and resistance training program on β -endorphin in plasma and desire for speed questionnaire (DSQ) for methamphetamine (MA) dependence.

METHODS: A total of 60 MA-dependent individuals were randomized to aerobic exercise group (AE, $n=30$) and resistance exercise group (RE, $n=30$). Each training group was trained over 8 weeks, 3 times/week, 90 minutes each time, which include formal training (70 minutes), warm-up (10 minutes) and recovery (10 minutes). The aerobic exercise intensity is 65%-85% HR_{max} and the muscle strength by 1-repetition maximum (1-RM) and endurance at 85% in resistant exercise group.

RESULTS: (1) After 8 weeks of exercise intervention, the β -endorphin levels in the group AE and group RE were significantly increased ($p < .01$). Inside, the level of β -endorphin in the group AE was increased from 154.7 pg/ml to 214.3 pg/ml, the rate of change of β -endorphin in plasma was 39.24%. The level of β -endorphin in the high-intensity group was increased from 158.4 pg/ml to 181.7 pg/ml, the rate of change was 14.76%. It is suggested that the effect of aerobic exercise on plasma β -endorphin is more effective than that of resistance exercise. (2) After 8 weeks of exercise intervention, MA-dependent have reduced their desires, The score of the DSQ in t both group were significantly decreased ($p < .05$). In the group AE the score was decreased from 105.40 to 75, and the score of the group RE was decreased from 111.4 to 77.7.

CONCLUSIONS: Both aerobic and resistance exercise can increase the level of β -endorphin in MA-dependent individuals, promote the formation of euphoria compensation mechanism, and reduce the desire for speed. The effect of aerobic exercise on plasma β -endorphin in methamphetamine dependent individuals was more obvious.

3969 Board #286 May 30 8:00 AM - 9:30 AM
Academic Burnout Amongst Exercise Science Students

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 (Sponsor: Monica Hubal, FACSM)
 (No relevant relationships reported)

PURPOSE: Prior research shows that the psychological constructs of hope, optimism, and self-efficacy impact voluntary behavior, and quality of life. Academic burnout is prevalent among university students of all types. However, knowledge of what predicts burnout in undergraduate exercise science (ES) students is limited. Thus, the purpose of this longitudinal study was to examine the level of burnout at the beginning and end of the semester in ES students. Second, we examined the association of psychological factors and physical activity (PA) with burnout in ES students. **METHODS:** Students completed two online surveys within one Fall semester: one at the beginning and the other near the end. The first survey included the following questionnaires: Copenhagen Burnout Inventory, Adult Hope Scale, Life Orientation Test-Revised (optimism), Self-Efficacy to Regulate Exercise, Satisfaction with Life, and International Physical Activity Questionnaire (IPAQ). The second survey included the Copenhagen Burnout Inventory, IPAQ, and Satisfaction with Life. From the IPAQ, measures of moderate PA, vigorous PA, walking, and total PA were computed. Of the 169 participants, 59 were retained who completed both surveys and listed their major as ES. **RESULTS:** At the beginning of the semester 35.6% of students reported high burnout and 22.8% reported high burnout near the end of the semester. Predictors of burnout were

chosen based on significant correlations. Burnout at Time 1 negatively correlated with vigorous PA, optimism, and Life Satisfaction at Time 1. The regression revealed vigorous PA ($Beta = -.232$, $p = .037$), life satisfaction ($Beta = -.268$, $p = .04$), and optimism ($Beta = -.369$, $p = .005$) as predictors of burnout at Time 1. Burnout at Time 2 negatively correlated with GPA, optimism, life satisfaction, and hope at Time 1. Regressions showed life satisfaction ($Beta = -.359$, $p = .008$) and optimism ($Beta = -.415$, $p = .002$) at Time 1 as significant predictors of burnout at Time 2. **CONCLUSION:** ES students reported higher burnout at the beginning of the semester compared to the end of the semester. Higher levels of vigorous PA, optimism, and life satisfaction predicted lower burnout at the beginning of the semester. Greater optimism and life satisfaction at the beginning of the semester predicted lower burnout near the end of the semester.

3970 Board #287 May 30 8:00 AM - 9:30 AM
An Exercise-based Didactic Strategy In Physical Education Increases Motor Skills In Preschool Children: A Pilot Study

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Physical education (PE) in preschool aims for the corporal and motor skills development in children, nevertheless the evaluation strategies of acquired skills has been neglected in Mexican public school system. Since 2018 only PE teachers are responsible to teach classes, and a collaboration between public institutions allowed us to launch a pilot study of PE classes based on motor skills circuits called "motor action circuits" as an effective tool to develop motor skills. **PURPOSE:** To determine the effects of an exercise-based didactic strategy on the PE curricula on motor skills performance in children. **METHODS:** Five boys (Age = 5.2 ± 0.4 yr.) and nine girls (Age = 5.1 ± 0.3 yr.) participated in the study. Exclusion criteria for children were having a major pathology, pharmacological therapy, and enrollment in after-school physical activity programs. Children attended three 30-min lessons in non-consecutive days per week under the supervision of two trained female PE teachers. Motor skills were measured by the Movement Assessment Battery for Children (MABC-2) test. Two-way (2 genders x 2 measurements) mixed ANOVA were computed for motor skills performance using the GraphPad Prism software. **RESULTS:** The assumption of normality was met by the Shapiro-Wilk test for girls ($W = 0.849$) and boys ($W = 0.807$). A better performance was found on threading beads (Pre = 1.7 ± 0.5 vs. Post = 1.1 ± 0.5 min, $p = 0.0004$) and posting coins with the preferred hand (Pre = 26.5 ± 2.1 vs. Post = 21.8 ± 5.0 s, $p < 0.0001$). A significant improvement was found on throwing at a wall target with the right arm (Pre = 2.8 ± 0.1 vs. Post = 3.8 ± 0.2 hits, $p = 0.02$), the left arm (Pre = 2.4 ± 0.2 vs. Post = 3.8 ± 0.08 hits, $p = 0.0001$), throwing a bean bag into a box (Pre = 0.4 ± 0.2 vs. Post = 4.1 ± 1.2 hits, $p = 0.0038$), maintaining one-board balance with the preferred leg (Pre = 12.3 ± 8.4 vs. Post = 26.7 ± 7.7 s, $p = 0.0007$), and one-board balance with the other leg (Pre = 10.3 ± 5.9 vs. Post = 23.6 ± 6.9 s, $p = 0.0011$). **CONCLUSION:** Significant motor skill performance improvements were observed in children attending an exercise-based didactic strategy on the PE program, which highlights the need to increase physical activity at early ages in Mexican children.

3971 Board #288 May 30 8:00 AM - 9:30 AM
Pedagogical Considerations In Exercise Physiology Laboratory Courses

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 (No relevant relationships reported)

PURPOSE: To explore how pedagogical approaches in an undergraduate exercise physiology laboratory course may reflect test results. **METHODS:** A retrospective analysis was conducted using three course sections taught in two separate semesters (six total sections, taught by the same instructor), with 31 students enrolled per semester ($N = 62$). Didactic (lecture and discussion) and practical (demonstration, in-class skills practice) instruction was provided for exercise physiology laboratory theory and procedures. Additional skills practice throughout the course was achieved via fitness assessments performed on five peer subjects recruited by each student in the class over the semester. Fitness assessments required testing for height, weight, resting blood pressure, four site skinfolds (4SKF), YMCA Step Test, YMCA Bench Press Test, 1-Minute Curl-Ups, and Sit-and-Reach. Tests were selected to cover a spectrum of fitness attributes and skills, as well as in accordance with pragmatic considerations of available practice opportunities. Course assessment included two written examinations consisting of multiple choice and short response questions, administered at the middle and end of the course, covering different sets of theoretical content, and a practical skills examination scored by rubric conducted individually by the instructor at the end of the course.

RESULTS: Scores for both sets of written examination scores were combined, resulting in an average score of 21.6±4.1 points out of 30 possible points, or 72.1%. The practical exam average equaled 13.6±1.3 points out of 15 possible points, or 90.4%. Accordingly, it was noted that scores for student performance on the practical exam were higher than those for the written examinations ($p<0.05$).

CONCLUSIONS: While pedagogical approaches differ for theoretical and practical instruction due to the nature and need for specific instruction in an undergraduate exercise physiology laboratory course, it appears that additional skills practice opportunities may result in higher test scores and improved learning, as reflected by practical examination. Thus, adequate skills practice opportunities, in conjunction with traditional didactic instruction, are recommended to enhance student learning and competence in laboratory content.

G-44 Free Communication/Poster - Genetics, Immunology and Endocrinology in Athletes

Saturday, May 30, 2020, 8:00 AM - 10:30 AM

Room: CC-Exhibit Hall

3972 Board #289 May 30 9:00 AM - 10:30 AM

Association Between Muscle Stiffness And ESR1 Rs2234693, Rs9340799 And Actn3 R577X Polymorphisms In Collegiate Athletes

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(No relevant relationships reported)

Previous studies have reported that distinct gene polymorphisms (e.g. ACTN3 R577X, ESR1 rs2234693, rs9340799) are associated with muscle stiffness, amongst which ESR1 rs2234693 and rs9340799 polymorphisms are also associated with instances of muscle injury. **PURPOSE:** To investigate the association between muscle stiffness and ESR1 rs2234693, rs9340799 and ACTN3 R577X polymorphisms in collegiate athletes. **METHODS:** In this study, 40 athletes (33 men and 7 women), who had undergone resistance training, were evaluated for the occurrence of muscle stiffness (hamstring: biceps femoris, semitendinosus, and semimembranosus) by ultrasound shear wave elastography. Additionally, ESR1 rs2234693, rs9340799 and ACTN3 R577X polymorphisms were analyzed using the TaqMan SNP Genotyping Assay. Comparisons of muscle stiffness between the genotypes were performed using one-way ANOVA. The Hardy-Weinberg equilibrium was determined for the ESR1 rs2234693, rs9340799 and ACTN3 R577X polymorphism using a Chi-square test. **RESULTS:** Genotype frequencies of the ESR1 rs2234693 (CC 13%, CT 55%, TT 33%), rs9340799 (GG 3%, GA 25%, AA 72%) and ACTN3 R577X (RR 18%, RX 64%, XX 18%) polymorphisms were consistent with the Hardy-Weinberg equilibrium ($p=0.36$, $p=0.90$, $p=0.08$, respectively). However, there was no significant difference in muscle stiffness between ESR1 rs2234693 and ACTN3 R577X genotypes. Further, the GG or GA genotype of ESR1 rs9340799 polymorphism tend to exhibit greater muscle stiffness of the hamstring muscles compared with the AA genotype in collegiate athletes (27.2 ± 7.0 kPa vs. 22.4 ± 6.7 kPa; $p=0.054$). **CONCLUSIONS:** Our results suggested that ESR1 rs2234693, rs9340799 and ACTN3 R577X polymorphisms are not associated with muscle stiffness in collegiate athletes.

3973 Board #290 May 30 9:00 AM - 10:30 AM

Self-reported Stress And Well-being Impacts Immune Response To Maximal Exercise In Collegiate Swimmers

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(No relevant relationships reported)

Exposure to acute psychological and physiological stressors is associated with impairments in immune function including reduced exercise-induced mobilization of naïve (NA) T-cells and increased mobilization of antigen-specific, highly differentiated T-cells following maximal exercise. However, the impact of sustained stressors on the immune response to maximal exercise is unknown. **Purpose:** Characterize the impact of self-reported stress and well-being on lymphocyte responses to acute bouts of exercise in collegiate swimmers over six months. **Methods:** Blood samples were collected from fifteen NCAA D1 swimmers (7 M, 6 F: 19.8 ± 0.7 y) before and after maximal swims at two timepoints (V_1 : immediately post-season 1 and V_2 : early season 2). An additional mid-off season timepoint (V_3) was collected in a subset of nine swimmers. T-cells were quantified by flow cytometry, and self-reported measures

of sleep quality (PSQI), symptoms of upper respiratory tract infection (URTI, WURRS-21), and overtraining (DALDA) were collected. Linear mixed models were used to determine the effects of exercise, season timepoint, and their interaction on lymphocyte percentages ($\alpha=0.05$). Pearson's correlation coefficients were used to assess correlations between lymphocyte percentages and stress measures. **Results:** Lower sleep quality was correlated with greater resting and post-exercise senescent CD4+ T-cell percentages ($r=0.44$, $p=0.01$; $r=0.47$, $p=0.004$, respectively). Low sleep quality was also correlated with lower post-exercise NA CD4+ T-cells ($r=-0.35$, $p=0.04$). Higher ratings of self-reported symptoms of URTI ($r=0.38$, $p=0.02$) and overtraining ($r=0.38$, $p=0.02$) were correlated with greater post-exercise senescent CD4+ T-cell percentages. Compared to pre-exercise, post-exercise NA CD8+ T-cell percentages were lower at V_1 and V_2 , while CD8+ T-cell percentages were higher post-exercise ($p < 0.01$). **Conclusion:** Elevations in stress and well-being at rest adversely impacted immune response to maximal exercise in collegiate swimmers. Impaired sleep quality and higher URTI and overtraining symptoms were associated with an exacerbated exercise-induced mobilization of senescent CD8+ T-cells, highlighting the importance of monitoring athlete stress level and overall well-being throughout the competitive season.

3974 Board #291 May 30 9:00 AM - 10:30 AM

Acute And Chronic Brain-Derived Neurotrophic Factor Responses During One Season Training In Young Swimmers

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(No relevant relationships reported)

It has been demonstrated that Brain-Derived Neurotrophic Factor (BDNF) is a mediator of neuroprotective and neuroplastic processes, and that serum BDNF is representative of central concentrations as well. Interestingly, there is evidence that BDNF levels are elevated in response to exercise.

PURPOSE: This study aimed at investigating the acute and chronic effects of a full season swimming training on serum BDNF, both at rest and after a maximal exercise bout in young athletes.

METHODS: Twelve well-trained male swimmers (14.08 ± 1.0 yrs) participated in the study. Measurements were carried out at the beginning of the training season (T1) as well as pre- and post- taper of each of the two competitive periods (i.e., T2, T3 for the first macrocycle, and T4, T5 for the second macrocycle, respectively). At each of the above time points, blood samples were collected pre- and 1 hour post a maximal, 400m swimming testing. Serum BDNF levels were measured by ELISA. Adjustment for exercise-induced plasma volume changes was performed before data analysis. Two-way ANOVA with repeated measures was used for statistics.

RESULTS: A significant pre-post testing difference was observed at T2 ($p=0.048$). In addition, a main effect of time was found among the 5 time points (T1-T5; $p=0.000$). Moreover, both pre- and post- testing responses had a similar profile exhibiting a decline from T1 to T3 (pre: $23,412 \pm 2,504$ pg/ml vs $3,433 \pm 669$ pg/ml, post: $23,004 \pm 3,410$ pg/ml vs $2,743 \pm 550$ pg/ml) and from T4 to T5 (pre: $19,428 \pm 1,097$ pg/ml vs $11,993 \pm 969$ pg/ml, post: $22,111 \pm 1,455$ pg/ml vs $12,838 \pm 1,763$ pg/ml), and an increase from T3 to T4 (pre: $3,433 \pm 669$ pg/ml vs $19,428 \pm 1,097$ pg/ml, post: $2,743 \pm 550$ pg/ml vs $22,111 \pm 1,455$ pg/ml).

CONCLUSIONS: To the authors' best knowledge this is the first study examining the acute and chronic BDNF responses during one season training in young athletes. These findings indicate that long-term swimming training can affect the resting and acute (pre-post testing) circulating BDNF in young swimmers.

3975 Board #292 May 30 9:00 AM - 10:30 AM

Hormonal And Heart Rate Changes To Maximal Exercise In Elite Adolescent Athletes

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One of the main biomarkers of stress is the steroid hormone cortisol (C), while testosterone (T) and estrogen (E) steroid hormones are associated with physical activity. **PURPOSE:** To determine the relationship between a maximal swimming exercise and hormone level changes and acute training's influence on the stress level in elite adolescent athletes. **METHODS:** The study was conducted with 31 participants (boys: $n=19$, mean age±SD: 16.34 ± 1.12 years; girls $n=12$, 15.17 ± 0.81 years) from the

field of water sports (swimming: n=10; water polo: n=21). The young elite athletes completed a maximal freestyle swimming test (200 meter) after a 25 minutes unified warm-up. Saliva samples were collected before (C1), immediately after the exercise (C2) and after a 30 minutes rest (C3). Free hormone levels in saliva were quantified by using IBL ELISA kits. Heart rate (HR) was measured throughout the whole procedure (Polar V800). We used the Brunel questionnaire to determine the participants' mood states after the field test. **RESULTS:** There was significant rise in boys' C levels compared to the C1 (0.176±0.134 µg/dl) with C2 (0.339±0.278 µg/dl; p=0.030) and C3 (0.426±0.319 µg/dl; p=0.001) measured results. Rise in girls' C level was not significant (p=0.057), however their C2 (r=0.71) and C3 (r=0.60) levels correlated with their peak HR in swimming test. Boys' T levels decreased significantly after the exercise (0.0046±0.0023 µg/dl) compared to basal levels (0.0061±0.0028 µg/dl) and T/C ratio also decreased (basal: 0.047±0.032 µg/dl; after exercise: 0.02±0.015 µg/dl). There was no significant difference in girls' E levels, however their C3 levels correlated with their happiness (r=0.62), and C3-C1 concentration difference correlated also with happiness (r=0.68) and calmness (r=0.71) items of the Brunel scale. **CONCLUSION:** These results justify the application of the swimming field test to monitor maximal performance induced hormonal changes in adolescent athletes. Changes in T and T/C levels go against the experienced trend in literature therefore we feel the need of further analysis of our results. Moreover, the repeated measures might be an effective way to register the alarming symptoms of the common overtraining syndrome in swimming. *Supported by the ministry of human capacities [ÚNKP-18-3-I-TE-6].*

3976 Board #293 May 30 9:00 AM - 10:30 AM
Assessment Of High-intensity Training Load And Exercise-induced Oxidative Stress In Professional Soccer Players.

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It is documented that intense periods of soccer can induce oxidative stress, the negative effects of which can compromise performance. However, few studies have explored the potential association between exercise-induced oxidative stress and training load intensity. **PURPOSE:** The aim of the study was to quantify oxidative stress relative to indicators of high-intensity training load in a cohort of professional soccer players throughout different phases of a competitive in-season. **METHODS:** Ten professional soccer players (age: 23±2yrs; body mass: 83.5±6.2kg; stature: 181.3±5.3 cm; $\dot{V}O_{2max}$: 57.2±6.7 mL·kg⁻¹·min⁻¹), representatives from an English Football League One team, participated in the study. Training load was assessed at three time points throughout a competitive in-season (T1: early in-season; T2: mid-season; T3: end of in-season [1st, 16th & 32nd microcycle]) using global positioning system (GPS) and heart rate (HR) based methods to quantify external (HETL) and internal high-intensity training load (HITL). Urine samples were collected at each time point and analysed for malondialdehyde (MDA) as a biomarker of oxidative stress. Data normalised to creatinine. Results presented as M ± SD. **RESULTS:** High-intensity training load varied significantly throughout the competitive in-season and was significantly higher at T2 compared to T1 (HETL: 18.56 ± 7.30 mmol⁻¹ vs. 6.72 ± 2.62 mmol⁻¹, an increase of 11.84 mmol⁻¹, 95% CI [4.33, 19.36], p = .004; HITL: 60 ± 34 %Time spent > 80% HR_{max} vs. 23 ± 15 %Time spent > 80% HR_{max}, an increase of 37 %Time > 80% HR_{max}, 95% CI [13, 60], p = .004; T2 vs. T1, respectively). Urinary MDA concentrations decreased significantly throughout the competitive in-season, $\chi^2(2) = 6.889$; p = .032, (T1: 0.76 ± 0.90 µMmmol⁻¹ vs. T3: 0.18 ± 0.12 µMmmol⁻¹, Z = -2.192, r = .52, p = .028). No significant correlations were observed between indicators of high-intensity training load and MDA. **CONCLUSION:** Chronic soccer training appears to promote an adaptive response as oxidative stress was attenuated over the competitive in-season, irrespective of the intensity of the training load. Monitoring urinary MDA may be a useful tool to provide coaches and sports scientists an insight into adaptive or maladaptive responses throughout a competitive season in soccer.

3977 Board #294 May 30 9:00 AM - 10:30 AM
Effects Of Recovery Using Cryotherapy On The Athlete'S Immune System After Repetitive Exhausting Aerobic Exercise

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Muscle damage and changes in immune cell numbers are induced by intensive repetitive and long-term physical stress leading to fatigue and decreased performance. It is widely suggested that cryotherapy (CT) is an effective strategy for accelerated

recovery. **PURPOSE:** Assessing the influence of CT compared to passive recovery on blood biomarkers after repetitive and exhausting aerobic running exercise. **METHODS:** Twelve moderately trained males (age: 28 ± 5.1 yrs) participated in this randomized cross-over study. After a graded exercise test the protocol comprised two visits including four exhaustive runs on a treadmill starting every 60 min with inclines being raised every 4 min. During the rest period of 20 min, participants rested passively or CT was applied using pants with an integrated cooling system (Aquila Sports GmbH, Switzerland). Heart rate (HR) was measured continuously and venous blood samples were taken before, immediately, 30 min, 1 h, 3 h, and 24 h after terminating the final run. The following parameters were analyzed: blood glucose (GLU), creatine kinase (CK), lactate dehydrogenase (LDH), total white blood cells (WBC), lymphocytes (LYM), granulocytes (GRA), interleukin 6 (IL-6), blood lactate concentration (La). **RESULTS:** Significant longer running times were found in the final run when using CT compared to passive rest (+ 5.8%, p = 0.036). GLU was significantly higher immediately after the final run and IL-6 was significantly higher 60 min after terminating the final run in CT (GLU + 362.5%, p = 0.006, IL-6 42.2%, p = 0.046). WBC and GRA were significantly higher in CT 180 min after the final run (WBC + 1.4%, p = 0.028, GRA + 13.7%, p = 0.010). No significant differences were found between recovery methods in HR, maximum La, CK, LDH and LYM (all at p > 0.050). **CONCLUSIONS:** Application of CT significantly elevated the resistance to fatigue of the participants. There is no evidence that this is due to reduced muscle damage as there has not been an effect in CK. According to the elevation of immune cells a higher activation of the immune system is suggested which in turn is counteracting to the frequently observed immune suppression after exhaustive exercise. Increased IL-6 levels can likely be explained by the increase of GRA. This study identified that there is a trend towards a positive effect of CT on the immune system.

3978 Board #295 May 30 9:00 AM - 10:30 AM
Increased Risk Of Symptomatic Respiratory Viral Infections In Athletes During Nordic World Ski Championships 2019

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PURPOSE: Respiratory symptoms are commonly recognized in athletes during winter sport games. There are no controlled studies on the occurrence and aetiology of the infections. Respiratory symptoms are commonly recognized in athletes during winter sport games. There are no controlled studies on the occurrence and aetiology of the infections.

METHODS: We performed a prospective controlled study of respiratory viral infections in Team Finland during 2019 Nordic World Ski Championships. There were 26 athletes and 36 staff members. Nasal swabs were taken from all team members on days 1, 7 and 13 during the Games which lasted 14 days. Respiratory symptoms were recorded daily. At the onset of a symptom two nasal swabs were taken. One swab was analysed within 60 minutes using a point-of-care test (POCT) for 15 viruses. The other swab was tested for 16 viruses in laboratory. Fifty-two matched control subjects were studied in Finland according to the same protocol.

RESULTS: Respiratory viruses were detected in 35%, 36% and 25% of the athletes, the supportive staff and the controls, respectively. Ten out of 26 (38%) athletes and 6 out of 36 (17%) staff members and 3 out of 52 (6%) control subjects experienced symptoms of respiratory infection (athletes vs staff p=0.048, athletes vs. controls p<0.01). Asymptomatic infections were identified in 4%, 19% and 21%, respectively (athletes vs staff p=0.07, athletes vs. controls p=0.03). The aetiology of the respiratory infections was detected in 84% of the cases. Four virus clusters were identified caused by rhinovirus, coronavirus 229E and NL63 and respiratory syncytial virus B.

CONCLUSIONS: The athletes had a 6-fold increase in risk of illness compared to normally exercising control subjects. The athletes had significantly less asymptomatic infections compared to staff and controls. Viruses circulated actively within the team.

3979 Board #296 May 30 9:00 AM - 10:30 AM
The Effects Of Acute Antigravity Treadmill Exercise On Inflammatory Markers In Elite Athletes

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PURPOSE: The aim of this study was to compare the responses of interleukin-8 (IL-8), tumor necrosis factor- α (TNF- α) and C reactive protein (CRP) to antigravity treadmill exercise and normal treadmill exercise in male football players. **METHODS:** Eleven male football players aged between 18- 22 years, with at least 2 years of football history and regularly trained were included in the study. $\dot{V}O_{2max}$ values of the athletes were calculated with 20 Meter Shuttle Test. The participants were randomly allocated to two groups. Half of the participants were exercised on the antigravity

treadmill and half of them were exercised on the normal treadmill for 45 minutes on % 70 of $\dot{V}O_{2max}$ values. After a week participants were exercised vice versa. IL-8, TNF- α and CRP levels were analyzed before, immediately after, 30 minutes and 2 hours after the exercises. **RESULTS:** CRP levels did not change with time in the antigravity and normal treadmill exercise and it was not different between the both groups ($P > 0.05$). TNF- α levels were lower 30 minutes after the exercise than the immediately after the exercise in the normal treadmill exercise ($P < 0.05$). However, it did not change with time in the antigravity treadmill exercise and was not different between the both groups ($P > 0.05$). IL-8 levels were higher 2 hours after the exercise than the before and immediately after the exercise in the antigravity treadmill exercise ($P < 0.05$). However, it did not change with time in the normal treadmill exercise and was not different between the both groups ($P > 0.05$). **CONCLUSIONS:** Antigravity treadmill exercise differently affects inflammatory processes than the normal treadmill exercise.

3980 Board #297 May 30 9:00 AM - 10:30 AM
Differential Responses Of Resting Vs. Post-exertion Hormone Concentrations During Simulated Military Operational Stress

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(No relevant relationships reported)

Military operational stress has been shown to impair performance and cause changes in corresponding blood biomarkers. Anabolic and stress hormones are common biomarkers used as surrogate endpoints to monitor physiological status during military training. **PURPOSE:** To determine patterns of resting and exercise-induced anabolic and stress hormones across 5 days of simulated military operational stress (SMOS). **METHODS:** 51 service members (25.8 \pm 5.1 yrs, 174.5 \pm 9.4 cm, 80.1 \pm 15.9 kg, 21.4 \pm 7.0 BF%; 11 women) completed a 5-day/night SMOS protocol. During days 3 (D3) and 4 (D4), subjects were given 50% of caloric demands. On nights 1, 2, and 5 subjects slept from 2300-0700. During nights 3 and 4, subjects slept from 0100-0300 and 0500-0700. Participants underwent a Tactical Mobility Test (TMT) familiarization on D1 followed by testing on D2-5: 2-min water can carry (40 kg), fire and movement course, 20-meter casualty drag (91 kg), 300-meter unloaded and loaded (16 kg) shuttle runs, and 2-mile paced then 2-mile best effort timed ruck march (15 kg). Blood was drawn before (PRE) and immediately after (POST) the TMT. A two-way repeated measures ANOVA was run to determine the effect of exercise over time on growth hormone (GH), insulin-like growth factor-I (IGF-I), adrenocorticotrophic hormone (ACTH), and cortisol concentrations. **RESULTS:** There were no significant interactions between exercise and time on hormone concentrations. However, there was a significant main effect of time on IGF-I (D2: 40.2 \pm 2.0 to D4: 37.3 \pm 2.0 to D5: 35.2 \pm 1.9 ng/mL, $p < 0.001$) and cortisol (D2: 22.3 \pm 1.0 and D5: 19.6 \pm 1.2 μ g/dL, $p = 0.02$). Exercise caused a significant increase in IGF-I (PRE: 37.1 \pm 2.0 vs. POST: 38.2 \pm 1.9 ng/mL, $p = 0.02$), GH (PRE: 1.2 \pm 0.3 vs. POST: 3.9 \pm 0.6 ng/mL, $p = 0.001$), ACTH (PRE: 49.8 \pm 11.1 vs. 61.8 \pm 11.5 pg/mL, $p = 0.001$), and cortisol (PRE: 15.8 \pm 0.8 vs. POST: 25.8 \pm 1.5 μ g/dL, $p < 0.001$). **CONCLUSION:** Despite significant declines in circulating hormone concentrations over time during SMOS, hormonal response amplitude was maintained. Hormonal response to exertion may provide important insights to physiological status that would otherwise be missed if measuring circulating concentrations alone.

3981 Board #298 May 30 9:00 AM - 10:30 AM
Rapid Gut Microbiome Changes In A World-Class Ultramarathon Runner: A Case Study

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The human gut microbiome is a dynamic ecosystem with prolific health connotations. Physical activity is emerging as a potent regulator of human microbiome composition. **PURPOSE:** This study examined changes in the gut microbiome of a world-class ultramarathon runner before and after competing in the Western States Endurance Run (WSER), a 163 km mountain footrace. **METHODS:** Anthropometrics and body composition were assessed and the ultramarathoner's submaximal and maximal performance profiles were evaluated. Gut microbiome analyses were performed at four time-points: 21 wk and 2 wk before and 2 h and 10 d after WSER. **RESULTS:** Aerobic power ($\dot{V}O_{2max}$) was 4.24 L/min (66.7 ml/kg/min), and running economy (51.1 ml/kg/min at 268 m/min) and lactate threshold (~83% $\dot{V}O_{2max}$) values were comparable to that of highly trained distance runners. Two hours post-race, considerable changes in the ultrarunners gut microbiome were observed. Alpha diversity (Shannon Diversity Index) increased from 2.73 to 2.80 and phylum-level bacterial composition

(Firmicutes/Bacteroidetes ratio) rose from 4.4 to 14.2. Underlying these macro-level microbial alterations were demonstrable increases in select bacterial genera such as *Veillonella* (+14,229%) and *Streptococcus* (+438%) concomitant with reductions in *Alloprevotella* (-79%) and *Subdoligranulum* (-50%). **CONCLUSIONS:** To our knowledge, this case study shows the most rapid and pronounced shifts in human gut microbiome composition after acute exercise in the human literature. These findings provide yet another example of how exercise can be a powerful modulator of human health.

3982 Board #299 May 30 9:00 AM - 10:30 AM
The Effect Of Probiotic Supplementation In Phagocytic Function Of Neutrophils In Amateur Marathon Runners

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The use of probiotics is recommended for maintaining the immunological health of endurance athletes, however the effects of probiotics on athletes immune cells function is still unclear **PURPOSE:** Investigate the effect of probiotics utilization in phagocytic function of neutrophils from marathon runners

METHODS: Twenty seven male marathoners were double-blind randomly assigned to either a probiotic group (PR) (PR=14; 35.96 \pm 5.81 years, 79.30 \pm 10.99 Kg; time of trial, 4:04 hours \pm 22.55 minutes) or placebo (PL) (PL=13 40.46 \pm 7.79 years, 72.67 \pm 10.20 Kg, time of trial, 4:53 hours \pm 1h:15 minutes). PR consumed during 30 days a sachet containing Lactobacillus Acidophilus and Bifidobacterium Lactis (10x10⁹UFC + maltodextrin 5g/day) while PL received a sachet with maltodextrin (5g/day). Phagocytic function of neutrophils were assessed by specific phagocytosis kit (Vybrant/Thermo Fisher®) after blood cell neutrophil isolation. The measures were evaluated before the supplementation period (B), one day before the race (1D), and one hour after race (1H). Data were analyzed in SPSS version 25® using ANOVA two way with repeated measures, "group" and "time" as factors, and Tukey's post-hoc test ($p < 0.05$). **RESULTS:** The statistical analyses showed significant differences among the times. The PL group showed significant decrease of phagocytic function when compared basal with other times (B: 32.46 \pm 14.47; 1D: 10.14 \pm 3.08; 1H: 8.15 \pm 4.65) and the same behavior was seen in the probiotic group with a significant decrease of phagocytic function when compared the basal with others times (B: 25.96 \pm 10.21; 1D: 8.59 \pm 4.33; 1H: 8.07 \pm 2.29). Between groups no differences was observed. **CONCLUSIONS:** Thirty days of probiotic (Lactobacillus Acidophilus and Bifidobacterium Lactis (10x10⁹UFC/day) supplementation was not able to cause alterations in neutrophil phagocytic function. These results may change regarding other immune cells population and with prolonged use or higher dosages of probiotic. Financial Support: CNPq, CAPES/PROEX

G-45 Free Communication/Poster - Clinical
Exercise Physiology - Other

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3983 Board #300 May 30 8:00 AM - 9:30 AM
Evaluating The Validity Of Heart Rate Measured By The Rhythm During Mountain Biking

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The Rhythm armband is a wearable device that measures heart rate, and it is unknown whether it is valid throughout rough terrain, such as mountain biking. **PURPOSE:** The purpose of this study was to investigate the validity of heart rate (HR) measurement by the Rhythm armband against the criterion, the Polar H7 chest strap while mountain biking.

METHODS: A total of sixteen healthy adults (males = 8, females = 8, 24.69 \pm 4.44 yrs, 171.45 \pm 8.9 cm, 74.23 \pm 21.07 kg) were recruited to ride mountain bikes on a 3.22km, beginner-level mountain biking trail at the McCullough Hills Trailhead in Henderson, NV. Participants were fitted with both a Polar H7 HR monitor and the Rhythm HR monitor and rode 1.61km away from the trailhead and 1.61km back to the start of the trailhead.

RESULTS: The lower and upper limit of agreement (LoA) range was -412.25 and 451.59, respectively, and the mean absolute percent error (MAPE) was 59.82%. The Rhythm armband also demonstrated an ICC = 0.008 (95% CI = -0.006, 0.022, p-value < 0.140).

CONCLUSIONS: The Rhythm armband demonstrated low correlation and a low level of agreement against the Polar H7 chest strap, suggesting that The Rhythm is not a valid measurement of HR during mountain biking.

3984 Board #301 May 30 8:00 AM - 9:30 AM
Large Vs Small Skeletal Muscle Mass Training: A Study On Solid Organ Transplanted Recipients

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Heart, kidney and liver transplanted patients (HTR, KTR and LTR) suffer from a reduced exercise capacity. Several studies pointed out the impairments of both central and peripheral factors as responsible for the decreased peak oxygen consumption ($\dot{V}O_{2peak}$) and diminished peak work rate (WR_{peak}); however, if the main limitation comes from central or peripheral origin is still unclear (Williams and McKenna, 2012). In healthy humans, $\dot{V}O_{2peak}$ is mainly constrained by central factors with peripheral factors playing a minor role, indeed endurance training (ET) involving small muscle mass fails to increase whole-body $\dot{V}O_{2peak}$ (Rud et al, 2012). Given the skeletal muscle abnormalities reported in HTR, KTR and LTR the limitation conferred by peripheral factors might be important as the central one. **PURPOSE:** The study investigated if ET of small muscle mass, e.g. single leg cycling (SL), induces higher increase in $\dot{V}O_{2peak}$ and WR_{peak} than ET with large muscle masses, e.g. double leg cycling (DL), in HTR, KTR and LTR.

METHODS: 33 sedentary patients were enrolled and divided into SL group (SLG) (n= 17; HTR=6, KTR=6 and LTR=5) and DL (DLG) (n= 16; HTR=7, KTR=5 and LTR=4). Subjects completed DL incremental tests to determine $\dot{V}O_{2peak}$ and WR_{peak} ; peak cardiac output (Q'_{peak}) was assessed by cardio-impedance and peak systemic arterio-venous O_2 difference ($C_{a-v}O_{2peak}$) was calculated as: $\dot{V}O_{2peak}/Q'_{peak}$. All subjects were asked to attend 24 ET sessions: the DLG performed traditional cycling and the SLG the first half of the session with the one leg and the second half with the other limb.

RESULTS: SLG and DLG increased $\dot{V}O_{2peak}$ by $19.7 \pm 2.7\%$ (mean \pm SE) and $23.2 \pm 3.1\%$ (Time effect: $P < 0.001$), respectively; WR_{peak} became $15.3 \pm 2.2\%$ and $18.2 \pm 3.2\%$ larger in SLG and DLG (Time effect: $P < 0.001$), respectively. Q'_{peak} changed by $-1.5 \pm 5.5\%$ in SLG (n=11) and by $6.7 \pm 5.3\%$ in DLG (n=10), however no effect of ET was found Q'_{peak} . $C_{a-v}O_{2peak}$ improved by $17.6 \pm 6.5\%$ and $12.7 \pm 6.2\%$ in SLG (n=11) and DLG (n=10) (Time effect: $P: 0.003$), respectively.

CONCLUSIONS: Given the absence of improvement in Q'_{peak} after ET, the accretion of $\dot{V}O_{2peak}$ and WR_{peak} seems to be induced by a greater $C_{a-v}O_{2peak}$, suggesting a key role of peripheral factors in impairing exercise capacity in HTR, KTR and LTR.

3985 Board #302 May 30 8:00 AM - 9:30 AM
Functional Capacity, Physical Activity And Body Composition In Type 2 Diabetes Chronic Kidney Disease Patients

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Type 2 Diabetes Mellitus is one of the major public health problems in Puerto Rico. It is the principal cause for Chronic Kidney Disease. There is evidence that suggests that engaging in physical activity (PA) improves glomerular filtration rate (GFR), body composition, cardiorespiratory fitness, psychological state, and quality of life. Thus, it is important to assess functional capacity (FC), PA, and body composition (BC) in patients diagnosed with Type 2 DM and CKD.

PURPOSE: To describe: 1) the level of PA, FC and BC in patients diagnosed with type 2 DM and CKD; and to assess 2) the relationship between Type 2 DM, CKD, the level of PA, FC and BC. **METHODS:** 15 participants diagnosed with Type 2 DM and CKD were evaluated (IRB: # 1516-0884). 1) PA was assessed using the International Physical Activity Questionnaire—Long Version (IPAQ-L); 2) FC was assessed using 2-minutes step test; 3) BC was assessed using anthropometry. **RESULTS:** The

participants average height 64.2 ± 0.53 inches, weight 190.9 ± 8.78 pounds, Body Mass Index 32.4 ± 1.27 , GFR 41.4 ± 2.23 mL/min/1.73 m², CKD Stage 3.13 ± 0.91 , ratio waist/height 0.9200 ± 0.77 , body fat percentage $34.300 \pm 3.37\%$, 2-minutes step test 13.87 ± 2.36 steps. The average scores of the IPAQ-L were: 1536 ± 345.05 METs/week, Sitting time 2760 ± 402.7 minutes. A Spearman Correlation analysis did show significant inverse relationship between BC (body fat percentage) and FC ($p < .05$). Also showed significant inverse relationship between GFR and CKD Stage ($p < .05$).

CONCLUSIONS: This study gave descriptive data of the Puerto Rican population with Type 2 DM and CKD, referring to their level of physical activity, functional capacity and body composition. The results from the IPAQ-L showed that the participants engaged in moderate physical activity and remain sitting for long periods of time, obese and with lower functional capacity.

3986 Board #303 May 30 8:00 AM - 9:30 AM
ELITE ATHLETE WITH RHABDOMYOLYSIS AFTER A WORLD EXTREME CONDITIONING COMPETITION.

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 (No relevant relationships reported)

PURPOSE: Understand the conditions surrounding rhabdomyolysis in extreme conditioning programs such as CrossFit to prevent new cases.

METHODS: Blood tests, abdominal ultrasound and urine summary of a 36-year-old Crossfit athlete (5'9" and 154 pounds) were analyzed after suffering an injury during the world competition of Crossfit (Reebok CrossFit Games, 2018).

RESULTS: On the same day of the injury it was already possible to notice great abdominal distension and the creatine kinase (CK) values were 42,040 U/L, and after 72h it reached 82,443 U/L. After 6 days, abdominal ultrasound was performed, identifying areas of hemorrhage and rupture in the rectus abdominis, bilaterally and throughout. After 8 days, blood tests showed elevated values of enzymes other than CK, such as oxalacetic glutamic transaminase (TGO) and pyruvic glutamic transaminase (TGP): 456 U/L (reference value 5 to 40 U/L) and 513 U/L (reference value 10 to 49 U/L) respectively. In addition, elevations in lactate dehydrogenase (555 U/L; reference value: 120 to 246 U/L), and again CK (18,962 U/L) levels were also seen. The urine summary showed an increase in red blood cell levels and the presence of hemoglobin. After 15 days the examinations were repeated and TGO levels decreased by 92.6% (29 U/L; reference value 5 to 40 U/L) and 72.7% TGP (140 U/L; reference values 10 to 49 U/L). Lactate dehydrogenase decreased to 157 U/L and CK to 284 U/L (99.6% reduction). **CONCLUSIONS:** Thus, it is possible to conclude that an athlete's susceptibility to rhabdomyolysis is real, especially when in conditions that are determinant for it, such as sports competitions, heat, dehydration and other factors. Early diagnosis that requires clinical suspicion associated with laboratory confirmation is important in order to avoid further damage to the athlete, as well as to prevent future cases.

3987 Board #304 May 30 8:00 AM - 9:30 AM
Effects Of Transcutaneous Vacuum Treatment On Joint Mobilization On Leg

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BACK GROUND: Last year, we reported that transcutaneous vacuum treatment improved gliding function, flexibility of muscle and fascia in vastus lateralis. However, the effect of transcutaneous vacuum treatment on joint mobility has not been investigated to date. **PURPOSE:** The purpose of this study was to investigate the effects of transcutaneous vacuum treatment on posterior thigh with straight leg raising angle, compared with passive static stretching of hamstrings. **METHODS:** Seven volunteers who had not undergone any prior orthopedic treatment for the lower legs participated in this study. The left and right legs were used for the experiment. Transcutaneous vacuum treatment (CVT) (vacuum and rolling [approximately 0.5Hz]) was applied to posterior thigh (ischial tuberosity to upper area of popliteal region) for 30 seconds 3 times with 15 second intervals between sets (n=7). Passive static stretching of hamstrings (PSS) was applied by pushing the heel using a hand held goniometer to the final angle of movement for 30 seconds 3 times with 15 second intervals between sets at supine position with knee extended (n=7). We measured straight leg raising (SLR) angle with active and passive hip flexion before and immediately after CVT or PSS. **RESULTS:** After PSS, the SLR angle statistically increased at active (89.9 ± 9.2 to 97.1 ± 12.4 degree) and passive (92.2 ± 11.5 to 99.0

± 13.8 degree) hip flexion. After CVT, there was no change in SLR angle at active hip flexion (92.0 ± 9.8 to 92.9 ± 8.3 degree). However, it statistically increased at passive hip flexion (92.0 ± 11.5 to 99.1 ± 13.8 degree). There were no differences of SLR angle for passive hip flexion between PSS and CVT after treatment. **CONCLUSIONS:** In this study, there was significant increase of SLR angle in passive hip flexion after CVT, and these changes were almost equivalent to the angle after PSS. However, despite the increase after PSS, the angle in active hip flexion after CVT did not change. These results suggest that the mechanism of change in active range of motion after transcuteaneous vacuum treatment may be different from that of static stretching.

3988 Board #305 May 30 8:00 AM - 9:30 AM
Aerobic Exercise Training, Fatigue And Fatigability In Women With Systemic Lupus

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Introduction: Persistent and excessive fatigue is the most common and debilitating symptom of systemic lupus erythematosus (SLE), potentially impacting quality of life and ability to sustain employment. While aerobic exercise training may improve cardiorespiratory limitations in women with SLE, its influence on fatigue and fatigability is not well understood in this population. **Purpose:** To evaluate changes in measures of performance fatigability and perceived fatigue in women with SLE after 12 weeks of aerobic exercise training. **Methods:** Subjects were 13 women (age 44±9 years, BMI 29.8±5.7 kg/m²) enrolled in the NIH Aerobic Exercise in Women with Systemic Lupus Erythematosus Trial (NCT03186794). All subjects had mild or no SLE activity, as measured by Safety of Estrogens in Lupus National Assessment-Systemic Lupus Erythematosus index (SELENA-SLEDAI, score <4), and self-reported the presence of fatigue on the Fatigue Severity Scale (FSS, score ≥3). Each subject participated in vigorous (70-80% heart rate reserve) supervised treadmill walking, 30 minutes per session, 3 times/week. Subjects also completed treadmill cardiopulmonary exercise tests (CPET) to volitional exhaustion, 10-minute walk tests (10MWT), and the Patient-Reported Outcomes Measurement Information System (PROMIS) and Fatigue Severity Scale (FSS) questionnaires, before and after the 12 weeks of training.

	CPET Time to Fatigue (s)	10MWT Distance	FSS	PROMIS (Fatigue domain)
Before Training	814 (226)	921 (136)	4.5 (1.2)	51.2 (5.1)
After Training	913 (163)	1012 (135)	3.0 (1.4)	45.8 (7.5)
p-value	0.0011	0.0003	<0.0001	0.0005

Results: Subjects attended an average of 34 (±2) supervised training sessions. Improvements in measures of performance fatigability (10MWT distance and time to volitional exhaustion on CPET) were observed. Additionally, perceived fatigue scores diminished, as indicated by improved scores on the FSS and PROMIS Fatigue Domain. **Conclusion:** These findings suggest that aerobic exercise training improved both performance fatigability and perceived fatigue in these women with SLE.

3989 Board #306 May 30 8:00 AM - 9:30 AM
Reliability Of Muscle Power And Functional Performance In Healthy, Older Women

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 (No relevant relationships reported)

Functional performance measures in older adults are commonly used in studies investigating age-related declines in mobility. Surprisingly, there is a lack of literature on the clinimetric properties associated with these tests, especially in healthy, older adults. In addition, reliability of tests is commonly measured over 1-2 weeks, and does not address the question of longer-term reliability that might be more relevant for a typical training study. **PURPOSE:** The purpose of this study was to assess the longer-term reliability (over 9 weeks and 15 weeks) of an isotonic muscle power test (using an isokinetic dynamometer) and commonly-used functional measures (Short Physical Performance Battery, maximal gait, 30s chair stand test, stair climbing, and the 400-meter walk) in healthy, older women. **METHODS:** Participants were older women (n = 18) who were healthy and untrained (Age = 73.3 ± 3.4 years, Height = 159.6 ± 7.7 cm, Weight = 69.5 ± 12.7 kg, BMI = 27.3 ± 4.8). Test-retest measures (muscle power and function) took place at baseline, week 9, and week 15. Intraclass

correlation coefficients (ICC) and the coefficient of variation of the typical error (CV) are reported for all time point comparisons. **RESULTS:** ICCs ranged from 0.83-0.97 for muscle power, and 0.64-0.93 for functional performance, indicating moderate to excellent reliability. CVs for upper-leg muscle power ranged from 5.7 - 10.5%, and lower-leg muscle power ranged from 9.9 - 20.0%, while CVs for functional tests ranged from 1.9 - 14.9%. For function, the stair-climb power test demonstrated the greatest reliability from baseline to week 15, with the CV = 8.94% and ICC = 0.94 (CI = 0.82-0.98). There were no changes in mean values for tests over time, with the exception of the chair stands which improved significantly from baseline to week 15 (p < 0.05). Although the chair stands were significantly different, these changes were smaller than what has previously been identified as clinically meaningful (eg. < 3.3 chair stands for the 30s chair stand test). **CONCLUSIONS:** Muscle power and functional tests demonstrated consistency over durations typically used in exercise studies. Conducting these tests under standardized conditions should enable researchers to confidently describe the impact of exercise interventions on muscle power and function in this population.

3990 Board #307 May 30 8:00 AM - 9:30 AM
Validity Of Body Composition Measures By Inbody 770 Bioelectrical Impedance Analyzer

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 (No relevant relationships reported)

PURPOSE: To test the validity of InBody 770 bioimpedance analyzer (IB770) against isotope dilution (D2O) for total body water (TBW) and against DXA for percent body fat (PBF). **METHODS:** Fifty-eight apparently healthy women (mean age 21.2 ± 2.6 years, BMI 26.7 ± 6.3) visited the Exercise Science Physiology Laboratory at KSU after an overnight fast. Subjects were given a 10g deuterium oxide solution (Cambridge Laboratories) to drink within 5 minutes and were asked to remain still in a reclining chair for 4 hours before providing a urine sample. Subjects were assessed via DXA for PBF and IB770 for both TBW and PBF. Frozen urine samples were shipped to an external laboratory for TBW assessment by mass spectroscopy. One extreme outlier was excluded from analysis due to probable D2O measurement error. Correlation analyses were used to assess the validity of TBW and PBF measures from IB770 compared to those from D2O and DXA.

RESULTS: TBW estimates from IB770 were similar to those from D2O (32.6 ± 5.9 vs. 32.3 ± 6.0, respectively). PBF estimates from IB770 were also consistent with those from DXA (35.1 ± 9.1 vs. 35.8 ± 8.5, respectively). T-tests indicated that there were no significant differences among these measures (p > 0.05 for both). IB770 measures for TBW and PBF were strongly correlated with D2O (r = .976, p < 0.001) and DXA (r = .961, p < 0.001), respectively. **CONCLUSIONS:** These data suggest that IB770 is a valid method for estimating TBW and PBF and may be appropriate for use as an alternative to D2O and DXA in a young female population.

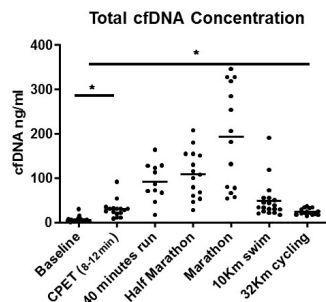
3991 Board #308 May 30 8:00 AM - 9:30 AM
The Effect Of Various Types Of Exercise On Cell-free Circulating DNA

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Elevated levels of cell-free circulating DNA fragments (cfDNA) released from dying cells into the blood stream have been established as a reliable biomarker in multiple pathologies such as trauma, heart attack, cancer and inflammation. Acute exercise also causes an immediate increase in the concentration of cfDNA in the blood. The cellular origins and the physiological significance of this phenomenon are not understood, but it has been speculated that cfDNA in exercise may reflect the intensity of the effort and potentially indicate overtraining. **Purpose:** The aim of the study was to compare the level of cfDNA after different types of exercise, and to identify their source.

Methods: We have used a methylation-based approach to assess the tissue sources of blood cfDNA of 75 subjects, men and women, ages 17-46 years, before and after the following exercise activities: Graded maximal exercise test (8-12 min; n=16), 40 minutes moderate-intensity run (n=12) half marathon (21.1km; n=15), marathon (42.2 km; n=14), cycling time trial (32 km; n=15) and open water swimming (10 km; n=19). **Results:** Our analysis revealed a significant (P < 0.0005) elevation of cfDNA after strenuous exercise which varied between sport modalities (Figure). CfDNA levels returned to near-baseline within 60 minutes post exercise, and derived exclusively from neutrophils and not from myocytes or other tissues. **Conclusions:** The origin of

the blood cfDNA in response to physical activity stems exclusively from neutrophils, with a large difference in its amount following various types of exercise. We are currently attempting to understand the physiological mechanisms of this exercise induced elevated cfDNA, including heart rate, blood pressure, type of muscle activity, blood oxygen levels, body temperature etc. Our findings open an exciting window into inflammatory and other physiologic processes taking place during exercise, and shed light on new aspects of cfDNA biology.



Plasma cfDNA concentration is dramatically increased after various types of exercise. *, p value < 0.0001

3992 Board #309 May 30 8:00 AM - 9:30 AM
Effects Of High-intensity Interval Training On The Expression Of Circulating Micro-RNAs In Women With Polycystic Ovary Syndrome

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 (No relevant relationships reported)

Purpose: 1) To compare the expression of circulating miRNAs (c-miRNAs) in women with and without Polycystic Ovary Syndrome (PCOS), and 2) to determine the effects of two different high intensity training (HIT) protocols in women with PCOS on c-miRNA expression. **Methods:** Women with PCOS were randomised to one of three conditions: 1) 10×1 min "all-out" work bouts (HIT1, n=13); 2) 4×4 min work bouts at 90-95% of HR_{max} (HIT4, n=14); 3) Control (Non-Ex, n=15). Both HIT groups exercise trained 3 x per week for 16 weeks. c-miRNAs were quantified before and after 16 weeks. c-miRNAs were extracted from plasma and quantified via a customised plate array with real-time PCR in women with (n=42; 29 ± 5 years; BMI, 31.2 ± 7.0 kg/m²; VO_{2peak} 32.7 ± 7.3 mL/kg/min) and without PCOS (Non-PCOS, n=12; 30 ± 6 years; BMI, 29.3 ± 5.5 kg/m²; VO_{2peak} 34.9 ± 6.7 mL/kg/min). Women without PCOS were age- and BMI-matched to 12 women with PCOS. The array contained 8 c-miRNAs previously reported to associate with PCOS and/or training response. **Results:** Women with PCOS had a higher basal expression of c-miRNA-27b compared to Non-PCOS ($P=0.006$, 269 \pm 184% difference). Non-Ex had a higher basal expression of c-miRNA-27b compared to both HIT1 ($P=0.003$, 30 \pm 52%) and HIT4 ($P=0.003$, 45 \pm 52%). miRNA-27b is associated with hormone metabolism, inflammation, adipogenesis and is positively correlated with testosterone. No observed basal differences in c-miRNA-146a and c-miRNA-223. Following the training intervention, HIT4 increased VO_{2peak} with 2.0 ± 3.4 mL/kg/min ($P=0.020$). Non-Ex had a higher expression of c-miRNA-27b compared to HIT1 ($P<0.001$, 96 \pm 126%) and HIT4 ($P=0.005$, 95 \pm 126%). No changes in the expression of c-miRNA-27b occurred within groups after training. The expression of c-miRNA-146a and -223 were lower in HIT4 compared to Non-Ex after the training ($P=0.043$, 156 \pm 105% and $P=0.040$, 184 \pm 106%, respectively). miRNA-223 is linked to hypertension, apoptosis of endothelial cells and type 2 diabetes, whereas miRNA-146a is linked to reducing progesterone, estradiol and testosterone release. **Conclusion:** c-miRNA-27b might have a role as biomarker for women with PCOS and high intensity interval training has the potential to decrease the expression of c-miRNA-146a and -223 in women with PCOS compared to non-exercising women with PCOS.

3993 Board #310 May 30 8:00 AM - 9:30 AM
Exercise Snacking And Detraining Effects On Postprandial Glucose Responses - A Randomized Crossover Trial In Trained Older Adults

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 (No relevant relationships reported)

Purpose: Experimental data suggest that frequent interruptions in sedentary behavior (SB) promote improvements in postprandial glucose (PPG) responses. However, little is known about the impact of these interruptions before and after a detraining period in active older adults. The main purpose of this investigation was to examine the acute effects of interrupting prolonged SB in a sample of trained older adults, before and after 2-weeks of detraining, on PPG.

Methods: Older active adults performing structured exercise at least 2/week for the past 6 months (n=14; aged between 65 and 90 years-old), were enrolled in a randomized crossover trial. Participants performed two conditions before and after 2-weeks of detraining (i.e. refrain from structured exercise): 1) uninterrupted sitting, where participants remained seated throughout 7 hours (SIT); 2) Sitting + moderate intensity breaks (INT), where participants were instructed to sit for 7 hours, while interrupting this behavior with 2 minutes of moderate-intensity physical activity (PA) every 30 minutes. The primary outcome was changes in PPG, while body composition and cardiorespiratory fitness (CRF) were considered secondary outcomes. Generalized estimating equations (GEE) were used.

Summary of Results: Both at baseline and after detraining, no differences were observed for 7-h total area under the curve (7h-AUC) for glucose (baseline: Δ -3.1%, $p=0.542$; post-detraining: Δ -8.8%, $p=0.182$) and mean glucose (MG) values (baseline: Δ -3.3%, $p=0.541$; post-detraining: Δ -9.0%, $p=0.188$) between INT and SIT experimental conditions. An unfavorable effect was observed for the SIT condition from baseline to after the detraining period, with higher values for 7h-AUC (Δ 10.6%, $p=0.014$) and MG (Δ 11.7%, $p=0.015$). No changes were observed in the response to INT condition between baseline and after detraining in PPG values (7h-AUC: Δ 4.4%, $p=0.535$; MG: Δ 5.2%, $p=0.523$).

Conclusion: Frequent interruptions in SB had no effect on PPG, prior to or after a 2-week detraining period, when compared to prolonged SB in active older adults. On the contrary, older adults experiencing a short-term detraining period can use strategies, such as breaking up SB, in order to potentially improve glycemic control during these intermissions.

3994 Board #311 May 30 8:00 AM - 9:30 AM
Step Count Error Of Activity Monitors For Patients In Phase II Cardiac Rehabilitation

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 (No relevant relationships reported)

The use of wearable activity monitors in patient populations is gaining popularity with researchers and clinicians. Because much of the research describing their accuracy has been completed with healthy participants, investigating the error in daily steps in patient populations, the most intuitive physical activity metric, is necessary. **Purpose:** To investigate the step count error of four wearable activity monitors compared to StepWatch (SW) steps across the day for days when patients attended phase II cardiac rehabilitation (CR) and days when they did not attend. **Methods:** Nineteen phase II CR patients (mean \pm SD; age, 68 ± 7 yr; BMI, 31.7 ± 14.7 kg/m²) wore an SW (criterion step method) on the ankle for four days. For comparison, one wrist-worn monitor (Fitbit Charge 2 [Charge] or Apple Watch series 2 [Apple]) and one waist-worn monitor (Fitbit Zip or ActiGraph GT9X [AG]) were randomly assigned, per participant, for wear during the first two days and the other wrist and waist monitors were worn during the second two days. Each monitor was worn for one day where participants attended CR (ACR) and for one day they did not attend (NCR). AG steps were processed with and without the low-frequency extension (AG_{LFE} and AG, respectively) and with the moving average vector magnitude algorithm. Daily steps for each monitor were summed across self-reported wear time and converted to percent of SW steps. One sample t-tests were used to determine if the percent of SW steps from each monitor, for each condition, was significantly different from 100% of SW steps and paired samples t-tests were used to compare the ACR and NCR conditions, per monitor. **Results:** Summary statistics showing the degree of error for each monitor are available in Table 1.

Conclusion: For those in phase II CR, steps are underestimated during ACR and NCR days, except when the LFE is applied.

Table 1. Summary statistics and comparisons of steps per day for each monitor and condition when participants attended cardiac rehabilitation (ACR) and a day when they did not attend (NCR).

Monitor	Condition	N	Steps per day Mean (SD)	% of SW steps Mean (SD)	MAPE (%)	95% CI	
						LL	UL
SW	ACR	37	5204 (2496)	-	-	-	-
	NCR	35	8418 (4225)	-	-	-	-
AG ^a	ACR*	17	3514 (1155)	62.7 (14.0)	38.2	-46.6	-31.1
	NCR*	16	4348 (2658)	50.2 (13.2)	49.8	-56.8	-42.7
AGLFE	ACR*	17	7473 (2596)	145.0 (28.8)	34.0	25.1	57.7
	NCR*	16	10614 (4286)	134.9 (29.8)	34.9	19.0	50.7
AGMAVM	ACR*	16	2666 (1116)	44.9 (15.6)	55.2	-63.9	-47.6
	NCR*	15	3128 (2214)	36.4 (14.6)	63.4	-71.7	-55.5
Apple	ACR*	18	4293 (1212)	85.2 (26.8)	31.7	-37.4	-5.8
	NCR*	16	5594 (2602)	71.6 (17.3)	27.9	-37.8	-7.6
Charge	ACR*	18	4562 (2655)	80.4 (26.5)	33.1	-31.4	-3.4
	NCR*	17	6180 (3501)	73.3 (19.9)	27.7	-35.5	-11.6
Zip	ACR*	18	3202 (1955)	65.3 (7.8)	34.4	-39.9	-30.3
	NCR*	16	5329 (3387)	58.8 (15.3)	42.2	-50.0	-21.0

*Significantly different from 100% of SW steps (p<0.05). ^aSignificantly different between ACR and NCR condition (p<0.05).

3995 Board #312 May 30 8:00 AM - 9:30 AM
Gait Improvements With BWSTT For Incomplete SCI One Year Post-injury
 Becky Schoeneberg, Abigail Norman. *Southwest Baptist University, Bolivar, MO.*
(No relevant relationships reported)

PURPOSE: The purpose of this case study is to highlight the use of Body Weight Support Treadmill Training (BWSTT) to improve gait deficits in an incomplete spinal cord injury (SCI) patient one year post-injury.

METHODS: RC is a 60 y/o female who sustained a cervical SCI. Initial diagnosis was C4, ASIA C incomplete injury, which was later changed to ASIA D due to improvements. One year and four months after the initial injury, RC received BWSTT to improve gait. BWSTT was implemented 2x/week for 8 weeks. Initial treatments involved 8 minutes at 0.8 mph based on the patients endurance with offloading to normalized gait pattern with tactile facilitation of the lower extremities. The gait speed was gradually increased and offloading gradually decreased as RC improved throughout the sessions.

RESULTS: At baseline, RC demonstrated decreased arm swing, decrease left step length with left foot not advancing past the right foot, and a gait speed of 0.17 m/s. Within a 50 foot walking distance, RC lost her balance three times, two of which she was able to independently recover and one of which required minimal assistance to regain her balance. After 8 weeks, RC's gait speed improved to 0.6 m/s. Within a 50 foot walking distance, RC demonstrated improved arm swing, and increased left step length with the left foot advanced beyond the right foot. Her gait speed improved from a household ambulator to a limited community ambulator. At an 18 week follow up, the patient's gait speed was 0.42 m/s. Although the patient did regress in her gait speed, she still maintained a speed more than twice as fast as her baseline speed and remained a limited community ambulator.

CONCLUSIONS: BWSTT has the potential to improve the speed and quality of gait in an incomplete spinal cord injury even after a year post-injury. RC's ability to receive continued physical therapy services was limited by insurance and cost, but she was able to receive ongoing BWSTT through the university pro bono services. Future studies can include BWSTT beyond 8 weeks to investigate whether or not further improvements can be gained. Even with a discontinuation of BWSTT, the patient was able to maintain a higher walking speed compared to baseline at 4 months after treatments.

3996 Board #313 May 30 8:00 AM - 9:30 AM
Metabolic And Motor Proficiency Profiles Of Youth With Down Syndrome
 Vincenzo G. Nocera, Aaron P. Wood, Tyler J. Kybartas, Angela J. Wozencroft, Dawn P. Coe, FACSM. *University of Tennessee Knoxville, Knoxville, TN.*
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(No relevant relationships reported)

Two factors that have a significant impact on obesity levels are low resting metabolic rate (RMR) and insufficient physical activity (PA) levels. Impaired RMR and neuromuscular coordination are common in youth with Down syndrome (DS) and may contribute to high rates of obesity. **PURPOSE:** To determine the metabolic and motor proficiency profiles of a sample of youth with DS. **METHODS:** Participants were youth with DS (n=11; 7 females; 16.8±3.9 y) attending a weeklong therapeutic recreation camp. Height and weight were measured, body mass index (BMI) was calculated, and BMI percentiles were used to determine weight status. The participants' RMR was evaluated in a supine position in a quiet, dark room for 15 minutes, using a portable metabolic system (Oxycon Mobile, Vyaire). One-minute averages were collected, and the first five minutes were excluded from the analysis. A rolling average technique was used to determine the average for each 5-min interval. The lowest rolling average was considered the RMR. The Bruininks-Oseretsky Test of

Motor Proficiency Ed. 2 (BOT-2) Short Form was used to test motor proficiency. The BOT standard scores (range from 20 - 80) and age- and sex-specific percentiles were calculated for each participant using conversion tables in the BOT-2 administration manual. Spearman correlations were run to determine associations among BMI, RMR, and BOT-2 scores.

RESULTS: The average BMI of the participants was 29.7±7.6 kg·m⁻² (91% obese). Average RMR was 4.1±1.8 ml/kg/min. The average standard BOT-2 score was 26.8±3.8, average percentile was 1.4±0.7. All youth were classified as *Well-Below Average*. There were no significant correlations among the variables (p>0.05).

CONCLUSIONS: RMR does not appear to be impaired in this sample. However, in this sample, the extremely low motor proficiency scores may contribute to limited PA participation and obesity levels. PA programs and interventions should consider addressing strategies to improve motor proficiency in youth with DS.

3997 Board #314 May 30 8:00 AM - 9:30 AM
The Effects Of Exercise Timing On Sleep
 Travis Emerson, Jay Porter, Ryan Petit-Mee, Guido Lastra, Anand Chockalingam, Jill Kanaley, FACSM. *University of Missouri, Columbia, MO.*
(No relevant relationships reported)

Epidemiological research has linked sleep quality with exercise, but few prospective studies have examined if exercise improves sleep quality and if the timing of the exercise impacts sleep.

PURPOSE: To determine if exercise timing differentially affects sleep quality in men and women.

METHODS: Thirty subjects wore an Actiwatch (Actiwatch 2, Phillips Respironics), which measured sleep duration, sleep efficiency and wake after sleep onset (WASO) for three consecutive nights at home, followed by a testing day of either no exercise (NOEx), morning exercise (AMEx), or nighttime exercise (PMEx). Morning exercise occurred at 0700 h and the nighttime exercise occurred at 2000 h on the respective study night. For each exercise bout, the subject exercised on a treadmill at 55% of their VO₂max for 45 minutes. The order in which they completed each condition was randomized, and study nights were separated by about one month. For the study nights, subjects arrived at the hospital at 1700 h and were given a standard meal at 1800 h. Lights were turned off by 2230 h and turned back on at 0700 h.

RESULTS: Sleep duration significantly increased on the study nights (7.9±0.16 h) compared to the nights of sleep at home (7.4±0.13 h, p=0.02), but was not affected by exercise. There were no differences in the sleep efficiency between study nights (84.8±1.6%) and non-study nights (83.4±1.1%, p=0.33) or between exercise conditions; NOEx (82.0±2.2%), AMEx (85.7±1.1%), and PMEx (84.5±1.5%, p=0.14). WASO was not different by study nights (0.8±0.13 h) and non-study nights (0.7±0.09 h, p=0.15), or between exercise conditions; NOEx (0.87±0.21 h), AMEx (0.55±0.5 h), and PMEx (0.78±0.22 h, p=0.14).

CONCLUSIONS: Sleep quality was maintained from the home setting to the research setting. Exercise did not improve sleep duration, efficiency or WASO in our subjects between the exercise and no exercise day and exercise timing had no effect on these variables.

G-46 Free Communication/Poster - Pilot and Feasibility Research in Exercise Oncology
 Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3998 Board #315 May 30 9:00 AM - 10:30 AM
Impact Of A Home-based Exercise Program In Men With Prostate Cancer
 Darpan I. Patel, Amber Gallegos, Bilal Sheikh, Sarah Vardeman, Michael Liss. *University of Texas Health Science Center at San Antonio, San Antonio, TX.*
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(No relevant relationships reported)

PURPOSE: Physical activity after cancer diagnosis is associated with better cancer-specific and overall survival in individuals diagnosed with prostate cancer (PCa). The purpose of this study is to test the hypothesis that a home-based exercise program improves quality of life (QoL), physical fitness, and functional capacity in men with PCa under active surveillance.

METHODS: A single-group, self-controlled study design was used to test the hypothesis. A total of 30 men are planned to complete the 6-month home-based exercise study. The 24-week home-based exercise program consisted of weekly light calisthenic exercise (i.e., incline pushups, body weight squats, and hip thrusts) and 150 minutes of light-to-moderate walking (monitored via FitBit). Participants completed the Short Form (SF-36) and Functional Assessment of Chronic Illness Therapy-Fatigue

(FACIT-F) surveys. Anthropometric measurements (i.e., height, weight, and body mass index; BMI) were measured and functional exercise capacity was assessed using the 6-minute walk test (6MWT). **RESULTS:** At this time, five men with PCa (age: 69 ± 3; BMI: 27.4 ± 3.2) under active surveillance have completed the 24-week home-based exercise program with 100% adherence rates for weekly activity. As a result, we have observed substantial improvements in BMI (Pre: 27.4 ± 3.2; Post: 25.4 ± 2.0; -7.6%), 6MWT distance (Pre: 494.0 ± 38.3 meters; Post: 565.4 ± 8.3 meters; 14.5%) and SF-36 subscale of social functioning (Pre: 81 ± 21.3; Post: 72.5 ± 39.1; 17.2%). Modest improvements were reported for the SF-36 subscale of emotional well-being (Pre: 75.2 ± 23.7; Post: 78 ± 34.1; 3.7%) and FACIT-F subscales of functional well-being (Pre: 22.8 ± 1.3; Post: 23.5 ± 6.4; 5.9%). No other changes greater than 5% have been reported. **CONCLUSIONS:** This home-based exercise program was shown to be feasible with promising outcomes in body mass, physical performance and indicators of quality of life. Though it is too early to determine statistically, the results are trending towards supporting the hypothesis that a structured home-based exercise program can lower BMI and improve both QoL and functional exercise capacity.

3999 Board #316 May 30 9:00 AM - 10:30 AM

A Feasibility Study: Self-efficacy Amongst Cancer Survivors In A 12-week Individualized Exercise Intervention

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Cancer survivors have unique physical and psychological challenges that can affect exercise adherence. While many factors play a role in regular exercise for cancer survivors, adherence may be improved by increased exercise self-efficacy (ESE), exercise support (ES), and exercise outcomes (EO). **PURPOSE:** To determine the impact a community-based, individualized exercise intervention on exercise adherence, ESE, ES, and EO following the completion of a tailored exercise intervention. **METHODS:** Six cancer survivors (mean age 60.2±11.5) were enrolled in a 12-week feasibility study. Baseline measures included the following tests: 1-rep max, treadmill, sit-and-reach and the ESE survey. Participants attended three, weekly, one-hour session led by a Cancer Exercise Specialist (CES). Training included cardiovascular, strength, and flexibility exercises tailored to the participant's fitness and physical needs. Measures were repeated immediately post-intervention (week 6) and at week 12. Exercise adherence was determined by the percentage of the 36 sessions completed. Paired t-tests were used to compare baseline and follow-up assessments. **RESULTS:** Exercise adherence was 87.9%. Total ESE was not significantly higher at week 6 (15.4 ± 2.1, vs. 17±1.2, p<0.09) or week 12 (15.4 ± 2.07 vs. 16.6 ± 0.5, p<0.06). ES was not significantly higher at week 6 (18. 8±8.2 vs. 26.3±7.5, p<0.35) but demonstrated a statistically significant increase at week 12 (18.8 ± 8.2 vs. 23.2 ± 12.3, p< 0.03). EO was not significantly higher at week 6 (41.8 ± 3.9 vs. 46 ± 5.4, p<0.09) or week 12 (41.8 ± 3.9 vs. 43.8 ± 3.7, p<0.16). **CONCLUSION:** This study demonstrated feasibility of a community-based, CES-led 12-week exercise intervention. Improved ES and adherence were demonstrated among participants. Study outcomes are being used to guide an exercise intervention focused on adolescent and young adult survivors of cancer, a traditionally understudied group.

4000 Board #317 May 30 9:00 AM - 10:30 AM

Exercise And Compression Therapy To Improve Lymphedema In Breast Cancer: A Pilot Randomized Controlled Trial

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(No relevant relationships reported)

Breast cancer related lymphedema (BCRL) is a chronic swelling that may develop in breast, trunk and arm on the side of the surgery. More than one in five women with breast cancer develop BCRL. Recent studies in BCRL have demonstrated that resistance exercise can improve symptoms and quality of life without worsening the lymphedema. Few studies, however, have controlled for the use of a compression garment during or following exercise. Moreover, no studies have explored the potential of combining resistance exercise with therapeutic strategies to help reduce arm lymphedema volume. We hypothesize that a progressive resistance exercise program that incorporates compression therapy and follows the decongestive exercise sequence

(DPRE) has the potential to reduce arm lymphedema volume. **Purpose:** To investigate the feasibility of a 12-week DPRE with compression therapy among women with BCRL. **Methods:** A randomized controlled pilot trial was conducted involving 20 women with stable BCRL, recruited through the Cross Cancer Institute in Edmonton, Canada. As per standard of care, all women were required to wear their day-time compression sleeve daily for 12 hours. Women were randomly assigned to one of three groups: (i) Standard care: home decongestive exercise regimen (n=6), (ii) DPRE plus use of a daytime compression sleeve during exercise (n=7), and (iii) DPRE plus use of an adjustable compression wrap (AC) garment during exercise (n=7). Approval was obtained from the Health Research Ethics Board. Feasibility outcomes were analyzed descriptively. Due to the pilot nature of the study and the small sample size, no inferential analyses were performed. **Results:** Feasibility data demonstrate high study completion (95%), attendance (94%) and adherence to prescribed protocol of DPRE program (97%). A mean reduction in arm lymphedema volume of 35 ml (-5.1%) was observed in the DPRE with day-time sleeve group and a 45 ml (-6.7%) in the DPRE with AC group. In contrast, a mean increase of 68 ml (+14.6%) was observed in the standard care group. **Conclusion:** DPRE with use of compression is feasible and shows promise in reducing arm lymphedema volume. A large-scale RCT is being conducted to examine the efficacy of this program on arm lymphedema volume, with the addition of imaging techniques to further inform changes to tissue composition.

4001 Board #318 May 30 9:00 AM - 10:30 AM

Feasibility And Preliminary Efficacy Of High-intensity Interval Training During Neoadjuvant Chemoradiotherapy For Rectal Cancer

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PURPOSE: To assess the feasibility, safety, and preliminary efficacy of a supervised high-intensity interval training (HIIT) program in rectal cancer patients undergoing 5-6 weeks of neoadjuvant chemoradiotherapy (NACRT).

METHODS: Thirty-six rectal cancer patients scheduled to receive NACRT followed by surgery were randomized to either exercise training (n=18) or usual care (n=18) in the Exercise During and After Rectal Cancer Treatment (EXERT) Trial in Edmonton, Alberta. Patients in the exercise group were asked to complete 3 supervised HIIT sessions/week for the duration of NACRT. Feasibility was determined by eligibility rate, recruitment rate, follow-up rate and exercise adherence. Safety was assessed by tracking serious adverse events related to exercise. The primary efficacy outcome was cardiorespiratory fitness (VO₂ peak) assessed immediately post-NACRT by a graded exercise test. Secondary efficacy outcomes included functional fitness assessed by the Senior's Fitness Test.

RESULTS: From June 2017 to August 2019, 205 rectal cancer patients were screened, 131 (64%) were eligible, and 36 (27%) were recruited. Follow-up fitness testing post-NACRT was completed in 75% (exercise n=14; control n=13). Reasons for missed fitness testing were medical issues. Median attendance for the supervised HIIT sessions during NACRT was 82%. No serious adverse events were observed, however, 2 patients in the exercise group experienced musculoskeletal events which resulted in 4 missed exercise sessions. Analyses of covariance showed no statistically significant or clinically meaningful difference between groups for the primary outcome of VO₂ peak (adjusted between-group mean difference, 0.9 ml/kg/min; 95% CI, -1.6, 3.3; p = 0.47). The 8-foot up-and-go was significantly better in the exercise group post-NACRT (adjusted between group mean difference, -0.4 seconds; 95% CI, -0.7, 0.0, p = 0.031). No other significant group differences in functional fitness were observed. **CONCLUSIONS:** Supervised HIIT during NACRT for rectal cancer was feasible and safe. Further research is needed, however, to better understand the feasibility of completing fitness testing immediately following NACRT and whether HIIT can produce meaningful improvements in fitness in this challenging clinical setting.

4002 Board #319 May 30 9:00 AM - 10:30 AM

Cardiorespiratory Fitness In Men With Prostate Cancer Following 8 Weeks Of Vigorous Continuous Or Interval Exercise Training Performed During Radiation Therapy

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(No relevant relationships reported)

Persons with cancer have been reported to experience significant fatigue due to marked reductions in cardiorespiratory fitness as a result of anticancer therapy. Moderate exercise programs during and after completion of cancer treatment have been suggested to mitigate cancer-related fatigue **Purpose:** This study aimed to

characterize cardiorespiratory fitness and physiological changes in fatigue in men with prostate cancer who participated in an exercise training program during External Beam Radiation Therapy (EBRT). **Methods:** Subjects were eight men with prostate cancer (age 65.75±8.84 years; BMI 25.31±2.62 kg/m²) scheduled to receive EBRT. Subjects completed eight weeks of vigorous supervised exercise [either continuous training (30 minutes at 70-80% of peak heart rate) or high intensity interval training (eight one-minute intervals of 95% peak heart rate)] three times a week during EBRT. Subjects also completed a treadmill cardiopulmonary exercise test (CPET) to exhaustion before and after eight weeks of EBRT. CPET results were compared before versus after completing the training regimen and EBRT. **Results:** Pre (28.2±5.07 ml/kg/min) and post (28.7±6.08 ml/kg/min) peak oxygen consumption (VO₂) were not significantly different. Conversely, a significant increase in time to anaerobic threshold (AT) before (409.5±66.97 sec) and after (448.16±72.70 sec) exercise training was observed (p = 0.049). There were no significant changes in VO₂ at AT or time to exhaustion after exercise training. **Conclusion:** While the construct of fatigue is complex and multidimensional, AT provides an objective measure of endurance that is not influenced by perception or motivation. The National Comprehensive Cancer Network (NCCN) recommends moderate exercise programs during and after completion of cancer treatment to reduce cancer-related fatigue. In this study, vigorous exercise training performed during EBRT, maintained cardiorespiratory fitness and increased the time to AT in these men undergoing prostate cancer therapy. **Funding:** This study is fully supported by the Division of Intramural Research of the National Institute of Nursing Research and the Clinical Center, Rehabilitation Medicine Department of the National Institutes of Health, Bethesda, Maryland.

4003 Board #320 May 30 9:00 AM - 10:30 AM
Exercise Triage And Program Adaptations For Cancer Survivors With Multiple Myeloma: A Case Series.

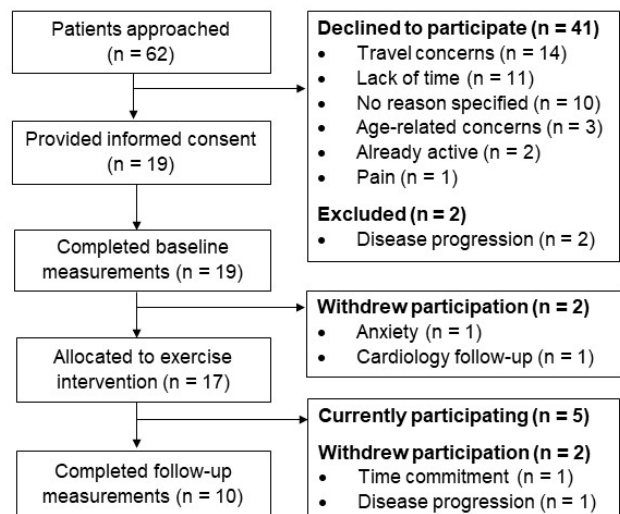
Graeme M. Purdy¹, Chris M. Sellar¹, Chris P. Venner², S. Nicole Culos-Reed³, Margaret L. McNeely¹. ¹University of Alberta, Edmonton, AB, Canada. ²Cross Cancer Institute, Edmonton, AB, Canada. ³University of Calgary, Calgary, AB, Canada. Email: gmpurdy@ualberta.ca (No relevant relationships reported)

Multiple myeloma (MM) is associated with fracture risk and deconditioning. Exercise training can attenuate functional declines, but the safety of exercise in this population remains unclear. **PURPOSE:** This case series explores the clinical history, considerations for triage, program adaptations, and functional changes in patients with MM taking part in the Alberta Cancer Exercise (ACE) study. **METHODS:** An exercise physiologist screened cases using a cancer-specific intake and the PAR-Q+. Due to MM diagnosis, physician approval was required for entry into the ACE study. ACE involved 60 mins of community or clinic-based exercise 2x/wk for 12 weeks. Pre/post measures included the 6-Minute Walk Test (6MWT), 30s sit-to-stand, sit and reach, and optional max bench press (1RM) and plank tests. **RESULTS:** CASE 1: 54-year old male on chemotherapy with a history of lytic lesions throughout the thoracic cage and pelvis, and radiation therapy (RT) to large lytic lesions in the pelvis and left clavicle. Goal: improve fitness for upcoming stem cell transplantation (SCT). Physician recommendation: controlled low loading due to fracture risk. Approved for community (1x/wk) and clinic-based (1x/wk) exercise. CASE 2: 37-year old female diagnosed with MM without bone involvement, receiving chemo and targeted therapy. She had undergone surgery and was recovering from a SCT. Goal: reduce fatigue and improve fitness. Approved for clinic-based exercise with transition to community after 12 wks. CASE 3: 54-year old female on maintenance chemo with multiple lytic lesions, history of cervicothoracic decompression, reduction and instrumentation C5-T3, and prior RT to spine and pelvis. Goal: improve fitness, strength and health. Approved for clinic-based exercise. Physician recommendation: low intensity exercise due to fracture risk and pain. No adverse events occurred and increases were seen across cases in 6MWT (8.2%, 5.6%, 9.5%), sit-to-stand (0%, 18.8%, 5.9%), sit and reach (18.6%, 56.7%, 42.2%), 1RM (4.1%, 21.4%, N/A), and plank (36.8%, 50%, N/A). **CONCLUSIONS:** The cases presented with unique complications and apprehension towards exercise. Presence and location of lytic lesions, fracture history and risk, surgical history, and treatment stage were key considerations for exercise triage and adaptations within the ACE program.

4004 Board #321 May 30 9:00 AM - 10:30 AM
Feasibility Of A Progressive Walking-based Exercise Programme In Clonal Plasma Cell Disorders

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Epidemiological data shows that regular physical activity is associated with reduced risk of developing the blood cancer Myeloma. Myeloma is preceded by the asymptomatic stages Monoclonal Gammopathy of Undetermined Significance (MGUS) and Smouldering Myeloma (SM). International guidelines do not advocate treatment for MGUS and SM, instead disease biomarkers are routinely monitored. The effect of exercise training on MGUS and SM disease activity has not yet been investigated despite evidence that an active lifestyle may reduce Myeloma risk. **PURPOSE:** Determine the feasibility of a progressive exercise programme for MGUS and SM patients, for subsequent investigation of its effect on disease activity. **METHODS:** 62 patients (21 MGUS, 41 SM) were invited to participate in a single-arm trial. The exercise programme comprised 2 supervised and 1 home-based session per week for 16 weeks. Supervised exercise involved treadmill walking (30 mins progressing from 40% to 80% VO_{2MAX}). At home participants completed a moderate intensity walk for ≥40 mins. Results are mean ± SD. **RESULTS:** Uptake was 31% and retention was 79%. Ten participants (2 MGUS, 8 SM, 50% male, 60 ± 11 years) have completed the trial to date. Adherence was higher for supervised (91 ± 7%) than home-based (74 ± 26%) sessions. In supervised sessions, compliance to duration was high (98 ± 3%) but compliance to intensity was low (61 ± 20%) due to a drop-off at intensities >70% VO_{2MAX} (<70% = 70 ± 30%; >70% = 52 ± 28%). The 40-min home-based walk target was exceeded (47 ± 11 mins). No severe adverse events occurred. **CONCLUSION:** Exercise is safe for patients with MGUS and SM. Adherence to supervised exercise was high, as was compliance to 30 mins of walking at 40-70% VO_{2MAX}. Walking exercise >70% VO_{2MAX} was not feasible. Future studies could evaluate interval training to maximise exercise intensity with the aim of delaying disease progression from MGUS and SM to Myeloma. Grants: Physiological Society & University of Bath Alumni Fund



4005 Board #322 May 30 9:00 AM - 10:30 AM
Aerobic Recovery Of A 65-year Old Following Radical Prostatectomy

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 (No relevant relationships reported)

Following radical prostatectomy, patients are generally advised to engage in no strenuous exercise for 4-6 weeks. Beyond that time range, the rapidity with which a patient may return to high-level aerobic activity is not known.

PURPOSE: To examine the recovery following radical prostatectomy (RP) of an endurance-trained 65-year old man with localized prostate cancer and single-vessel heart disease.

METHODS: A maximal incremental exercise test and a one-hour steady-state test were performed just prior to and three months following robotic RP to determine maximal oxygen consumption (VO_{2max}) and other cardiorespiratory variables. The patient recorded his training as he prepared for an endurance event that was to occur three months after RP, the Norwegian Foot March (NFM), a 30-km road march carrying 11.4 kg.

RESULTS: In the month prior to RP, the patient performed 2-3 hours of vigorous-intensity aerobic exercise per week, fast walking carrying an 11.4-kg pack, with the longest individual session being a 16-km road march. Just prior to surgery, VO_{2max} was 36.7 mL·min⁻¹·kg⁻¹, heart rate during 30 min at 7.2 km·hr⁻¹ and 0% grade was 77% of heart rate reserve (HRR), and during 30 min at 5.3 km·hr⁻¹ and 10% grade was 92% HRR. On post-surgery day 44, he did a 19-km road march carrying 11.4 kg, exceeding the training level of the month pre-surgery. Three months post-surgery, VO_{2max} was 42.7 mL·min⁻¹·kg⁻¹, and heart rates during the flat and uphill 30-min sessions at the same absolute-intensity as pre-surgery were 70% and 83% HRR, respectively. He completed the NFM 93 days post-surgery in 4:24:37, with an average heart rate of 72% HRR.

CONCLUSIONS: This case study demonstrates that an aerobically trained prostate cancer patient can return to high-level aerobic training in as little as seven weeks post-radical prostatectomy, and even exceed pre-surgery fitness. This finding has implications for prognosis given the beneficial effect of vigorous-intensity exercise on prostate cancer progression.

4006 Board #323 May 30 9:00 AM - 10:30 AM
Physical Activity During Pediatric Hematopoietic Stem Cell Transplant And 1yr Follow-up: A Case Study

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PURPOSE: The hematopoietic stem cell transplant (HSCT) is considered for patients who are non-responsive to first intention treatments. This process can last between 4-6 weeks and requires complete isolation of the child. Intensive chemotherapy is given to suppress completely the immune system before transplant. Past studies have reported major motor-developmental and growth deficiencies post-transplant. In this case study we evaluate the feasibility, adherence and effect of physical activity (PA) before, during and after an HSCT process. **METHODS:** Physical capacities, quality of life (QoL) and the daily PA level were evaluated for the 6 yrs. old male subject, 2 months after a diagnosis of a Burkitt Lymphoma stage III. For one-year, PA sessions were offered to the subject twice a week for 5-30 min, at intensities between 4-6 on the Borg Scale. We reassessed the subject after one-year. **RESULTS:** The subject participated 67% of the sessions. Eleven sessions during pre-transplant, 26 during transplant and 4 after treatment completion. The main reason for cancellation was "schedules" (32%). His height did not increase but his body mass increased by 2 kg. The total scoring results from the PedsQL cancer questionnaire increased by 6% for the subject and by 9% for the proxy. The ankle ROM increased by 18°. The vertical jump test increased by 14 cm and the hand grip test increased by 9 kg. Due to the poor physical condition of the child, we were not able to perform the incremental shuttle walk test (ISWT) prior to transplant. Thought, the one-year assessment revealed that the subject was able to reach 90% of his predicted VO_{2max} for this test. The level of daily PA diminished after HSCT (<30min/day), but the active transportation time doubled (90 min-180min/day) and the sedentary activity time was diminished by more than half (172min-65min/day). No major adverse event occurred during this study. **CONCLUSIONS:** Physical activity was safe and feasible before, during and after the HSCT. We could observe positive results on the child's physical capacities, quality of life and daily PA levels. Larger studies evaluating the long-term effect of PA before, during and after HSCT are needed to conclude on the possible late effects it may have on physical and psychological aspects.

4007 Board #324 May 30 9:00 AM - 10:30 AM
Abstract Withdrawn

4008 Board #325 May 30 9:00 AM - 10:30 AM
Physical Activity Measurement Feasibility In Chemotherapy-Receiving Gastrointestinal Cancer Survivors

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Oxaliplatin, a standard chemotherapy for invasive gastrointestinal (GI) cancer, can cause immediate and lasting side effects. Intractable fatigue and neuropathy are common and particularly severe 4-7 days after each oxaliplatin infusion but could be lessened with moderate-vigorous (MV) physical activity (PA). The best MVPA measurement method in PA intervention trials during oxaliplatin treatment is unclear. **PURPOSE:** To describe the feasibility of MVPA measurement in a pilot RCT of home-based brisk walking compared to PA education alone in stage II-IV GI cancer survivors receiving oxaliplatin ($N = 60$). **METHODS:** Patients were recruited at the second oxaliplatin infusion and randomized 1:1 to the 8-week intervention or PA education group. The intervention group received motivational interviewing, a Fitbit Charge 2, and other PA supports. Pearson bivariate correlations were performed among the self-report (PA vital sign [VS] interview) and objective measures (ActiGraph GT9X and Fitbit) of MVPA minutes per week. **RESULTS:** Mean MVPA minutes at 8 weeks were 273.8 (SD 252.34; $n = 24$) by Fitbit, 136.01 (SD 67.28; $n = 11$) by ActiGraph vector magnitude, and 272.52 (SD 666.48; $n = 24$) by self-report in the intervention group; and 107.07 (SD 36.04; $n = 17$) by ActiGraph and 145.02 (SD 154.63; $n = 27$) by self-report in the control group. The intervention group's ActiGraph-PAVS correlation was moderate ($r = 0.714$). Self-report and objective MVPA were not correlated in the control group at 8 weeks and intervention group at baseline. Technical errors ($n = 7$), devices lost while exercising ($n = 2$), and noncompliance ($n = 5$; i.e., not wearing when less active than usual) led to missing ActiGraph data. Patients often struggled to respond to the PAVS, because their MVPA differed 1- and 2-weeks post-infusion. **CONCLUSION:** Self-reported MVPA (the PAVS) may be unreliable in GI cancer survivors during oxaliplatin treatment, due to high response variability, influenced by acutely changing chemotherapy side effects and lack of objective MVPA awareness. For the few compliant participants, ActiGraph measurement the week after infusion may represent true MVPA levels, but re-evaluation of the Fitbit MVPA cut-off points and required duration of ActiGraph measurement is still needed among oxaliplatin-receiving patients.

4009 Board #326 May 30 9:00 AM - 10:30 AM
Abstract Withdrawn

4010 Board #327 May 30 9:00 AM - 10:30 AM
Scientific Abstract

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 (No relevant relationships reported)

INTRODUCTION: Physical activity has been associated as a health protection factor relating its benefits to the reduction of chronic diseases. **PURPOSE:** to present a physical training program, as a proposal of Hospital Physical Education. **METHODS:** ONCOFITNESS method, in patients diagnosed with malignant neoplasms, as part of adjuvant and neoadjuvant treatment, and a non-pharmacological alternative for maintaining quality of life, fitness and health recovery. The eight-week program included 51 patients; 27 women with breast cancer (54.1 ± 6.76 years) and 24 men with prostate cancer (58.4 ± 2.57 years) classified as: Level I - Weak; Level II - Intermediate; and Level III - Advanced. It began with a routine of stretching exercises, moving to neuromuscular exercises. The load determination for effort intensity control was maintained on a light to moderate scale (50% to 75% of the maximum heart rate),

on a subjective exertion perception scale (PSE) of 9-13 and with a consumption of 3 to 6 METs, performing 3 sets of 6 to 10 repetitions, with 2-3 weekly sessions, up to 48h apart. Overload was applied weekly, initially by volume (repetitions); after reaching 10 repetitions the intensity was increased, returning to the six repetitions. Stretching and strength exercises were selected. **RESULTS:** Table 1 presents the results before and after participation in the program. **Table 1.** Results before and after participation in ONCOFITNESS

	Fat percent-age *	Cardiorespiratory Resistance **	Muscular endurance ***	Muscle strength ****	Flexibility *****
Mens (pre)	18,73 (±0,83)	332,92 (±32,66)	11,7 (±3,79)	54,8 (±18,48)	83,3 (±5,69)
Mens (post)	16,39 (±0,81)	471,25 (±24,62)	19 (±3,57)	67,2 (±19,06)	87,9 (±5,97)
Wom-en (pre)	30,13 (±1,16)	280 (±21,76)	12,6 (±3,18)	16,4 (±11,05)	80,7 (±7,12)
Wom-en (post)	26,58 (±0,94)	434,81 (±23,22)	21,3 (±4,18)	24 (±12,55)	91,8 (±6,5)

Units: %; ** Meters in 6 minutes; *** Repeats per minute; **** kg; *****Degrees
CONCLUSION: It is believed that ONCOFITNESS can fill a gap in physical activity issues for cancer patients with a view to health promotion, protection and recovery, and care delivery, ensuring a comprehensive approach to the health-disease process with an emphasis on primary care.

G-47 Free Communication/Poster - Health Equity - Socio-Economic Status

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

4011 Board #328 May 30 8:00 AM - 9:30 AM
One (1) Month Contextual Comparisons Between Obese Black And White Women To Inform Weight Loss Interventions

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 (No relevant relationships reported)

More than 60% of black women in the U.S. are obese. Evidence suggests black women are exposed to more obesogenic microenvironments. To address this issue, research calls for exploration of bold, new obesity intervention approaches to discover unconventional tactics to address weight loss disparities.

PURPOSE: To compare microenvironments and assessment outcomes across obese black and white women for whom weight loss information and services were made available.

METHODS: A research assistant (RA) entered the participant's home to complete informed consent, baseline assessment, and onboarding. The RA also took note of the home environment without the participants' awareness. Follow-up assessments occurred in the participant's home 28 days after baseline.

RESULTS: Of the 186 black and white women, 62.9% self-reported being African American or Black and the mean age of the group was 52.3 ± 8.4. The mean BMI of all participants at baseline was 44.8 ± 10.1 and 45.4 ± 10.5 at the 30-day follow-up. There were significant group differences in social and physical micro-environments. When compared to white women, more black women had lower incomes ≤ \$20,000 (58.5% vs 29.5%, p<0.03) and lower health literacy (50.4% vs 18.8%, p<0.001). In regard to context, more black women had a television visible from their kitchen (17% vs 3%, p<0.01), when compared to white women, a fry pan visible (61% vs 37%; p<0.01), spent significantly fewer average days with a spouse (4.1 vs 10.0; p<0.01), and more consecutive hours alone (20.9 vs. 15.4; p<0.03). Both groups reported seeing similar numbers of people on a weekly basis (4.2 ± 2.1 and 4.4 ± 2.2), home as their most common location, and the same amount of time at home (39.2 ± 50.1 and 35.5 ± 30.1 hours; p=.422).

CONCLUSIONS: Variables such as lower health literacy and annual income have commonly been associated with the higher incidence of obesity among black women. Intervening on the higher prevalence of micro-level obesogenic cues in the homes of black women is another potential target for weight loss interventions.

4012 Board #329 May 30 8:00 AM - 9:30 AM
Factors Associated With High Response Rates To Improve Ecological Momentary Assessment Research

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 (No relevant relationships reported)

Research indicates black women experience 50% less weight loss through behavioral counseling programs when compared to white women. Examining context may reveal factors associated with weight loss differences. Ecological Momentary Assessment (EMA) via digital devices enables data collection from participants as they move through their daily routine. In this project, we asked participants to respond to prompts about their eating, physical activity and social copresence up to eight times per day over a 30-day period.

PURPOSE: To identify characteristics associated with EMA response rates.
METHODS: Eligible participants were female, aged 35-64 years, self-reported Non-Hispanic black or white race, and were eligible for a Federally Qualified Health Center-based weight loss program based on having a BMI ≥ 30. Survey measures were RA-administered and included household income, work hours, years of education, health literacy and numeracy, food security, depression, anxiety, and social relationships. The RA measured and recorded participant height and weight. The RA then installed and configured the EMA system for data collection on a study-provided smartphone or on the participant's smartphone if it was compatible with the system. The EMA survey asked: "Where are you?" "With anyone?" "Eat or drink in the last 15 minutes?" "Walk or move in the last 15 minutes?" Responses were automatically submitted to the study's secure server.

RESULTS: Of the 259 participants, 136 (52.5%) were classified as responders (>50% response rate). A significantly greater percentage of responders owned a smartphone, 60.3% vs 35.8%, p < 0.001 and lived alone or with one other person 62% vs 49%, p = 0.036. Marginally non-significant positive associations with response included an eating disorder, 21.3% vs 12.2%, p = 0.05; seeing fewer people weekly, 4 vs 5, p = 0.06; not having a TV in the kitchen, 91.8% vs 84.6%, p = 0.07; and food insecurity, 30.9% vs 19.5%, p = 0.09.

CONCLUSIONS: EMA helps examine context if the research participant regularly responds. Identifying factors associated with high response rates is useful in improving EMA research. Future research with EMA in vulnerable populations may require more extensive participant training/practice using study phones or integration of EMA into participants' existing tools.

4013 Board #330 May 30 8:00 AM - 9:30 AM
Influence Of Socioeconomic Status On Cardiometabolic Risk Factor Responses In Active Older Adults

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Socioeconomic status (SES) has been reported to influence cardiovascular disease (CVD) and health in adult populations. **PURPOSE:** This study was designed to determine if older adults from communities with different SES would differ on cardiometabolic risks (CMO) initially and following a three-month period where they were encouraged to be physically active.

METHODS: The study is part of a larger project as older participants volunteered to take part in the study and they signed an institutional approved informed consent form prior to participation. The mean age of the participants ranged from 72.0 to 74.3 years. The average community income of the participants were \$50,537 (site 2), \$68,673 (site 1) and \$78,894 (site 3). Some of the participants were involved in structured, some in unstructured and some in little or no physical activity. CMO risks measured included cholesterol, HDL, LDL, Triglyceride, blood glucose, SBP and DBP on the initial assessment and three months later. Additionally, they were measured for BMI, BF% and timed up and go.

RESULTS: SBP was a risk factor (>135 mmHg) for every assessment, except for test 2 at site 1. Blood glucose suggest on test 2 that participants at site 2 and site 3 were diabetic (GLU ≥ 125 mg/dL). However, the participants had not fast and their HbA1c values were below 6.4 mmol/mol. Cholesterol on test 1 (233 mg/dL) indicate a risk for individuals from site 1. Generally, the blood profiles were not statistically different and most were not risk factors.

CONCLUSIONS: These data indicate that in diverse populations with different SES, CMO risks are essentially the same. This allows for the possibility that healthy lifestyle choices maybe a critical element contributing to the development of CVD.

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